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THE MAGAZINE OF ASME

No. 11
136

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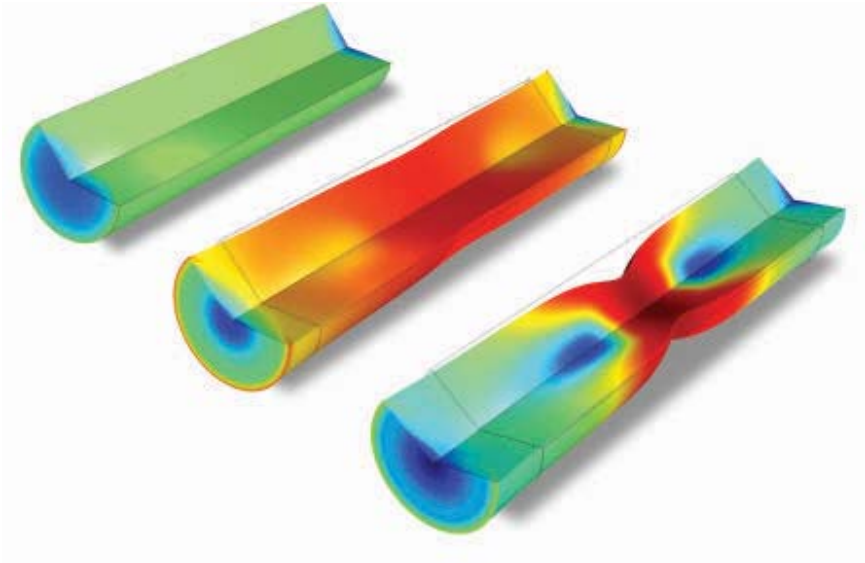

LARGE STRAIN PLASTICITY: A piece is subjected to a uniaxial tensile test resulting in large scale plastic deformation and necking of the central cross section region.

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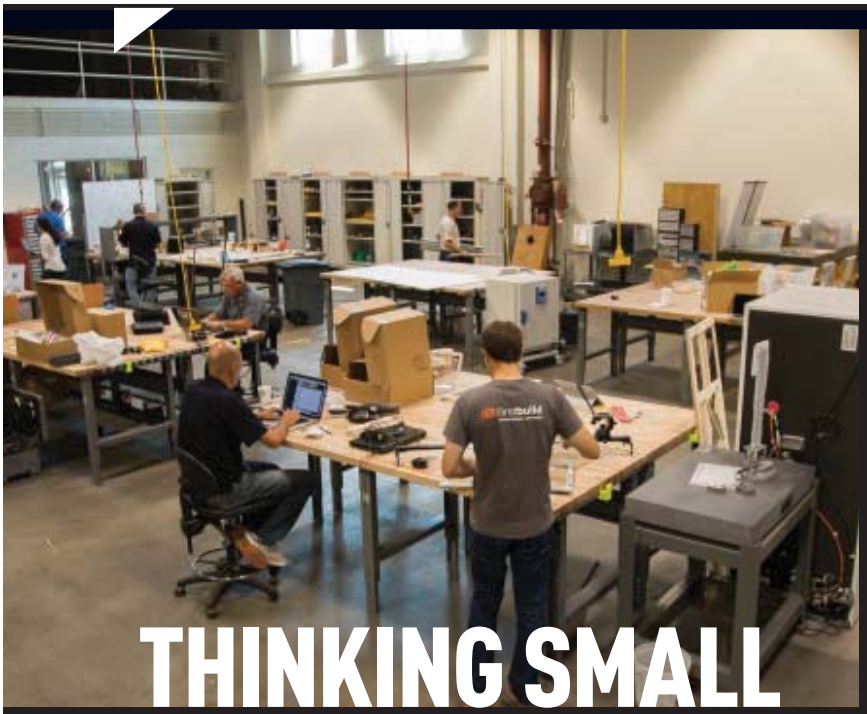
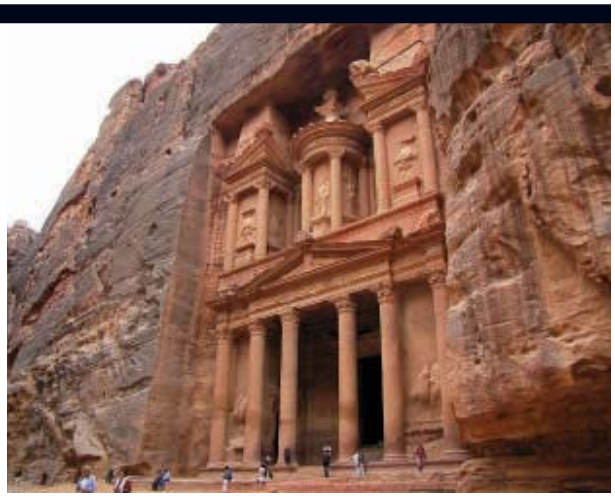


THINKING SMALL TO GROW LARGER

BY GOING SMALL, ONE OF THE WORLD'S LARGEST APPLIANCE manufacturers is looking to spark design innovations and bring new products to market faster, a move that could help it grow even bigger. GE Appliances is establishing partnerships with some of the more successful firms tied to the growing Maker movement to build and develop a microfactory for company engineers, students, and pretty much anyone with an idea for a product.



THE ENGINEERING BEHIND A WORLD WONDER

The rock city of Petra, and particularly "The Treasury" building, is young as wonders go. But as with all wonders, when studied closely, it turns out there is a great deal of engineering behind what the eye sees.

BIG DATA UNDER THE DOME

A new dome-shape data center consumes far less power than traditional designs. It may be the hemispherical shape of things to come.

For these articles and other content, visit **asme.org.**

ROBOTS HELP THOSE WITH AUTISM COMMUNICATE

A Colorado-based robotics startup is building an affordable robot companion to help autistic people communicate and interact with their environments.

NEXT MONTH ON ASME.ORG

TECHNOLOGY AGAINST ALS

A nonprofit organization is building a low-cost device using off-the-shelf components that will help amyotrophic lateral sclerosis patients communicate and interact with their surroundings.

VIDEO: FUELING THE AMERICAN MANUFACTURING RENAISSANCE

Helmuth Ludwig, CEO, Industry Sector, Siemens USA discusses and how public-private partnerships can help achieve a renaissance in American manufacturing.

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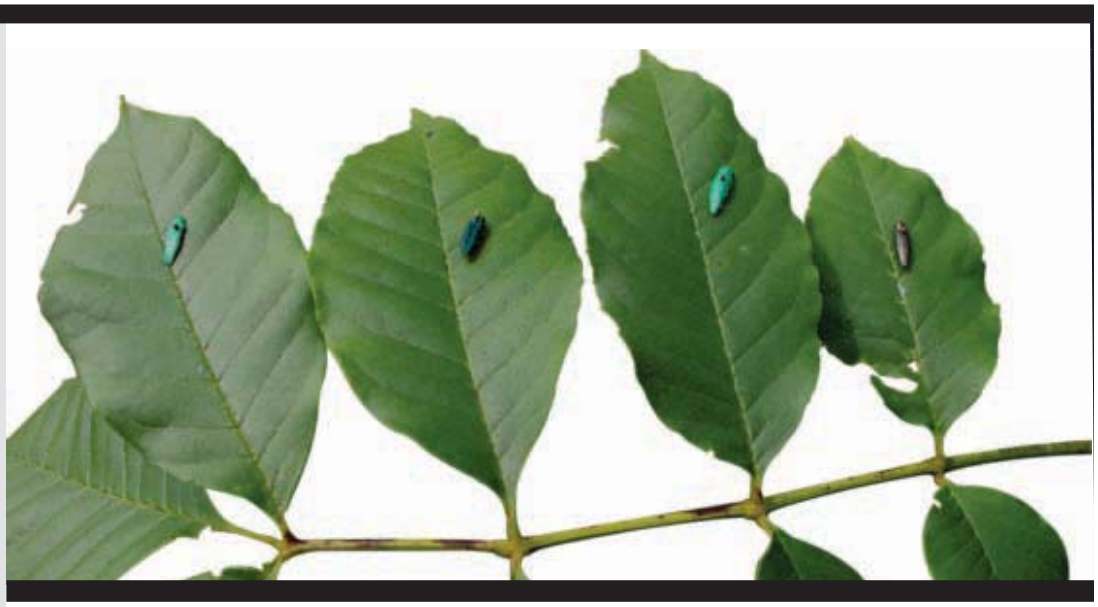
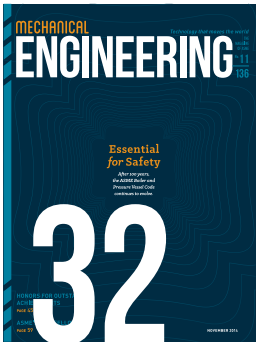


Tech Buzz: One of these decoy bugs uses nanotechnology to lure the invasive emerald ash borer. P.10

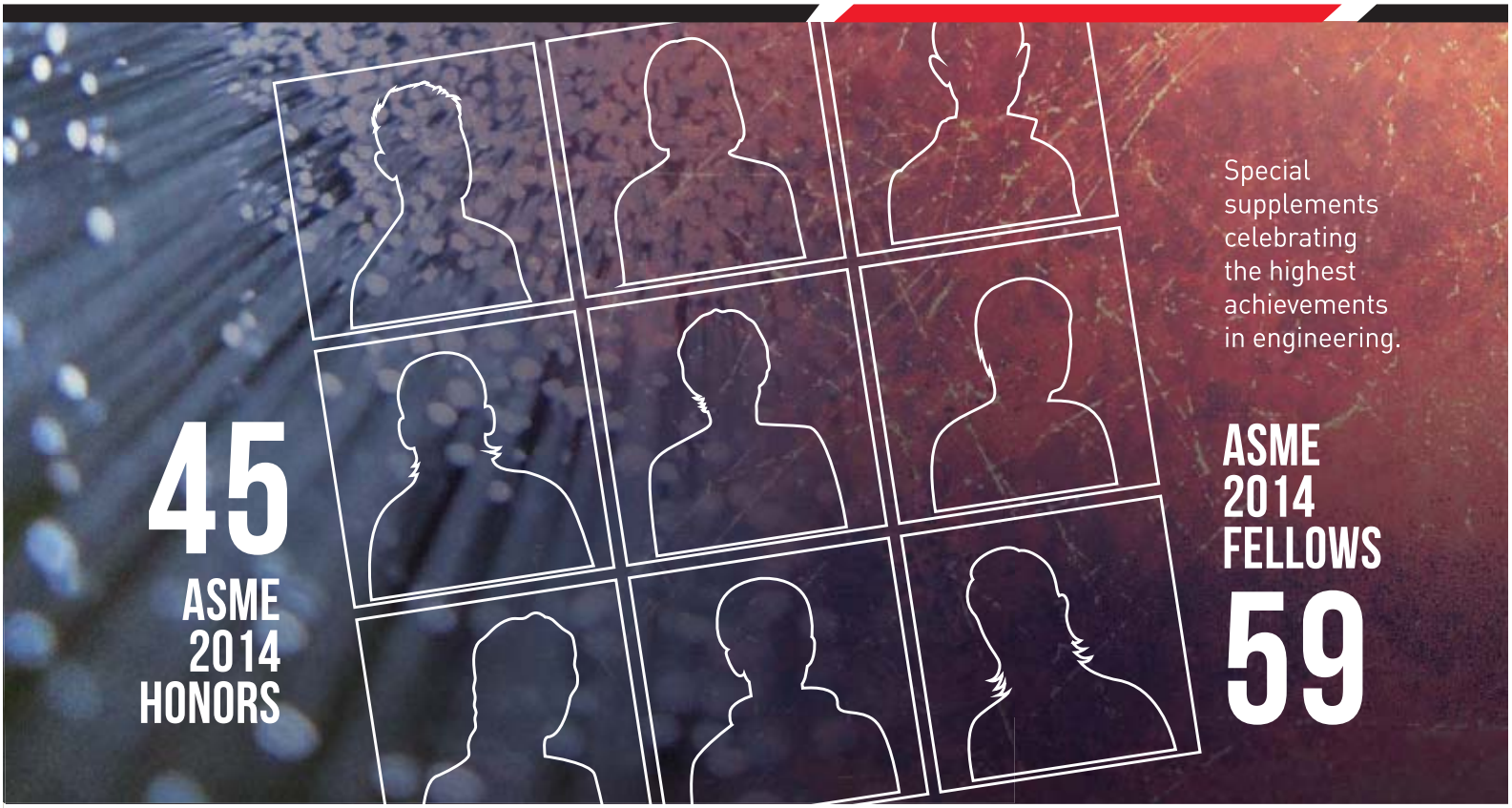


ON THE COVER

ESSENTIAL FOR SAFETY

Leading engineers talk about how the ASME Boiler and Pressure Vessel Code meets their professional needs.

ASME
SETTING THE STANDARD



RUBBISH GOES FROM BIN TO "WASTE HOUSE"

Researchers in England study an experimental building made from discarded materials.

BY JAMES PERO

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INSIDE

MECHANICAL
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Give me the place to stand, and I shall move the earth
—Archimedes

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John G. Falcioni
Editor-in-Chief

MAKING LIFE BETTER THROUGH INNOVATION

The Unisphere at Flushing Meadows-Corona Park in New York City—a park not too distant from where I grew up—was built as the icon of the 1964-1965 New York World's Fair. It was dedicated to celebrate "man's achievements on a shrinking globe in an expanding universe."

This year marks the 50th anniversary of that World's Fair and the Unisphere remains a part of the city's recognizable landscape. Many people now probably identify it mostly as a symbol for the annual U.S. Open Tennis Championships, which is held at the park. After a few years of neglect, the Unisphere again shines brightly above the glow of spotlights and, like the old days, water flows from the fountain. Fittingly, the statement about a "shrinking globe" that defined the Unisphere when it was dedicated keeps getting more relevant by the day. Technologies far more advanced than those showcased in the pavilions of the World's Fair continue to transform communication, transportation, education, and other areas.

It was nice to visit the park again in September for this year's Maker Faire, a collection of engineers, tinkerers, and garage inventors who were showcasing and celebrating innovation. It was a fitting location given the park's legacy with innovation. The maker culture represents a technology-based extension of the do-it-yourself movement. Makers like to tinker in electronics, robotics, and 3-D printing as much as woodworking and metalworking.

I've met few mechanical engineers who didn't work on gadgets in their basements or car engines in their garages growing up, or even now. But the maker movement also has a more serious subtext. The developing world—where resources are often scarce and access to the technology that we take for granted here is limited—is full of makers. Some have become renowned, but others work silently to help build better, safer environments for themselves, their families, and their villages. We might consider some of the things that they create tools or gadgets rather than technology, but to millions of people these locally sourced innovations represent vital instruments of everyday life.

At a forum on engineering for global development at this month's ASME International Mechanical Engineering Congress and Exposition, a group of influential thinkers, who are most familiar with the nuances of the technology, economics, and politics of the developing world, will debate the ways in which those of us in the First World can help makers in the Third World usher in more sustainable technologies to local areas. The program will be streamed live on asme.org on Nov. 17.

This movement is one push toward the democratization of technology, where greater access to better technology for more people leads to a better life.

Since its formation in 1880, ASME's mission has been to advance technology and safety. So besides noting the Unisphere's anniversary, in this issue we celebrate the 100th anniversary of the ASME Boiler and Pressure Vessel Code, which was first published in 1914. The Code is updated regularly to focus on new challenges and extend its growing influence around the world.

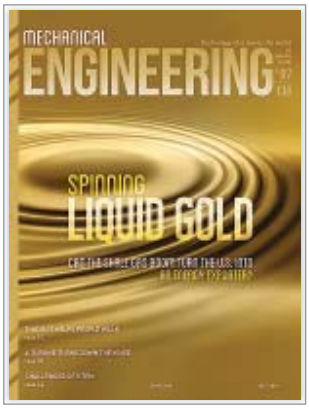
The Boiler and Pressure Vessel Code represents one way in which the achievement of men and women—hundreds of ASME volunteers—impact a shrinking world in an expanding universe. Finding more creative solutions to make people's lives easier is another. **ME**

FEEDBACK

Do you consider yourself a maker? Email me.

falcionij@asme.org

LETTERS & COMMENTS



JULY 2014

Reader Mobley finds his 1984 article in the Vault.

Readers react in different ways to our STEM roundtable. And another takes engineers to task for complacency in language skills.

LIME VS. SULFUR

To the Editor: I was surprised and gratified by my 1984 article on commercial utility flue gas desulfurization being featured from the Vault in the July issue.

It was an appropriate article to feature as lime and limestone flue gas desulfurization processes are still the predominant technology being used today to control sulfur dioxide emissions from coal-fired power plants.

I would have appreciated an opportunity to review the extract, however, as I am still a member of ASME (around 44 years). By the way, the correct terminology is New Source Performance Standards (NSPS), not New Source for Performance Standards.

Thank you for an interesting and relevant magazine.

David Mobley, *Raleigh, N.C.*

POTENTIAL LEADERS

To the Editor: Reading the expert panelists' comments presented in "Critical Thinking, Critical Choices: What Really Matters in STEM" (July) prompted this thought. Today's technology needs are mired in big data. As a mechanical engineer with the propensity for needing information presented to me in black and white, big data looks like a swirling soup of disparate colors and a whole lot of gray.

If I may, women are excellent leaders in a world of chaos, extracting the black and white, herding the cats to clean up the mess, then explaining to the world what the black and white means and how to use it.

Look at the images in this copy of *Mechanical Engineering* on pages 44-45, how many women do you see? I suspect this panel was carefully staged to uphold women in technology. I applaud that goal.

Now look at the images on pages 17, 25, 62, and 64. How many women do you see? A dearth of women represented in the technical arena continues to be a reality. I am, so many days, the only woman in a technical meeting.

Perhaps STEM education should not only focus on sparking a girl's interest, but also seek out clever methods to retain girls as they mature and grow into outstanding capable technical women. Hint: this will take non-traditional, creative solutions.

Jennifer Herron, *Lakewood, Colo.*

BASIC FOUNDATION

To the Editor: My engineer husband and I read the July issue with interest. Alberta is experiencing an unprecedented education fiasco, as our Education Minister foists his "discovery" fixation upon over 600,000 students and their 30,000 teachers. Minister Jeff Johnson's Task Force on Teaching Excellence threatens teachers with de/recertification every five years if they don't comply with his "discovery"/inquiry method approach to teaching (vs. direct instruction) throughout the K-12 curricula.

You noted that U.S. students' STEM-related exam results "pale in comparison" to the top countries. In Canada, we too have noted how our students' International Pisa Math Exam results have plummeted since 2003. Alberta (517) lags almost 100 points below Shanghai's (613) math exam results. Yet Minister Johnson repeatedly tells Albertans (and expects us to believe) that Alberta test scores are still "at the top."

Our K-12 curriculum (since 2003) has failed to utilize proven methods of mastery of the basic facts and skills, prior to moving on to teach higher-level problem solving, and our students are being short-changed and disadvantaged on the global stage.

Only under great pressure has Johnson conceded to make some of the requested changes, to ensure that elementary students again learn to add, subtract, multiply, divide, and work with fractions (instead of relying on their calculators and cell phones). Alberta students have recently been encouraged to guess, estimate, or speculate to "discover" their own answers, and this has had abysmal results.

We are deeply concerned about the education of the whole child, and the direction North America has taken in the past decade does a disservice to our students.

Marion Leithead, *Bawlf, Alberta*

LANGUAGE CHALLENGE

To the Editor: I just read your editorial in the July issue. I can see the truth in your comparison of the excuses, "I've never been good at reading" and "I've never been good at math."

I must point out that there is still really bad news in the language areas of our lives, however. The excuses "I've never been a good speller" and "I didn't do well in English" are quite common and are the equivalent excuses to the math excuse that you referred to. In fact, if you ask people to

correct their spelling errors or awful punctuation, you often receive far worse than excuses: you get defensiveness and even offensiveness thrown back at you.

So people are at least as complacent regarding their language skills as they are regarding their mathematics skills. I've noticed that people tend to look at others whose English skills are worse than theirs as inferior, and tend to defend themselves or attack people whose skills exceed theirs, and judge themselves as being just right, with no need for improvement.

I've been saying this for twenty five years: engineers are good at what they do, but beyond that, their expertise drops off grammatically. I would love to see our engineering profession focus as much on improving our communications as our mathematics. But I think that the "I'm OK the way I am" mentality blocks progress in all areas.

That mentality may be the biggest roadblock to improving the performance of our STEM students. It is incongruent that we practice "continuous improvement" in the workplace and even in our own homes, but we refuse to follow that principle with our language. We can do better.

William J. Vanek, *Clayton, N.C.*

IMPROVEMENT FOR THE SPORT OF IT

To the Editor: To your question, "What has been the most critical technological improvement in sports?" (Editorial, August) I nominate the aluminum bat for baseball and softball. Second would be the non-wood tennis racket.

The aluminum bat reduced costs for college, high school, and age-level teams. When I played in high school in the late '60s, I would go through three or four wood bats a season—at $15 a pop. Jump ten years when I attended Iowa State University and assisted on the baseball team. ISU had maybe three bats over the course of the academic year that had to be retired due to cracking. (ISU's Department of Metallurgical Engineering grabbed them all for analysis and course study examples).

Participation in tennis increased when the Prince Racket and subsequent non-wood rackets appeared. They had a larger sweet-spot and were more forgiving for mishits. Thus, recreational players became less frustrated during their early game and were more likely to "stick it out."

Mel Coleman, *Naval Air Station Lemoore, Calif.*

FEEDBACK

Send us your letters and comments via hard copy or e-mail memag@asme.org (use subject line "Letters and Comments"). Please include full name, address, and phone number. We reserve the right to edit for clarity, style, and length. We regret that unpublished letters cannot be acknowledged or returned.

NANOTECHNOLOGY FROM THE START

To the Editor: It was good to see K. Eric Drexler's interview in August 2014.

I met Dr. Drexler in 1991 at his first Foresight Institute conference in California. I attended as the ASME Executive Branch Fellow in the Technology Administration of the U.S. Department of Commerce. In January 1992 I gave a talk on Drexler's work to the local D.C. chapter of ASME.

Later in 1992 I attended Dr. Drexler's testimony in front of Sen. Al Gore's Senate Science Committee, and then escorted him to the White House Science Office, where I was working as the ASME Fellow.

I had arranged for executives from the Office of Science and Technology Policy and the National Science Foundation to meet Drexler and discuss possible government support of nanotechnology.

Drexler was not well received by the officials present. At least one was openly hostile. More details of the political beginnings of nanotechnology appear in my 1994 article, "Nanotech and Nanominds: Footnotes for the Future," in the anthology *Nanodreams*, edited by Elton Eliott.

I wrote the manufacturing chapter in the President's Report to Congress on Science and Technology, which was published in April 1993. In that chapter, I endorsed Drexler's vision of "molecular nanotechnology," the first time the subject was mentioned in a White House publication. The well-funded National Nanotechnology Initiative did not begin until later in the Clinton administration.

At the 1993 ASME Winter Conference in New Orleans, I chaired the first ASME session on nanotechnology, and presented an overview paper. When some of the older engineers there seemed to despair at a development that might obsolete them, I replied, "But nanotechnology is a perfect fit for mechanical engineers: all of our piece parts will be absolutely identical. There are no tolerances!"

Arlan Andrews Sr., *P.E., Corpus Christi, Texas*

ELECTRIC BREW

To the Editor: I jumped from the cover of the August issue directly to the last page.

"Art, Science, and Beer" (Input/Output, August) was indeed fun and interesting.

Electrical engineers turned brewers. Fantastic!

Short-Circuit Stout, Flip Switch IPA, Schottky Pumpkin Ale. Would these pints go down smoothly and give you energy?

Joanna Eng, *Montclair, N.J.*

MEASURE THIS

To the Editor: In "Unsettled Science," Tim Parrish (Letters & Comments, August) noted that the term "global warming" has been replaced by "climate change."

The scientist Lord Kelvin (1824-1907) is often quoted as saying, "If you cannot measure it, then it is not science."

The thermometer was invented by Fahrenheit in 1714 and global temperatures have been measured ever since. How is "climate change" measured?

Gordon N. Rogers, *Toronto, Ontario*

NANOTECH MEETS THE ASH BORER

THE EMERALD ASH BORER IS ONE OF THE MOST DESTRUCTIVE FOREST PESTS IN NORTH AMERICA. Since it was accidentally introduced to the United States from China in 2002, the ash borer has spread to 24 states and two Canadian provinces, and has been responsible for killing tens of millions of healthy native trees. Identifying an infestation in its early stages is a key to controlling damage.

AN INTERNATIONAL TEAM OF RESEARCHERS has demonstrated a potential means of early detection. The strategy is to get the ash borer to make a poor choice for a date and in the process give away its presence in the forest.

Their method involves decoy females, electric shock, and a trap to collect the bodies of electrocuted males.

The researchers created the decoys using a bioreplication process with nanoscale fidelity. According to one of the developers, Akhlesh Lakhtakia, the Charles Godfrey Binder professor of engineering science and mechanics at Pennsylvania State University, replication involved coating a dead female beetle with a vapor of nickel, and using the shell to make two matching molds in the shape of a resting beetle.

The team pressed a colored plastic sheet between the molds while simultaneously applying heat, to cast numerous replicas to serve as decoys. The finished decoys retained the surface texture of the beetle at the nanoscale, Lakhtakia said.

The decoys are part of an ambush that involves an electric charge. When males land on the decoys in an attempt to mate, they are electrocuted, and the dead insects fall into a trap, which can be retrieved and disclose the early presence of ash borers.

QUICK FACTS:

WHAT IT IS:
An electrified decoy to trap male ash borers.

PURPOSE:
Early detection of the insects' presence.

DEVELOPERS:
Penn State, Hungarian Academy of Sciences and Forest Research Institute, U.S. Agriculture Department.

Alternative decoys were made by 3-D printing, which did not duplicate the surface detail of the molded decoys.

Three types of decoys were tested in a forest in Hungary. Entomology researchers pinned the molded and printed decoys, as well as dead female emerald ash borers onto leaves in forests to see which ones best attracted wild males.

According to Michael Domingue, postdoctoral fellow in entomology at Penn State, the light-scattering properties of the beetle's shell, which the team experimentally demonstrated using a laser, made the molded decoys more lifelike and, therefore, more attractive to males than the printed decoys. Domingue said he and his team of researchers have "gained new insights into how to manipulate the behavior of emerald ash borers and similar pests in ways that can help to trap them and monitor where they might be doing damage."

The team included entomologists and engineers from Penn State, the Hungarian Academy of Sciences, the Forest Research Institute in Matrafured, Hungary, and the U.S. Department of Agriculture.

Understanding how these destructive beetles find each other to mate will help the USDA Animal Plant Health Inspection Services meet its goals of early detection and mitigation of invasive pests.

Thomas C. Baker, distinguished professor of entomology at Penn State, said the multidisciplinary team is investigating the use of the decoys to attract other insect species. **ME**

JAMES PERO

Decoys (left) are placed on leaves to draw, zap, and trap male emerald ash borers.

DEFYING GRAVITY: PARTNERSHIP TO TRACK SPACE JUNK

A plot of space debris in low Earth orbit and the geosynchronous region, as seen above the north pole. An animated version is available at tinyurl.com/LEODebris.

Early in the movie *Gravity*, a Russian antisatellite missile test unleashes a cloud of debris that shreds the International Space Station. This is just what a new business partnership hopes to avoid. Lockheed Martin and Australia's Electro Optic Systems are creating a monitoring system to track the trajectories of space junk.

The partners will use the information to forecast likely collisions, giving satellites (as well as the ISS) enough time to change their orbits to get out of the way.

This may sound far-fetched, but EOS argues that on average, space debris knocks out about one satellite every year. Those satellites can easily cost hundreds of millions of dollars to build and deploy.

No one is certain exactly how much junk is circling the Earth. In addition to collision residue, a major source of debris was the explosion of propellant and high-pressure liquids in old launch vehicles and derelict satellites. Smaller fragments come from solid fuel effluent, debris released during missions, and even flecks of paint that pop off rockets because of thermal stress.

In fact, the scenario played out in *Gravity* has parallels in an actual incident. In 2007, China tested an antisatellite missile by blowing up its own 1-ton Fengyun-1C weather satellite. This produced a large debris cloud: According to a 2007 NASA Orbital Debris Program Office estimate, it included 2,317 pieces large enough for NASA to track and more than 35,000 pieces larger than 1 centimeter.

While a swarm of dime-sized particles may not sound threatening, each fragment is moving at 14,000 miles per hour and packs a huge kinetic wallop. In 2013, a Fengyun fragment apparently disabled a Russian scientific satellite. Due to slight variations in their trajectories, the fragments in the Fengyun swarm continue to spread over a wider area, making future collisions more likely.

This is just one of many orbital collisions. In 2009, a derelict Russian Kosmos satellite rammed an Iridium communications satellite 500 miles above Siberia and created a large debris cloud. Earlier, in 1996, fragments of an exploded Ariane booster rocket took down a French microsatellite.

NASA ESTIMATES THERE ARE 500,000 FRAGMENTS BETWEEN 1 CM AND 10 CM IN SIZE IN SPACE.

Space junk has also given astronauts a scare. In 1994, for example, a piece of debris penetrated halfway through the front window of the space shuttle *Endeavour* and threatened its integrity during reentry. In 2006, a piece of circuit board sliced into *Atlantis*'s cargo bay. At least three times, astronauts evacuated from the International Space Station to their rescue craft when they received late warnings about approaching debris.

NASA routinely tracks more than 21,000 pieces of debris larger than 10 cm using a combination of optical telescopes and radar. It estimates there are 500,000 fragments between 1 cm and 10 cm in size.

Lockheed Martin estimates there are hundreds of thousands of fragments larger than 5 cm. It plans to track 200,000 of them with the Space Fence S-band radar system it is building for the U.S. Air Force.

"These radar-based systems are very good for scanning large portions of sky and giving you a wide-angle view of what's out there so we can catalog and track it," Lockheed Martin spokesperson Matt Kramer explained.

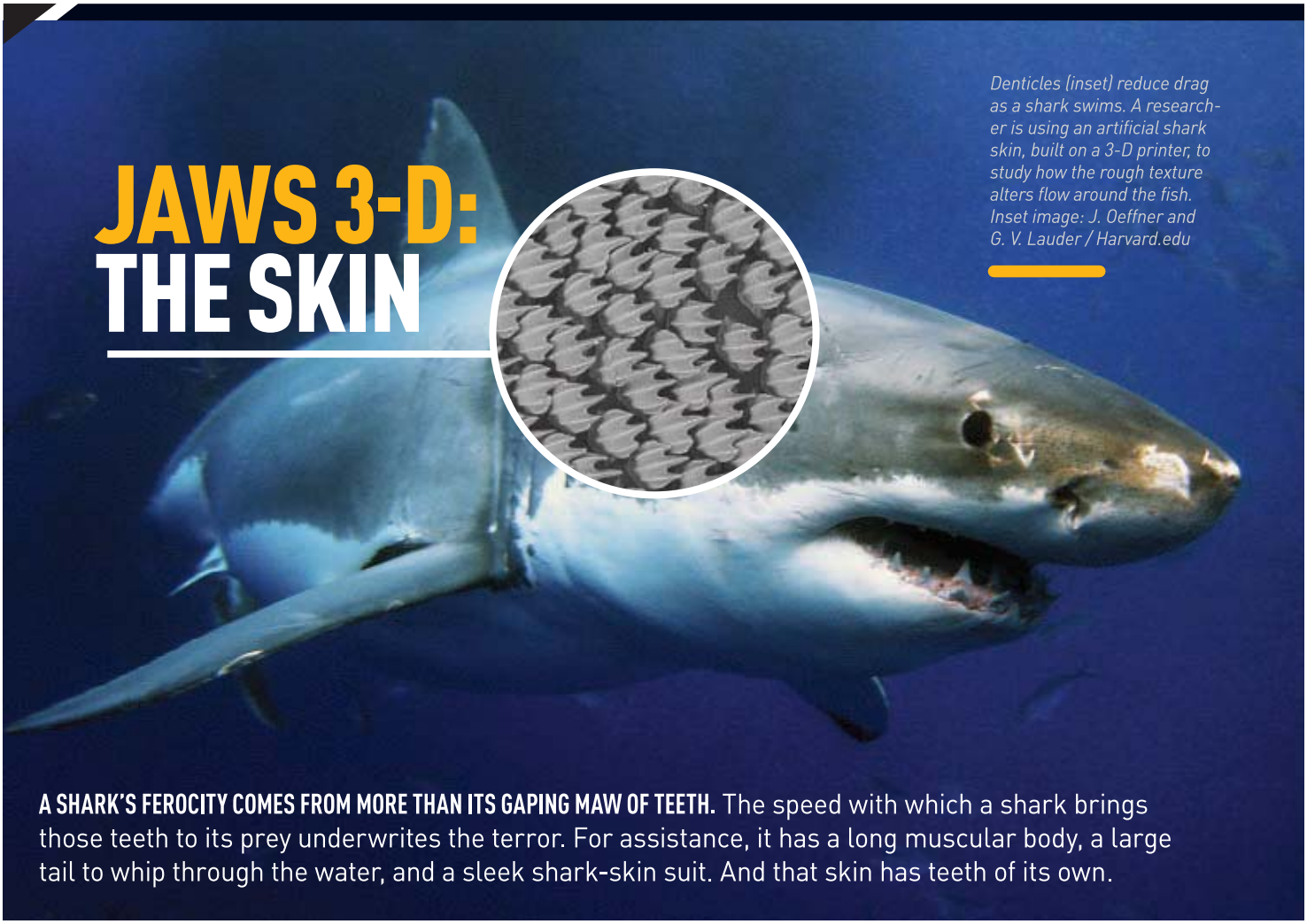
"The laser ranging system we are building with Electro Optic Systems will zoom in closely on specific objects in those swarms and tell you exactly where they are, how fast they are moving, and what they are made of. This will let us make precise projections of the path of that debris.

"We're going to sell that information, first to the government and then private industry. They can use the information to make very precise decisions about whether or not to move their satellite out of the way. That's important, because satellite propellant is a very precious resource, and once you run out, there is no way to refill the tank," Kramer said.

The companies plan to start building their laser facility in Australia this year and finish by early 2016. By cataloging space debris, they hope to make space—and the ISS—safer for both astronauts and satellites. **ME**

ALAN S. BROWN

JAWS 3-D: THE SKIN



Denticles (inset) reduce drag as a shark swims. A researcher is using an artificial shark skin, built on a 3-D printer, to study how the rough texture alters flow around the fish. Inset image: J. Oeffner and G. V. Lauder / Harvard.edu

A SHARK'S FEROCITY COMES FROM MORE THAN ITS GAPING MAW OF TEETH. The speed with which a shark brings those teeth to its prey underwrites the terror. For assistance, it has a long muscular body, a large tail to whip through the water, and a sleek shark-skin suit. And that skin has teeth of its own.

No, the sleekness isn't as sleek as it seems. Covering every inch of the big fish's skin are tiny denticles, interlocking scales that bend with the shark's body and decrease drag.

In 2012, Harvard University's George Lauder (an ichthyologist with a focus on biomechanics) showed that a shark skin with denticles outperformed a skin that had been sanded smooth. But to further explore just how denticles were helping sharks speed through the seas, never mind create potential applications, Lauder decided he needed to make a shark skin—on a 3-D printer.

"When dealing with real shark skin, you can't manipulate it, change the shape, change the pattern, or delete scales," Lauder said. "The only way to do that is to make your own artificial shark skin."

"WHEN DEALING WITH REAL SHARK SKIN, YOU CAN'T MANIPULATE IT, CHANGE THE SHAPE, CHANGE THE PATTERN, OR DELETE SCALES. THE ONLY WAY TO DO THAT IS TO MAKE YOUR OWN ARTIFICIAL SHARK SKIN."
GEORGE LAUDER, HARVARD UNIVERSITY

Such a pursuit is not as simple as it sounds. In fact, the project took more than a year from the first laser scans of a real shark's skin to the first successful printout. "You can't do it with a MakerBot," Lauder said. Instead he used a $300,000 Objet500 Connex. "You can never have too much money, pay too few taxes, be too thin, or have high enough resolution," he said.

But resolution was only part of the problem. The denticles are only 100 or so micrometers wide, with narrow pointy edges that stick out and bend like wings hanging over each other. The scales are rigid and have to be embedded, on a minuscule base, in a more flexible material that is the skin proper. The denticle and skin design came from tweaking scans of real shark skin in SolidWorks. One of the advantages of the Objet500 is that the support material for each denticle could be washed away with a water jet.

Once it was printed, Lauder put the skin in a sort of flapping wind tunnel where it outperformed a smooth control by 6 percent. Exactly how the denticles get the boost remains a mystery. "When they are bending back and forth they do seem to alter the flow, especially where there's flow separation," he said. "It seems they can hold a low-pressure vortex closer to the surface than when smooth. We don't know exactly what's going on, but it's clear that the roughness is altering the flow near the surface."

Despite the increased speed in the flapper, applications for such a

continued on p. 14 »

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continued from page 12 »

JAWS 3-D: THE SKIN

material may not be plentiful. A ship's hull, for instance, doesn't bend and twist. And even if denticles provided some advantage, they'd probably add too much weight and attract too much growth. Similarly, denticles are not likely to improve the speed of any Olympic swimmer anytime soon. "You could 3-D print square foot sections and then sew them together," Lauder said. "But then your swimsuit would weigh five pounds."

The next step is to experiment with different denticle shapes "once we think we understand the parameters that actually improve the performance," Lauder said. There's an incredible diversity to denticle size and shape in the world of real sharks. Soon we may know why certain sharks have certain shapes, and which shapes best add to speed. And, of course, a printed denticle need not be constrained to what's already out there in the ocean. Lauder may eventually produce a skin that outperforms living sharks, though the competition is fierce.

George Lauder holds swimsuit material with surface properties similar to shark skin. Image: Kris Snibbe / Harvard.edu

After all, he said, "Sharks have had a few million years to perfect these things." ME

MICHAEL ABRAMS, ASME.ORG

GETTING

Biochar—the black char made from heating or gasifying wood and other plant material—is a top-notch, inexpensive way to filter contaminants from drinking water. It can even filter out pesticides, making it an attractive solution for farming communities and anyone downstream from fields.

But exactly how effective is it against pesticides? Josh Kearns is raising funds to find out.

Kearns is science director at Aqueous Solutions, Huntington, W.Va., a nonprofit water, sanitation, and hygiene development organization.

Josh Kearns

He's designed and

PESTICIDES OUT OF WATER

built biochar gasifiers and water filtration systems in Thailand. In that process, he'd discovered that no scientific research had been performed on the use of chars for control of pesticides and other organic chemical toxins in drinking water, he said.

About three-quarters of the pesticides used in Thailand are banned or heavily restricted in the United States and Europe due to ecological and human-health effects, Kearns said.

To determine biochar's efficacy in filtering pesticides in Thai villages and towns, Kearns is raising money to test filtered water using micro-columns and chemically tagged water contaminants, he said. They'll study the most commonly used pesticides and those that are hardest to filter, he added.

Micro-columns are filled with different quantities and types of biochar and then water is pushed through them. They can help researchers discover how well the different configurations of biochar filter contaminants and discover the best ways to use biochar in filtration systems, Kearns said.

A gasifier burns wood and plant waste to form biochar. The effectiveness of biochar in filtering pesticides is the subject of research. Photo: Aqueous Solutions

The chemical tags allow researchers to track the tagged compounds as they enter the micro-columns and pass through or get stuck in the biochar filters.

To raise money for the analysis, Kearns turned to a crowdfunding platform to seek funds to help to cover the cost of materials. When the crowdfunded request ended on August 15, he'd raised close to $2,000. He expects to need about $5,000 to cover his costs.

The pesticide and pharmaceutical contaminant reagents for use in laboratory micro-column tests are expensive because they are labeled with radiochemical tags, which allow researchers to detect the contaminants at parts-per-trillion levels when they're dissolved along with background natural organic matter in typical surface waters, Kearns said. **ME**

ENGINEERINGFORCHANGE.ORG

WASTING AN OPPORTUNITY

Americans generate a lot of trash and stick most of it in landfills. We need to recover more value from what we throw out.

The world of waste is innovative in ways most Americans would never imagine. Advanced recycling centers in the United States, for instance, use multi-million dollar machines with high-tech conveyor systems to automatically sort different materials using lasers, optical scanners, blowers, magnets, rakes, crushers, vacuums, and other devices. Unsorted trash enters the system, and neatly separated bales of like materials exit.

As David Scott, the executive director of economic and energy affairs for the United Arab Emirates, once said, "Waste is what you have when you run out of imagination." We can use our imagination to rethink our relationship with waste.

In spite of generating more than 20 percent of the world's trash, Americans are pretty unsophisticated in the way we deal with it. Less than half of the 250 million tons of municipal solid waste produced annually is recycled, composted, or incinerated for energy. Most is buried in landfills.

Europeans, conversely, produce less trash per person and send very little of what they do make to landfills. Why? To begin with, they do not have much space for landfills. Europeans also have a different cultural approach to resource management, aiming to use less and make each ounce of material go further. Americans often associate consumption with power and conservation with weakness; in Europe it's the other way around.

Importantly, the European Union has strict regulations about the end-of-life for different consumer goods, including electronics and automobiles. These regulations mostly prohibit landfills as an option for a majority of the materials and puts a responsibility on manufacturers to create designs that can be disassembled and separated after the product life into useful materials. The result? Many of those expensive, high-value systems that automate the recycling process are imported from Europe.

WE'RE BURYING MONEY IN THE GROUND. IT'S TIME WE REALIZED IT.

Compared to Europeans, who build high-tech machinery to recover valuable materials, Americans seem backwards. We're essentially burying money in the ground. It's time we realized it.

For example, baby diapers and some other plastics are hard to recycle and decompose slowly in landfills, but they have energy density the same as coal's or better. These plastics can be converted into fuel pellets and used at boilers and cement plants to displace fossil fuels. Many plastics also can be liquefied into fuels that displace petroleum products. Fibers can be used as fuels or as input for building materials. Metals can be melted down and used again.

Cities still pay recyclers millions of dollars to take away trash. But those costs are dropping as the separation and recycling technologies improve and the value of the harvested materials increases.

Changing the way we look at trash will require changes at every level of government. At the state and local levels, decision makers must recognize the value in trash; we could be charging companies for the right to "mine" our waste streams instead of paying them to haul it away. Federal R&D can bring down the costs of sorting and recycling our trash and help improve scrubbers for trash incinerators. Federal policymakers can also implement strict, European-style end-of-life requirements for durable goods.

The U.S. military is already operating in the new waste paradigm. For the Department of Defense, waste is a strategic liability: In some forward operating bases, every pound of waste needs to be trucked off site. And those trucks are soft targets that put human lives at risk, so that reducing trash isn't just good for the environment—it provides operational security.

Stateside, Fort Bliss and Fort Carson are both pursuing zero-waste initiatives. Doing so reduces the footprint of those bases and helps the military develop the expertise it needs in theater.

If reducing our waste and managing it better is good enough for our soldiers in harm's way, it's good enough for civilians here at home, too. We can push to turn our trash into treasure, and mechanical engineers should lead the way. ME

MICHAEL E. WEBBER is the Josey Centennial Fellow in Energy Resources and associate professor of mechanical engineering at the University of Texas at Austin.

WASTE NOT
Building with castoffs in Brighton. P.88

OBESITY TREATMENTS

Patented weight loss schemes: There are more than a million.

Engineers solve problems. Sometimes, numerous "solutions" are proposed for a problem, none really works, and the problem just gets worse.

One example is obesity. I can relate: at my age, if I miss a single workout during the week, it seems I gain 10 lbs. If you use Google Patents and type in "obesity" you will receive over a million patent results. The following are a few interesting obesity treatment patent examples.

MAGIC PILLS Patents for drugs purporting to treat obesity include amphetamines (Patent No. 3,369,967 dated Feb. 20, 1968). Noting the adverse side effects associated with taking amphetamines, a treatment based on the amino acid histidine was proposed by the Department of Health, Education, and Welfare in Patent No. 3,867,539 (Feb. 18, 1975). After the fen-phen debacle, we should be wary of any diet pill.

COMPUTER SOLUTIONS An early computerized weight loss management system is disclosed in Patent No. 4,951,197 dated Aug. 21, 1990. The abstract reads: "A weight loss management system utilizes a computer analysis of a participant's past medical history, eating habits, body measurements, exercise level, and taste preferences to provide a menu of a specified number of calories to maintain a reasonable weight." That particular patent is widely referenced including Weight Watchers Ltd. Patent No. 6,436,036 (Aug. 20, 2002) for its proprietary point value weight loss system.

SURGICAL SOLUTIONS More drastic weight loss measures include medical operations where something inflatable is placed in your stomach to make you feel full. Of the numerous patent examples in this category, included are Patent Nos. 4,133,315 (Jan. 9, 1979), 4,899,747 (Feb. 13, 1990), and 4,485,805 (Dec. 4, 1984). An early gastric band device is disclosed in Patent No. 4,592,339 dated June 3, 1986.

COVER IT UP It was a long time ago that inventers proposed different ways to hide obesity. Patent No. 1,184,516 (1916) is for an obesity belt with a very uncomfortable looking spring-like ring coupled to a belt for pulling your tummy in. Apparently, these obesity belts were pretty popular back in the day. In obesity belt Patent No. 806,482 (December 5, 1905) the inventor alleges:

"It is well known that by manipulating the body with a corrugated roller of wood, rubber, or other firm material the massage effect reduces weight and flesh. Acting on this principle I provide means for bringing a series of these rollers into position on the body, and particularly across the abdomen, in such a way that the natural movements of the body will cause the rollers to act both vertically and laterally, so as to subject the body to a continuous, but mild and yet effective, massaging, thereby producing the desired effect."

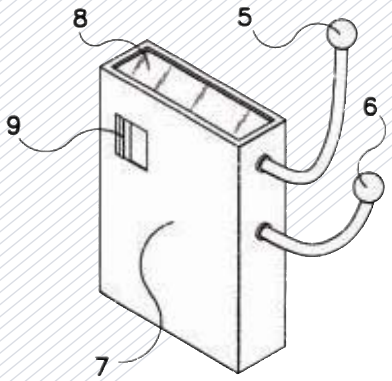
STIMULATION Published Patent Application No. 2013/0096469 (April 18, 2013) states: "It is the purpose of this invention to provide methods and systems for non-invasive neuromodulation of deep-brain targets using ultrasound to treat obesity and eating disorders." Medtronic Inc., Patent No. 8,538,532 (Sept. 17, 2013), proposes electrical stimulations delivered to a patient's stomach to induce "gastric distention" making you feel full.

THROAT MONITORING I like the "E-fit monitor" device of Patent No. 6,135,950. One sensor microphone is taped to your Adam's apple, and a processor inside the wearable unit sets off an alarm if your swallowing rate is too high.

Will there ever be a safe and effective weight loss pill, computerized treatment, weight loss surgery, or other method? After millions of tries over many years, maybe this is one problem for which there is no simple solution.

One recent patent for treating obesity is No. 8,272,152 (Dec. 17, 2013) which claims a dieting process with just two steps: first, eat less, and second, exercise more. Just kidding.ME

KIRK TESKA is the author of *Patent Project Management* and *Patent Savvy for Managers*, is an adjunct law professor at Suffolk University Law School, and is the managing partner of Iandiorio Teska & Coleman, LLP, an intellectual property law firm in Waltham, Mass.



EATING ALARM

The E-fit monitor, U.S. Patent No. 6,135,950, includes a microphone sensor (5 in the diagram) that alerts a processor to set off an alarm when the wearer swallows too fast.

A BACK-TO-THE-FUTURE DIESEL

TWO-STROKE GASOLINE ENGINES ARE INFAMOUS FOR THEIR high emissions. A new two-stroke diesel does better by updating an old concept.

A San Diego company is developing a two-stroke diesel engine with opposed cylinders, a simplified design that dates back to the early 20th century. Opposed-piston diesels once powered ships and locomotives but disappeared years ago.

According to the company, Achates Power, its design has overcome many of the emissions problems of earlier opposed-cylinder configurations, and its engine consumes about 20 percent less fuel than a conventional diesel.

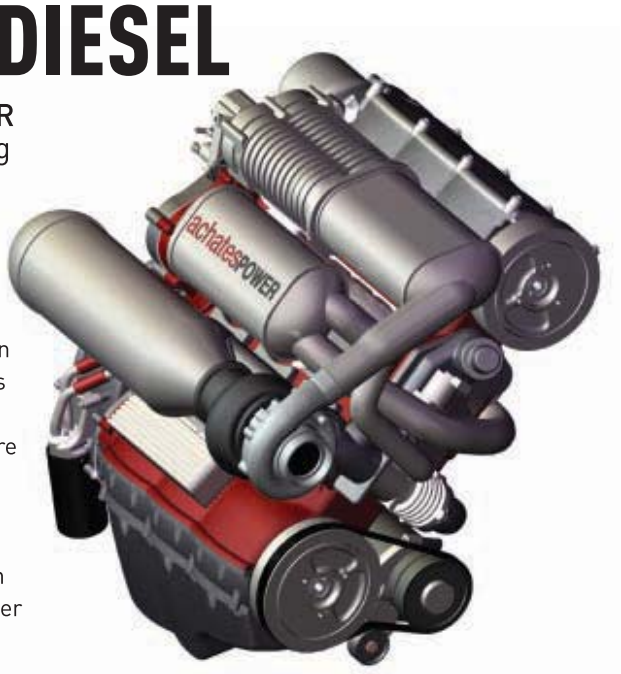
David Johnson, CEO of Achates Power, has led engine development teams at both GM and Ford. Johnson said Achates has tested several prototypes over the past seven years and is aiming for several markets.

Late last year, Achates Power signed a joint development agreement with Fairbanks-Morse, a maker of large diesels used in marine, industrial, and power generation applications. Johnson also wants to get his two-stroke diesels on 2025 pickup trucks.

The pistons in the Achates engine are paired at opposite ends of a very tall common cylinder and trap hot gases in the middle. One piston uncovers the exhaust ports, and the opposing piston opens the intake ports a short time later during the stroke.

The arrangement eliminates poppet valves, camshaft, and related hardware like rockers and drive gears.

Two-stroke gasoline engines are known to have high emis- continued on p.22 »



A concept for an Achates two-stroke diesel engine to fit an automobile. The company sees a potential market in pickup trucks.

Q&A MARTIN HEINRICH

SEN. MARTIN HEINRICH, DEMOCRAT OF NEW MEXICO, is the only engineer in the U.S. Senate. Prior to being elected to the Senate in 2012, Heinrich served two terms in the U.S. House of Representatives and four years as on the Albuquerque City Council. After earning a bachelor's degree in mechanical engineering at the University of Missouri (where he delivered the commencement address to the College of Engineering last May), Heinrich began his career at Phillips Laboratories in Albuquerque as a contractor working on directed energy issues. He also founded a small public affairs consulting firm. He lives with his wife and two children in Albuquerque.

ME: Can you talk about your move from engineering to politics?

M.H: That was interesting because it wasn't intentional. But I was always sort of fascinated by the nexus of science, technology, and policy, and it was pretty evident when I was still in school that scientists and engineers don't always engage in policy debates at the level that I would like to see for the importance of those fields. I got more involved in politics over time and decided to run for Albuquerque City Council in 2003.

When I was in House of Representatives I was on the Strategic Forces Subcommittee, a subcommittee of the House Armed Services Committee that deals with nuclear deterrence and space-based issues, from satellites to space debris. I was representing two national labs in New Mexico (Los Alamos and Sandia). It was a great fit for me because I go back to colleagues in the House and explain things like the budget ramifications of certain cuts.

ME: Does being the only engineer in the Senate come up in your senatorial or wider political dealings?

M.H: I'm always surprised by who brings it up. There aren't a lot of engineers in elected office, so it's fairly unique. I wish there were more of us. I'd love to have an engineering caucus in the Senate.

ME: Why do you think there aren't many engineers in elected office?

M.H: Politics is a world that doesn't necessarily work based on data and deliverables. What I try to bring to it is an understanding and tolerance of the politics that allows me to focus on policy and science. That's important but there's no question that that turns a lot of scientists off and I can certainly understand that perspective. But I feel it's also really important to have a scientific perspective in all those conversations.

I was having a conversation recently with the faculty at the University of Missouri College of Engineering about the need for communication to become part of the engineering curriculum. We do a good job educating engineers to be engineers but many of the projects I've worked on over the years succeeded or failed not on merits of the projects themselves but on how well they're communicated to the public.

For instance, take the San Juan-Chama Project in New Mexico and Colorado. I used to be the chair of the Albuquerque Bernalillo County Water Utility Authority. That project took years to do, but because the public embraced it and we had an active communication process, that project's working today. It moves water under mountains. There have been similar water projects not embraced by the public.

ME: What do you find rewarding about your work?

M.H: I get to meet young people who just blow your socks off. I meet kids from all around my state and the country who care about science and are clearly going to be incredible leaders for our country. When you're around young people with so much talent, intelligent, optimism, and drive it makes you optimistic, even in challenging times.

ME: What political issues should mechanical engineers be involved in or pay attention to?

M.H: They should be engaged in transit legislation and investment in infrastructure, particularly transportation and mass transit. Also STEM legislation because that's the pipeline for the future of engineering in the country. They should also be engaged on issues like immigration reform because we see the best and brightest university graduates leaving. All that intellectual capital students received at our land grant universities and take elsewhere, out of country, we could be putting to use at home. **ME**

continued from page 19 »

A BACK-TO-THE-FUTURE DIESEL

sions, largely because lubricating oil is added to the fuel and burns poorly, and because hydrocarbons escape from the cylinder into the exhaust when the new charge of fuel and air enters. Earlier opposed-piston engines were phased out because of oil consumption.

Two pistons, sharing a single cylinder, drive separate crankshafts. Among the advantages cited by the developer is that eliminating the cylinder head reduces heat loss.

The Achates engine has conventional crankcase lubrication that is separate from the fuel supply. Because it is a diesel, only fresh air enters the cylinder port, not a fuel-air mixture.

According to Johnson, Achates' engineers have addressed piston ring conformity to the cylinder wall, tension, end gap, land chamfers, and dynamic stability, and have taken advantage of new, harder materials that allow use of a thinner oil film. He said the two-stroke engine consumes no more lube per pound of fuel burned than a standard four-stroke.

The Achates engine has two crankshafts, which are connected and coordinated with a gear train. The engine has the same bore and stroke for each piston as a standard diesel, and thus will retain familiar piston speeds.

According to Achates, a three-cylinder engine with opposed pistons can replace a six-cylinder engine. The arrangement also eliminates the cylinder head, which in a conventional engine must be cooled and is a source of heat loss.

The company says it has tested several prototypes, including this one in a test cell.

According to Johnson, the steel pistons can run significantly hotter than a cylinder head and that enhances the engine's ability to retain heat.

The use of a two-stroke cycle means the engine can deliver the same power as present engines while running very lean because each cylinder fires every revolution rather than every other. The Achates' net ability to ingest and use air is similar to that of a standard engine that is nearly twice as large. The air/fuel ratio is 2.7:1 vs. 1.5:1 for a similar opposed-piston four-stroke.

Having extra air available helps increase efficiency because less exhaust gas recirculation is needed to maintain NO_x levels. The burning gases are easier to heat up, which increases cylinder pressure on the outward stroke.

Stephen Macadam, president of Fairbanks-Morse's parent company, EnPro Industries said the company expects to develop engines based on Achates' technology in a few years. "It will take us a couple of years to get the actual technology developed and incorporated into our engine," Macadam said, "but it could be a game changer for us." ME

JOHN BAXTER is a technical writer based in Downington, Pa., and also technical director of Advance Diesel Concepts, a developer of alternative engine technologies.

$67 MILLION TO ADVANCED NUCLEAR TECHNOLOGY

THE ENERGY DEPARTMENT HAS AWARDED NEARLY $67 MILLION TO 83 projects in nuclear energy research and infrastructure enhancement.

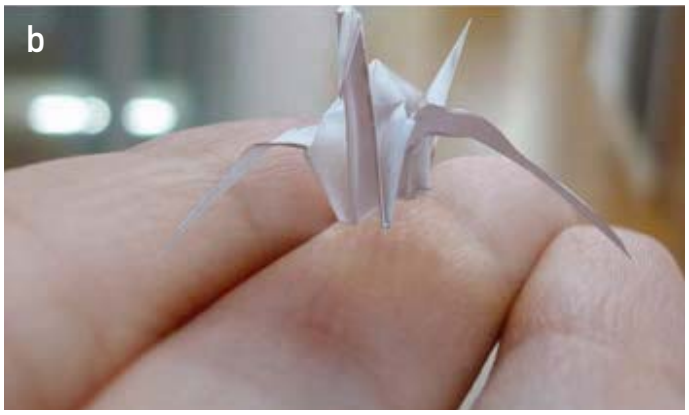
The Energy Department is awarding over $30 million through its Nuclear Energy Research Programs to support 44 university-led nuclear energy research and development projects to develop innovative technologies and solutions. The projects will be led by 30 U.S. universities in 24 states.

Approximately $4 million will go to 19 universities to provide important safety, performance, and student education-related upgrades to the nation's 25 university research reactors as well as enhancing university research and training infrastructure.

The Energy Department is also awarding $20 million for five projects exploring high priority nuclear energy research challenges, including instrumentation and vacuum drying systems associated with the storage of used nuclear fuel, an integrated approach to fluoride high temperature reactor technology development, and advanced instrumentation to support transient testing.

Additionally, $11 million will be awarded for 12 research and development projects in support of the Nuclear Energy Enabling Technologies Crosscutting Technology Development, which addresses issues shared among different nuclear technologies.

Two infrastructure enhancement projects totaling over $1 million will be awarded to national laboratories to further reactor materials and instrumentation research. ■



ADDING A DIMENSION

THE VIEW FROM UNDERNEATH

THE LAB Carnegie Mellon Robotics Institute, Pittsburgh; Matt Mason, director.

OBJECTIVE Research on robotics technologies including manipulation, locomotion, control, machine learning, computer vision, and graphics.

DEVELOPMENT The 3-D manipulation of objects within a 2-D image.

A 3-D photo editing system developed at Carnegie Mellon makes it possible to take a photo **(a)** and turn it to reveal surfaces hidden from the camera **(b)** while maintaining a realistic appearance. The object's shape can be changed, for instance, enabling an animation showing the crane flapping its wings. The editing system makes it possible not only to multiply the number of objects visible in a photo **(c,** original; **d,** manipulated**)** but to turn them to reveal unseen surfaces, including the underside. *Images: Carnegie Mellon University*

Researchers at two labs have created ways for two-dimensional images to spring from page and from screen. The three-dimensional images are available for photo editors to turn this way and that and for vision-impaired children to touch.

Photo editors routinely resize objects, or move them up, down or sideways, but researchers from Carnegie Mellon Robotics Institute are adding an extra dimension to photo editing by enabling editors to turn or flip objects in a photograph so as to expose surfaces not visible in the original.

A chair in a photograph of a living room, for instance, can be turned around or even upside down to display sides that would have been hidden from the camera yet still appear to be realistic.

This three-dimensional manipulation of objects in a single, two-dimensional photograph is possible because 3-D numerical models of many everyday objects—furniture, cookware, automobiles, clothes, appliances—are readily available online. The research team led by a lab member, Yaser Sheikh, associate research professor of robotics, found

it could create realistic edits by fitting these models into the geometry of the photo and then applying colors, textures, and lighting consistent with the photo.

"In the real world, we're used to handling objects. We've created an environment that gives you the same freedom when editing a photo," said Natasha Kholgade, a Ph.D. student in the Robotics Institute.

Designed for use with digital imagery, the same 3-D manipulation can be applied to objects in paintings and historical photos, she added. Objects manipulated in photos can also be animated; the researchers demonstrated that an origami bird held in a hand can be made to flap its wings and fly away, Kholgade said.

One of the catches to using publicly available 3-D models is that the models seldom, if ever, fit a photo exactly. Physical objects will vary from their model versions: real-life objects such as seat cushions and backpacks are deformed as they are used, while weathering, aging, or lighting change appearances, Sheikh said.

To fix these variations, the researchers developed a technique to semi-automatically align the model to the geometry of the object in the photo while preserving symmetries in the object. The visible side of a seat cushion or of a banana is used to create a plausible appearance for the opposite side. If the photo doesn't contain pertinent appearance information—such as the underside of a taxicab—the system uses the appearance of the stock 3-D model.

Though stock models aren't available for every object in a photo, that's likely to improve as 3-D scanning and printing technologies become ubiquitous, Sheikh said.

A video demonstrating the new system is available on the project website at **http://www.cs.cmu.edu/~om3d/**.

As a demonstration of the way a children's book can be converted into a tactile book, the Sikuli Lab displays a 3-D illustration from Harold and the Purple Crayon *along with the standard 2-D edition.*

Through the Tactile Books Project, Tom Yeh and his team in the Sikuli Lab at University of Colorado Boulder recently printed the popular children's book *Goodnight Moon* in 3-D to allow visually impaired children to touch objects in the story as the book is read aloud.

Now Yeh and his team are using the same techniques to print several other popular children's books in 3-D, including *Harold and the Purple Crayon* and *The Very Hungry Caterpillar*.

The idea of tactile picture books is not new, Yeh said.

"What is new is making 3-D printing more accessible and interactive so parents and teachers of visually impaired children can customize and print these kinds of picture books," he said.

The main idea is to represent 2-D graphics in a 3-D, tactile way on a scale appropriate for the cognitive abilities and interests of young children, Yeh said. The team creates computer algorithms for images from the books. The mathematical algorithms offer a way for parents and teachers to print their own customized picture books using 3-D printers.

But the project isn't as straightforward as creating the algorithms. The images need to be chosen and created for each page, and people need to be trained to print the books. They also need access to 3-D printers.

"Since each child generally has his or her unique visual impairment issues, the idea is to customize each book for each child," he said. "We're investigating the scientific, technical, and human issues that must be addressed before this vision can be fully realized." ME

PICTURE BOOKS IN 3-D

THE LAB Sikuli Lab, University of Colorado Boulder; Tom Yeh, director.

OBJECTIVE Enabling computers to interact with humans in a more natural way than they do at present.

DEVELOPMENT Three-dimensional picture books for visually impaired children.

BOUND FOR TEXAS: LIQUEFACTION TRAINS FOR A GAS EXPORTER

Companies are being contracted to convert an LNG terminal from import use to exporting.

Plans call for as many as three liquefactions trains at the Freeport site on the Gulf.

The United States is changing the direction of its liquefied natural gas flow. The country has been an importer, but now, thanks to the increase of natural gas production made possible by hydraulic fracturing, receiving terminals are being converted into export sites.

One of those sites reversing direction is Freeport LNG near Freeport, Texas, where GE Oil & Gas has been contracted to install electrical equipment for the liquefaction trains.

GE is supplying the main refrigeration compressors, variable-speed drive electric motors, and other electrical equipment for two customized natural gas liquefaction trains, each of which will produce a base volume of 4.4 million metric tons of LNG a year. In addition, GE Energy Financial Services is providing financing to support the project through pre-construction engineering and design.

According to GE, the electric motor driven technology will let Freeport LNG comply with strict local emissions standards and still meet its ambitious LNG production and export targets.

The Freeport electric LNG plant will feature all-electric drive compression directly connected at the utility incoming transmission voltage level.

GE said it has invested heavily in its capabilities for high-powered mechanical-electrical systems. GE also said it can provide an option for LNG projects to use available electric power or to build their own combined-cycle power plants to power electric motor-driven refrigeration systems.

GE Energy Financial Services underwrote a loan and secured three additional lenders to support the project. According to GE, the loans will help the project expedite equipment orders and permit approval.

GE will build and package the refrigeration trains in Florence, Italy, and will have them tested in Massa, Italy. They are due to arrive in Texas in 2016 and be fully operational by 2017.

They will include six centrifugal compressors, six 75-megawatt synchronous electric motors, and six variable speed drives.

CZJV, a joint venture between Air Products and Chemicals Inc. and Zachry Industrial Inc., is the engineering, procurement, and construction contractor for Train 1 and Train 2 of Freeport LNG's liquefaction project.

GE said it will also provide Freeport LNG with integrated LNG plant and power grid modeling, coordinated protection and control development, power quality evaluation, and power system design verification studies. ■

COMMENT EXTENDED ON CO2 RULES

THE U.S. ENVIRONMENTAL PROTECTION Agency has extended the comment period on its Clean Power Rule to December 1.

A bipartisan group of 53 Senators in September sent a letter asking the EPA administrator, Gina McCarthy, to provide an extension of the public comment period on the EPA's proposed rule to regulate carbon dioxide emissions from established power plants. They argued that the complexity and broad nature of the proposal could have a long-ranging effect and asked additional 60 more days in order to provide time for all sides to fully review the proposal and offer comments.

The comment period was extended for 45 days. ■

THE TEXT OF THE SENATORS' LETTER IS AVAILABLE ONLINE AT tinyurl.com/EPACommentLetter

INFORMATION ON HOW TO SUBMIT COMMENTS CAN BE FOUND AT tinyurl.com/CarbonProposal

LOOKING BACK

The vulnerability of the gasoline supply and the problem of emissions were on everyone's mind when this article was published in 1974.

WHICH AUTOMOTIVE ENGINES IN THE FUTURE?

BY BENO STERLICHT, MECHANICAL TECHNOLOGY INC., LATHAM, N.Y.

The founder of a company that made testing equipment and later became involved with fuel cells looked at various options for more efficient and cleaner-burning automobile engines. Some of his predictions proved right.

Gazing into the future is a risky business, but one thing is certain. The current energy and environmental crisis has catalyzed the search for an automotive engine competitive with the conventional IC type. By the year 2000, two general types will have emerged: some form of electric vehicle, either in pure or hybrid (engine/electric) form, and a heat engine, most probably with external combustion, such as the Stirling, the Warren, or the diesel. A "high-risk/high payoff" approach is urged.

The automobile is a major factor in four national issues: energy, natural resources, pollution, and transportation. Energywise, the automobile represents 31.3 percent of the total U.S. petroleum used, and over 75 percent of this energy is wasted. By 1985, the automobile is expected to double its fuel consumption; consequently, unless vast new domestic reserves are discovered, this nation must rely heavily on imported petroleum from now on. Pollutionwise in 1969, transportation (of which the automobile is the major component) generated 44 percent of the airborne pollutants. In large metropolitan areas, the contribution is even greater. For example, in Los Angeles, transportation contributed 88 percent of the pollutants. As for resources, the automobile represents 10 percent of the total U.S. use of steel and aluminum and anywhere between 5- 40 percent of various other critical materials, many of which have to be imported and have limited world natural reserves.

Thus, it is obvious that our domestic automotive industry is crucial to a healthy economy. Attention, therefore, is focusing on a radical redesign of its key mechanical component—the engine, along with its fuel. It is a formidable task whose solution requires the efforts of government, industry, and the university. Only through a massive R&D effort using all available resources (people, facilities, and money) can the aforementioned major issues be successfully resolved.

Aside from improved load matching and change of hp mix, if one has to go to selection of engines, there are short-term and long-term solutions. As a short-term solution, the diesel engine and the stratified-charge engine offer the highest potential because they require the least development and new manufacturing tooling.

...

On a longer-range basis, the diesel and the Stirling engines offer the greatest potential because historically there is already an appreciable amount of experience with these engines. (Other concepts have not been developed far enough, e.g., electrical vehicle, Warren engine, etc.) Since the stratified-charge engine presents only a short-term solution while the diesel engine offers both short- and long-range solutions, it seems more advisable to concentrate on the diesel engine and possibly forgo the stratified charge. Economic factors, which can be evaluated by the automotive industry, will undoubtedly govern this decision. ME

EASY ON THE EMISSIONS

Hybrid electric vehicles already had a history when Beno Sternlicht wrote his article. The first gasoline-electric hybrid, the Porsche Mixte, came out in 1901. But it was the late '90s, largely over concerns about auto emissions, when the Toyota Prius, Audi Duo III, and Honda Insight hit the roads of Japan, Europe, and the U.S. in significant, if not overwhelming, numbers.

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PD615	BPV Code, Section III, Division 1: Class 1, 2 & 3 Piping Design	8-10 Dec
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PD441	Inspections, Repairs and Alterations of Pressure Equipment	11-12 Dec
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PD457	B31.3 Process Piping Materials Fabrication, Examination and Testing *ASME Code Course*	12 Dec

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BY THE NUMBERS: STATES' ECONOMIC

To be positioned for economic evolution, according to a Washington think tank, state economies need to have knowledge jobs and a share in the digital economy. The group has published a report that ranks the 50 states according to a new-economy index.

MAP 01

WHERE THE INNOVATION IS: 2014 STATE NEW ECONOMY INDEX

SOURCE: *Information Technology and Innovation Foundation*

MAP 01 A new report rates the 50 states by their readiness for the so-called new economy. States with large digital or research-based businesses rated best; resource-dependent states did not.

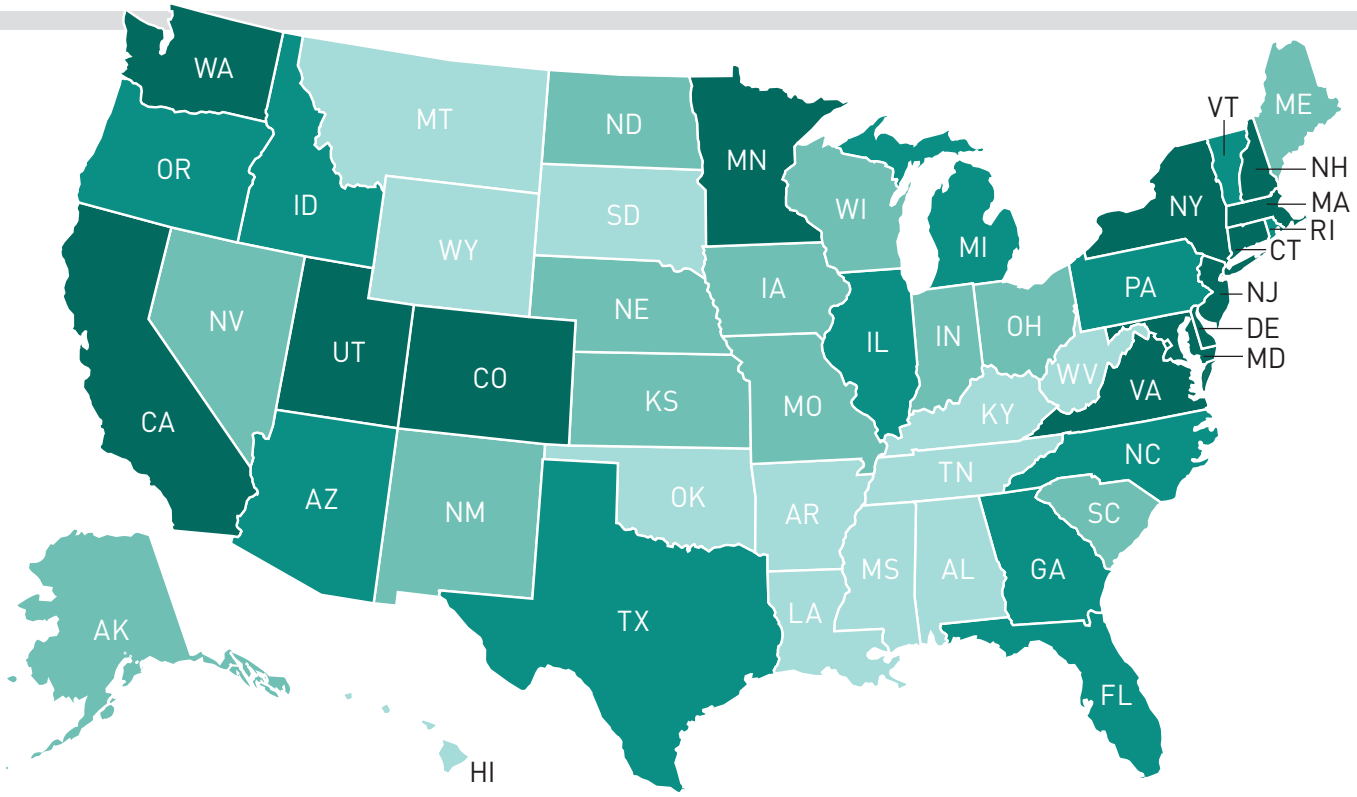
Massachusetts is farthest along on the path to what the Information Technology and Innovation Foundation calls "the new economy."

The foundation, based in Washington, D.C., promotes public policies to advance technological innovation. Its report, *The 2014 State New Economy Index*, ranked states in five areas that it said best describe the new economy: knowledge jobs, globalization, economic dynamism, the digital economy, and innovation capacity. The five areas were further broken out into 25 indicators.

Massachusetts has ranked highest in the foundation's earlier reports, published in in 1999, 2002, 2007, 2008, 2010, and 2012, according to the organization's president, Robert Atkinson, who prepared the report along with Adams Nager, an economic research assistant.

"Boasting a concentration of software, hardware, and biotech firms supported by world-class universities such as the Massachusetts Institute of Technology and Harvard, Massachusetts survived the early 2000s downturn and was less hard hit than the nation as a whole during the recession in terms of job growth and per-capita income growth," Atkinson wrote in the report.

As in the 2012 index, Massachusetts is ranked at the top with Delaware, Califor-



NEW ECONOMY INDEX RATING BY PERCENTILE

100% — 76%	75% — 51%	50% — 26%	25% — 1%

DEVELOPMENT IN A NEW ECONOMY

nia, Washington, and Maryland.

"Second-place Delaware is perhaps the most globalized of states, with business-friendly corporate law that attracts both domestic and foreign companies and supports a high-wage traded service sector. The state has moved up four ranks since 2010, driven by top rankings in high-wage traded services, foreign direct investment, and industry investment in research and development," Atkinson wrote.

Third-ranked California boasts what Atkinson calls innovation capacity thanks to the presence of Silicon Valley and high-tech clusters in the southern part of the state.

Washington State, in fourth place, holds its place due not only to its strength in software and aviation, but also because of the entrepreneurial activity that has developed in the Puget Sound region and the widespread use of digital technologies by all sectors.

Maryland and Virginia, ranked fifth and seventh respectfully, have realized high rankings primarily due to high concentrations of knowledge workers, many employed with the federal government or related contractors in the suburbs of Washington, D.C., according to the report.

The two states whose economies have lagged the most in making the transition to the new economy are Mississippi and West Virginia.

Oklahoma, Arkansas, Louisiana, Wyoming, Kentucky, Hawaii, South Dakota, and Alabama round out the bottom ten. Historically, the economies of many of these states depended on natural resources, on tourism, or on mass-production manufacturing, and relied on low costs rather than innovative capacity to gain a competitive advantage, Atkinson wrote. **ME**

JEAN THILMANY

CHART 01 2014 STATE NEW ECONOMY INDEX RANKINGS

SOURCE: *Information Technology and Innovation Foundation*

2014 RANK	2014 SCORE	STATE	1999 RANK
1	94.7	Massachusetts	1
2	85.1	Delaware	9
3	83.7	California	2
4	82.5	Washington	4
5	81.5	Maryland	11
6	81.4	Colorado	3
7	80.9	Virginia	12
8	77.6	Connecticut	5
9	77.0	Utah	6
10	75.4	New Jersey	8
11	74.6	New Hampshire	7
12	73.0	New York	16
13	71.7	Minnesota	14
14	69.5	Vermont	18
15	69.3	Oregon	15
16	67.1	Illinois	22
17	67.1	Arizona	10
18	67.0	Michigan	34
19	66.8	Rhode Island	29
20	65.2	Texas	17
21	64.3	Georgia	25
22	63.2	Pennsylvania	24
23	63.1	North Carolina	30
24	62.3	Idaho	23
25	61.6	Florida	20
26	58.7	New Mexico	19
27	58.7	Nevada	21
28	58.3	Maine	28
29	58.3	Ohio	33
30	57.8	Wisconsin	32
31	57.3	Kansas	27
32	56.8	Alaska	13
33	56.8	Missouri	35
34	56.6	South Carolina	38
35	56.0	Nebraska	36
36	55.8	North Dakota	45
37	54.8	Iowa	42
38	54.6	Indiana	37
39	54.4	Montana	46
40	51.3	Tennessee	31
41	50.4	Alabama	44
42	49.0	South Dakota	43
43	48.4	Hawaii	26
44	48.4	Kentucky	39
45	48.1	Wyoming	41
46	47.0	Louisiana	47
47	44.2	Arkansas	49
48	44.1	Oklahoma	40
49	39.8	West Virginia	48
50	38.0	Mississippi	50

CHART 01 The states listed by their 2014 New Economy Index score, as well as their 1999 ranking. Illinois, Michigan, and Rhode Island have improved, while Alaska, Hawaii, and Oklahoma have tumbled.

Essential *for* Safety

AFTER 100 YEARS, THE ASME BOILER AND PRESSURE VESSEL CODE CONTINUES TO EVOLVE TO MEET THE NEEDS OF ENGINEERS USING THE MOST ADVANCED TECHNOLOGY.

1911

1

THE COMMITTEE FORMS

ASME forms a committee to create a uniform set of standard specifications for the construction of steam boilers and pressure vessels, later to be known as the Boiler and Pressure Vessel Code Committee.

The first edition of what has become the ASME Boiler and Pressure Vessel Code was published in 1914. The Code has continued to expand and adapt over the years to meet the needs of new technologies, many unimagined 100 years ago. The Code continues to meet new challenges and to extend its influence in the cause of safety around the globe. In this issue, we hear from a few people representing all those for whom the Code is literally a way of life.

The Code has grown from a single 114-page book to volumes that fill a bookshelf—or a disc.

Dedicated Now and From the Start

BABCOCK & WILCOX, POWER GENERATION GROUP

Steam is one of nature's most useful and powerful phenomena; at Babcock & Wilcox it is present in some fashion nearly everywhere. From heating the offices in which we work, to the driving force behind the power plants we design.

The power of steam was once frighteningly evident; 1,200 people were killed in the U.S. between 1898 and 1903 in 1,900 separate steam boiler explosions. Imagine what it would be like to be in a restaurant and not know if the boiler below you would explode, or to know if your kids were safe at their school, things we thankfully take for granted today.

1914

FIRST EDITION

ASME publishes the first edition of Rules for the Construction of Stationary Boilers and for Allowable Working Pressures. Today, in much-expanded form, it is commonly known as the ASME Boiler and Pressure Vessel Code.

2

Several high-profile boiler accidents, such as a 1905 explosion and fire that killed 58 people at the Grover shoe factory in Brockton, Mass., ultimately led to an industry initiative to create a set of universal design and manufacturing standards for boilermakers, a Code that would help safety standards catch up to the rapid technical advancements of the boiler industry. The American Society of Mechanical Engineers published the first ASME Boiler and Pressure Vessel Code in 1914, and The Babcock & Wilcox Company—the leading boilermaker in America at the time—provided instrumental engineering and technical support for the publication.

B&W was also a stalwart and vocal advocate for industry-wide adoption of the Code, even as some companies resisted. Babcock & Wilcox became the holder of compliance certificate No. 1 under the new Code.

"From a manufacturer's perspective, the Code is without a doubt about safety, and no less today than when it was introduced one hundred years ago," said Kip Alexander, vice president of technology for B&W's Power Generation Group. "Safely harnessing the power of steam is quite literally why B&W exists, and our history, which we're very proud of, is almost inseparable from the history of the Code."

As time has passed and safe operation of pressurized equipment has become a normal practice, other benefits of the Code have become apparent. "While protecting life and property is always the priority, from a quality standpoint, the ASME Code provides a framework by which an organization can build consistent processes," said Ron Pulliam, group quality director for the Power Genera-

100 years
ESSENTIAL
FOR SAFETY

"While protecting life and property is always the priority, from a quality standpoint, the ASME Code provides a framework by which an organization can build consistent processes. It also provides a level playing field for all manufacturers, suppliers, and installers."

tion Group's boiler and emissions control division. "It also provides a level playing field for all manufacturers, suppliers, and installers. When you're all playing by the same set of rules and adhering to the same standards, you and your customers can be confident of the quality of your finished product, and nobody is tempted to cut corners on safety or quality."

The Code is ingrained in literally every part of Babcock & Wilcox's design and manufacturing process. The thermal-hydraulic and performance engineer begins with specifications for pressure and temperature and the Code returns wall thickness and material. The quality engineer relies on the Code to define essential non-destructive examination before first operation.

If one thing can be gleaned from the growth of the original Code from 114 pages to its modern form of binders filling an entire bookcase (that is, unless you're consulting the digital edition) is that details matter. The volunteers who meet four times a year to maintain and extend the Code are completely dedicated to translating sometimes painfully gained experience into rules that strive to protect people. It's why competitors come together and share critical knowledge with one another and the public, and why volunteers dedicate time that almost universally extends well beyond the traditional 40-hour work week.

From B&W founder George Babcock serving as the ASME's sixth president in 1887, to the numerous B&W employees who serve on committees today, Code participation has always been an integral part of our engineering culture.

WELDED STRENGTH

The fusion welded drum, tested to failure in 1930, led to later high-pressure vessels. It is on display in Chattanooga and has been designated an ASME Historic Mechanical Engineering Landmark.

Roberto Garcia, quality control manager at B&W de Monterrey, a Power Generation Group unit in Mexico, is the first Code committee member from Mexico, and contributes his expertise to the Subcommittee on Boilers and Pressure Vessels in Spanish. His participation highlights the rapidly growing importance of international collaboration for both industry and the Code.

"It is extremely important for the Code to have a presence in all those countries that are lacking or have no safety standards," Garcia said. The Code continues to expand internationally, and according to Garcia, "We will find more technical leaders around the world that share our interest to develop the Code and make it stronger. I would really like to see the Code translated into other languages. This would allow the Code to reach other countries and expand our spirit and frontiers."

The B&W corporate commitment to the Code has never diminished, even during the sometimes brutal economic conditions the power generation industry has seen over the last 100 years; because this commitment does as much for the volunteers as they do for the Code.

William Bees, who retired from the Babcock & Wilcox Nuclear Operations Group, Inc., and was the 2013 recipient of the ASME S. Y. Zamrik Pressure Vessel & Piping Medal, says the time he volunteered to work on the Code expanded his horizons and points of view.

"It was a rewarding experience and I worked with many talented individuals," Bees said. "When you work so closely with such people, you're always challenged to look at problems in new ways and from new perspectives."

Bob McLaughlin, former director of quality assurance at Babcock & Wilcox Nuclear Energy and current vice chairman of ASME's Section I standards committee agrees. He said he finds himself being educated every time he attends an ASME Code meeting. "We really get a great education from our peers on the Code, engineering and ideas, concepts and technologies," he said.

This collaboration and learning is important as ever, as the Code is facing the same challenges as the industry it serves: experi-

1925

FIRST BPVC VIII

Boiler and Pressure Vessel Code Section VIII Unfired Pressure Vessels appears. With the 1968 edition, the title became Rules for Construction of Pressure Vessels, Division 1.

3

enced engineers are retiring and fewer young engineers step into the gaps. It is an exciting time to be involved in the power generation industry and the Code because there are many opportunities to contribute, and many people willing to share their experience.

One of the more interesting aspects of the Code is that it is far from precluding innovation. Technology has made great strides during the tenure of the Code. Within B&W, we are still proud of our innovations in size (the first 1,300 MW units, for American Electric Power) and efficiency (the first commercial, supercritical steam pressure unit, UP-1, that advanced the state of the art by leaps and bounds).

An even more fundamental example of this evolution is the change from riveting to welding. When riveting boilers prevented further pressure and temperature gains, B&W not only pioneered the fusion welding of pressure vessels, but the x-ray inspection of these welds as a way to ensure their soundness. The Code and its writers were able to adopt this new technology into accepted best practices.

In the 1950s, the advent of nuclear powered steam generators required the creation of a whole new type of design code (Section III, with design by analysis and consideration of the concept of low cycle fatigue failure). B&W is proud to have contributed a significant amount of testing data that underlies the Code design fatigue curves even today, because design methods and material performance cannot be separated from safe operation of critical equipment.

Far from being a cookbook, the Code provides a consistent starting point for everyone, with a variety of design and construction methods that allows for improvements in durability and cost while promoting competition. "Even after working with the ASME Code for decades, I still continue to find ways to improve on designs and processes," said senior pressure vessel designer Dana Moot.

The evolution of the Code continues, and frames some of the most significant challenges in power generation today. While the Boiler Code celebrates its 100th anniversary, it is a living document keeping pace with industry. Efforts to modernize it to address higher temperature operation and frequent load cycling are in full swing.

The pursuit of material design temperatures up to 760 °C, termed advanced ultra-supercritical (or A-USC) operation, is a prime example of contemporary challenges. (Today, supercritical power plants operate at 565 °C and even the most advanced units operate around 625 °C.)

The Boiler Materials Development Consortium, supported by the Department of Energy, the Ohio Coal Development Office, the Electric Power Research Institute, and companies such as B&W, Alstom Power, Babcock Power, and Foster Wheeler Corp., has led this effort for over 10 years now. Operation at higher steam temperature greatly improves plant efficiency; reducing fuel waste, waste production, fuel transportation cost, cost of electricity and carbon dioxide emissions.

The consortium has been proactive in terms of the Code throughout, introducing the first new thickness formula (Equation A-317) to the Code in many, many decades to provide greater accuracy for thicker components at high temperature. New materials (such as Special Metals 740H) are also being introduced into the Code through consortium-sponsored Code Cases.

While better materials and more accurate basic equations are the first steps in safe design, the Code is also being challenged to develop design rules that will provide the same levels of safety for high-temperature service, including consideration of load cycling which fundamentally degrades the life of high-temperature components. Even traditional plants, due to uneven demand and the need to maximize use of alternative but varying energy sources such as wind and solar energy, are facing concerns about load cycling.

Modernization efforts are highlighting issues such as the role of tools like finite element analysis and its verification and validation in high-temperature, high-pressure design, and the generation and use of complex materials data—issues which are not easily addressed.

There will always be a need for power and the industry must respond with options that are economically feasible and respect the environment. Developing safety standards for advanced power plants with higher efficiencies and fewer emissions, and for alternative energy sources such as concentrated solar power has already started the Code on the road to the next 100 years. ■

Babcock & Wilcox employees (past and present) **DAVE DEWEES, CRAIG JONES, MEGAN SLATER, PAUL WEITZEL, STEVE SCAVUZZO, DANA MOOT, PATRICIA BECKER, JIM TANZOSH,** and **RYAN CORNELL** contributed to this article.

An Ability to Adapt and Change

MADIHA EL MEHELMY KOTB, HEAD OF THE PRESSURE VESSELS TECHNICAL SERVICES DIVISION FOR REGIE DU BATIMENT DU QUEBEC AND PAST PRESIDENT OF ASME.

It was in the summer of 1981 that I was first introduced to the ASME Boiler and Pressure Vessel Code. I joined the engineering and technical support group of the Pressure Vessel Department of the Ministry of Labor of the Province of Quebec. This responsibility is now under La Regie du batiment du Quebec.

My duties and responsibilities were primarily to provide technical support to the group of inspectors who were charged with oversight of the provincial regulation respecting pressure vessels. The ASME Boiler and Pressure Vessel Code is adopted by reference in the regulation.

Our regulatory approach back then was the same as it is today, a cradle-to-grave approach. We covered all aspects of the life cycle of a boiler or a pressure vessel from design to being taken out of service, and confirmed every step in between—fabrication, installation, repair and modification, and in-service inspection.


MADIHA EL MEHELMY KOTB

The task was huge and the responsibilities were heavy to bear, but the rewards were great. Working in the public safety domain is no small task. It is more than just a profession. You really have to believe in what you are doing, and it becomes your mission.

What was a difficult task became easier as I got more familiar with the ASME Boiler and Pressure Vessel Code and got a better understanding and knowledge of it.

Years later, I became the Chief Boiler Inspector for the Province of Quebec, and this position led me to become the member representing the province on the National Board of Boiler and Pressure Vessel Inspectors. I also became the jurisdictional member representing the Province of Quebec on the Conference Committee of the BPV Code. In that role, I began to work with many Code committees.

Serving on ASME Code committees introduced me to recognized experts from industry and gave me the opportunity to interact with them. What an enriching experience!

Attending my first Code Week, when all the committees, subcommittees, and working groups meet, was an intimidating and challenging experience that allowed me to see hundreds of volunteers putting their own personal interests aside, and contributing their technical expertise and personal perspective in the development of a world-class document. Whether it was a question about welding, design, material, nondestructive examination, or conformity assessment, by attending and participating committee meetings I always learned new information and found new challenges.

Participating as ASME President in the 100th anniversary year of the Boiler Code was no small event. It allowed me to be part of the celebration. During the week of the Boiler and Pressure Vessel Code meeting in Seattle, Wash., held in conjunction with the National Board of Boiler and Pressure Vessel Inspectors, I had a chance to meet and celebrate with many of the staff and volunteers who devoted many years of their professional lives and endless hours of their personal and family time to contribute to the development of the Code.

I had a chance to reflect on the journey of the last 100 years and look at how far we evolved in the short time in which I have been personally involved. We moved toward accreditation of authorized inspection agencies, changed the publication cycle from three years to two, eliminated addenda, and restructured the Code committees. We wrote the new Section VIII, division 2, and we are working on the modernization of Section I. We also published the Codes in digital electronic format, and developed C&S Connect and CA Connect, internet portals for codes and standards and for conformity assessment.

These are just some examples of many efforts and many things that happened in the last few years that we considered unthinkable not too long ago. Our strength as an organization setting the standard is largely dependent on our capacity to adapt and change to meet today's needs.

My travel during this past year as President of ASME provided me the opportunity to recognize first-hand how our ASME Code is recognized as a premier document and how it is gaining worldwide recognition. The openness of our system and the efforts that were made to get the international communities involved in our standards development has definitely paid off and made us a stronger, richer organization. The delegates program and the international working groups that have been established in different countries have been very successful. They not only opened us to the world but also opened the world to us. Many delegates and members of our international working groups were present in Seattle and took part in our anniversary celebration.

There is no telling how the Boiler Code will look 100 years or even 50 years from now. It may have technical requirements that we cannot imagine today. No one can predict how the committees will be struc-

100 years
ESSENTIAL
FOR SAFETY

"Working in the public safety domain is no small task. It is more than just a profession. You really have to believe in what you're doing, and it becomes your mission."
MADIHA EL MEHELMY KOTB

BOB SIMS:
"The most impressive thing to me about ASME codes and standards is the consensus process."

tured or conduct business. We cannot say what the format of the finished document will be.

One thing is certain, though. ASME will keep up with technological advances and will adapt as the state of the art advances. The Boiler Code will not change, however, in one single aspect, which is the one for which it was first developed, safety.

The Code will continue to be widely used and adopted, will have a bigger and larger input from all over the world, will have further outreach and adoption by far more countries, will contribute to the safety of billions of people, and will make the world that they live in a better place. ■

Consensus Rules for More Than 100 Years

BOB SIMS, DISTINGUISHED FELLOW, BECHT ENGINEERING LTD., AND PRESIDENT OF ASME.

I first became involved in Code activities when the Special Working Group (now Subgroup) on High Pressure Vessels was formed in 1981. I was immediately impressed with the expertise, hard work, and dedication that my fellow committee members showed in drafting a new "clean sheet" code for high pressure vessels.

This effort was initiated by a small group of volunteers, working with the staff, as a result of technical papers presented at Pressure Vessel and Piping Conferences in the late 1970s. They documented failures that had occurred in high pressure vessels.

At that time, the rules in the existing pressure vessel codes, such as the ASME Boiler and Pressure Vessel Code, Section VIII, Divisions 1 and 2, were not adequate, so the vessels were designed as "state specials." Because of the unique requirements for materials and design rules covering thick wall construction and specialized fabrication requirements such as autofrettage, it was difficult for regulatory authorities to determine whether these vessels were safe.

One of the great strengths of the ASME codes and standards development process is the ability to identify the need for new rules and to assemble the world's leading experts in the field to develop the rules. In the case of the high pressure vessel code, experts from the United States, Canada, the United Kingdom, Sweden, Germany, and Japan all made significant contributions.

It took 17 years of hard work, including extensive reviews by hundreds of experts on many committees, subcommittees, subgroups, and working groups, to be sure that we "got it right" before first publication of Section VIII, Division 3 on High Pressure Vessels. Since that time, the maintenance of Division 3 has resulted in the addition of rules for composite wrapped vessels and rules for hydrogen service, among many other updates.

The most impressive thing to me about ASME Codes and Standards is the consensus process that has been honed over 100 years to ensure that the views of all stakeholders are considered, but also to ensure that no one stakeholder group can dominate the process. It is also gratifying to see the many thousands of volunteers who dedicate so much time and energy to the development and maintenance of ASME codes, standards, and the associated certification processes.

We hear a lot about the so-called "Me Generation," but anyone who is active in Standards and Certification can tell you that does not apply to S&C volunteers. Participation from outside of North America is extensive and is growing. This is in contrast to codes and standards activities in some other parts of the world, which often limit participation to a selected group.

ASME Codes have resulted in saving thousands of lives by improving the integrity of not only pressure equipment, but also items as diverse as elevators and cranes. ASME has an excellent and well-deserved reputation worldwide for producing high quality codes and standards that meet the needs of manufacturers and materials suppliers, equipment users, regulators, and other stakeholders.

The complexities of modern technology demand more attention to codes and standards and ASME enters the second 100 years of this activity ready to meet those needs in many areas, such as alternative energy sources and advanced manufacturing. ■

Elevating the Pressure and Temperature

DAVID L. BERGER, SENIOR STAFF SCIENTIST/ENGINEER AT PPL GENERATION, LLC, CHAIR OF THE ASME COMMITTEE ON POWER BOILERS (BPV SECTION I).

Codes and standards have a twofold purpose. The paramount reason for standards is to assure that equipment is safe—safe for people who work around it and safe for the general public. The second main reason is to promote commerce by achieving uniformity, interchangeability, or at least compatibility. Within that backdrop, standards should also strive to assure that equipment can be used for economic benefit.

In the process of give and take that produces standards, each stakeholder not only presents his concerns, but also shares his expertise. Products that meet the Code are not only safe as long as they are built, maintained, and operated according to appropriate standards, but they are also expected to provide a reasonably long life over which they can be reliably operated for economic benefit.

As an employee of an electrical generation company, I am interested in technologies that will make units more efficient. By burning less fuel, my company saves money, and it is easier for us to comply with new emission regulations and remain competitive. Ultra-supercritical steam generators are a current trend toward greater efficiency, promising to push to ever higher temperatures and pressures than today's supercritical units.

Supercritical steam generators aren't boilers in the strict sense. Water heated above critical pressure of 3,208 psi (221 bar) does not boil, per se. Since the pressure in the furnace walls is above the vapor dome of the water-steam system, there is no phase change from water to steam. Unlike in a subcritical drum-type boiler, there is no point in the cycle where evaporation occurs at constant temperature; rather each unit of thermal input raises the fluid temperature. Final temperatures of the fluid to the turbine rarely exceed 1,100 °F on existing units.

For tomorrow's units, the industry will push for higher temperatures, since thermal efficiency is limited by the peak temperature of the cycle. Higher efficiency means less fuel for the work output,

1955

NUCLEAR BEGINNINGS

The Boiler and Pressure Vessel Committee appoints a special committee on nuclear power, the predecessor to the Boiler and Pressure Vessel Code Section III Committee.

DAVID L. BERGER: New challenges involving creep, fatigue, and corrosion.

saving money and reducing emissions, especially of carbon dioxide.

I Chair the BPV I standards committee on Power Boilers (Section I of the ASME Boiler and Pressure Vessel Code). In that capacity, I charged a task group to investigate modernization of Section I's rules to better accommodate the challenges of increasing temperature.

There can be no question about the safety of ultra-supercritical steam generators under the ASME Boiler and Pressure Vessel Code. Safety is never a negotiable goal.

At very high pressures and high temperatures, current Section I rules require components to be comparatively thick, but making things thicker is not always better. In thick components, temperature gradients and consequent differential thermal expansion produce large secondary stresses. When pressure and temperature drive a component's thickness to be very large compared to the size of the component, it can compromise that component's ability to endure thermal transients that occur in service.

Repeated cycles of heating and cooling can thermally fatigue components. And those cycles are certainly a reasonable expectation because tube leaks, air heater washes, and other events require a plant to shut down for repair or replacement of parts. Many of the Section I devices built for domestic power generation over the last two decades are heat recovery steam generators (HRSGs), essentially waste heat boilers that use the heat from the exhaust gas of a combustion turbine in combined cycle plants. Such units are characterized by fast startup and shutdown, plus a large turndown to follow demand, consequently their components endure a lot of thermal fluctuation.

One of the biggest challenges in addressing elevated temperature service will be understanding creep and fatigue interaction and developing appropriate design rules to manage that. Another challenge is that corrosion mechanisms change with increasing temperature. The push to higher temperatures will spawn development of new materials to meet all the design goals. The committee will also need to evaluate whether some of the construction details traditionally used will be appropriate at higher temperatures.

As a person who has many friends who work in operating power plants on a daily basis, I am very concerned with "keeping the steam in the pipe." ASME and other standards are one source of help to that end.

Participating in Codes and Standards development helps me in many ways. It helps me understand how to apply the rules properly. I learn the rationale for new rules. I interject my thoughts as a user and have a voice to shape the rules with a focus on what happens to the equipment after it is built.

Above all, my colleagues and I better protect our people working in the plants. ■

An Imprint for the Latest Technology

LIBO ZHANG, VICE DIRECTOR, TOTAL QUALITY MANAGEMENT OFFICE, HARBIN BOILER CO. LTD., HARBIN, CHINA.

5

2008

A NEW LANGUAGE

The Shanghai Power Equipment Research Institute, working in agreement with ASME, translates Boiler and Pressure Vessel Code Sections III and XI into the Chinese language.

The ASME Boiler and Pressure Vessel Code reflects the latest technology and research results to guide manufacturers of boilers and pressure equipment. The Code is recognized around the world.

As a leading supplier of utility boilers and pressure vessels, Harbin Boiler Co. Ltd. must assure its customers that the R&D, manufacturing, and servicing behind its products are in line with the international standard and can be marketed to the world. Application of the ASME Code is the only solution.

HBC got to know ASME Codes in the early 1980s. In 1987, HBC became the first manufacturer of utility boilers in China to obtain ASME Authorization Certificates and Code stamps S (power boilers), U (pressure vessels), and U2 (alternative rules for pressure vessels). HBC obtained the National Board Authorization Certificate and Code stamp R (repair and alteration of boilers) in 1996.

In 2004, HBC completed manufacturing the first product project with the U stamp—24 oil tanks and gas tanks for the Three Gorges Zuoan Power Plant. In 2007, HBC obtained Authorization Certificates and Code stamps N and NPT, confirming competence in construction of a wide range of equipment for nuclear power plants, and NS accreditation certification for supports.

During the course of obtaining ASME certificates and Code stamps, HBC enhanced its design capability and manufacturing level, promoted its technology and management levels, further improved its quality and management system, and greatly strengthened its comprehensive competitiveness in the market.

After HBC obtained the ASME accreditation, the ASME Codes have been applied in the design, manufacture, and inspection of 300 to 1,000 MW subcritical, supercritical, ultra-supercritical, and circulating fluidized bed boilers. HBC has also adopted the Code in the design and manufacturing of petrochemical vessels and power plant auxiliary equipment. In addition, ASME codes provided great help for our products in entering the field of nuclear power equipment.

At present, domestic and international customers generally specify that the equipment is to be designed and manufactured according the appropriate technical codes and the ASME codes for design, manufacture, and inspection. Thus it can be seen that ASME codes have been deeply recognized by users.

By conforming to the ASME Code, HBC's products can better integrate with the world market, and meet the requirements of the market and owners with widely recognized authority. HBC's products get more trust from owners at home and abroad, and HBC will continue to keep its domestic leading position in technology. HBC's products have successfully entered the international market and are exported to more than ten countries, including India, Turkey, and Brazil.

ASME codes have enhanced HBC's market share and reputation in China, and sped up development of overseas business, by lending credibility to its boiler and pressure vessel equipment in the global market. The choice to implement ASME codes was a strategic move for HBC in carrying out its plans for long-term development. ■

GOING ULTRA-SUPERCRITICAL
Harbin built China's first domestic 1,000 MW ultra-supercritical boiler for the Yuhuan Power Plant.

100 years ESSENTIAL FOR SAFETY

"During the course of obtaining ASME certificates and Code stamps, HBC enhanced its design capability and manufacturing level, … improved its quality and management system, and greatly strengthened its comprehensive competitiveness in the market."

Celebrating 100 Years of BPVC

IHS proudly supports manufacturers, inspectors, and stamp holders around the world with change control, inspection and compliance to the ASME BPVC

There are no small engineering decisions.

From the shop floor to the board room, only IHS can provide the full range of critical information and insights engineers and technical professionals require.

IHS helps companies achieve operational excellence directives, ensure safety and compliance, and speed time to market by accelerating knowledge discovery and improving utilization of the ASME Boiler and Pressure Vessel Code (BPVC), related standards and other essential engineering reference information.

Make better decisions faster – no matter how big the decision.

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100 YEARS

the BPVC increases safe manufacture and operation of boilers and pressure vessels

2015

marks the first two-year revision cycle

UNIQUELY, IHS is the only source that can provide hardcopy, subscription, and dynamic HTML access to ASME BPVC and related engineering reference information

1

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100 years ESSENTIAL FOR SAFETY

"Even though FWPMCL fabricates boiler pressure parts to many international codes and standards, the vast majority of those components are fabricated to the ASME Code."

Strong Branding for World Recognition

XIAOMING DING, GENERAL MANAGER, FOSTER WHEELER POWER MACHINERY CO. LTD, XINHUI, CHINA, AND TOM LESH, VICE PRESIDENT, QUALITY, FOSTER WHEELER POWER GROUP ASIA, SHANGHAI, CHINA.

Foster Wheeler has been designing and supplying steam generation equipment to customers around the world since the company formed in 1927. During these past 87 years (and counting), the ASME Boiler and Pressure Vessel Code has played an integral role in supporting the success of our business. Two prime examples of this support come to mind.

First, the Code has supported Foster Wheeler in maintaining the integrity of our brand and our reputation for consistently delivering high-quality products globally at a competitive price.

Many years ago, we recognized that in order to remain competitive we would need to start a systematic process of transitioning a significant portion of our manufacturing, sourcing, and engineering to Asia. That process was rife with challenges, not the least of which was to ensure that we continue to deliver the same high quality product associated with our brand.

We're proud to say we've succeeded with flying colors in doing just that. That success can in large measure be directly attributed to our reliance on and adherence to the Code. The Code was and continues to be a stabilizing factor through the growth and maturing of our Asian operations.

Foster Wheeler Power Machinery Co. Ltd. (FWPMCL) was established in China over 20 years ago and is today Foster Wheeler's largest manufacturing facility. FWPMCL possesses an impressive résumé, supplying high-quality boiler pressure part components for the entire range of Foster Wheeler designs such as super- and subcritical pulverized coal and circulating fluidized bed equipment, heat recovery steam generators, and waste heat and solar boilers to customers around the world.

Our steam generating units range in size from fully shop assembled oil- and gas-fired package boilers for industrial use, to the largest boilers in operation today for power generation. Our long-time global customers are today supremely confident in FWPMCL's ability to consistently deliver high-quality products.

Second, ASME Certification is an essential marketing tool for Foster Wheeler, both in China and globally.

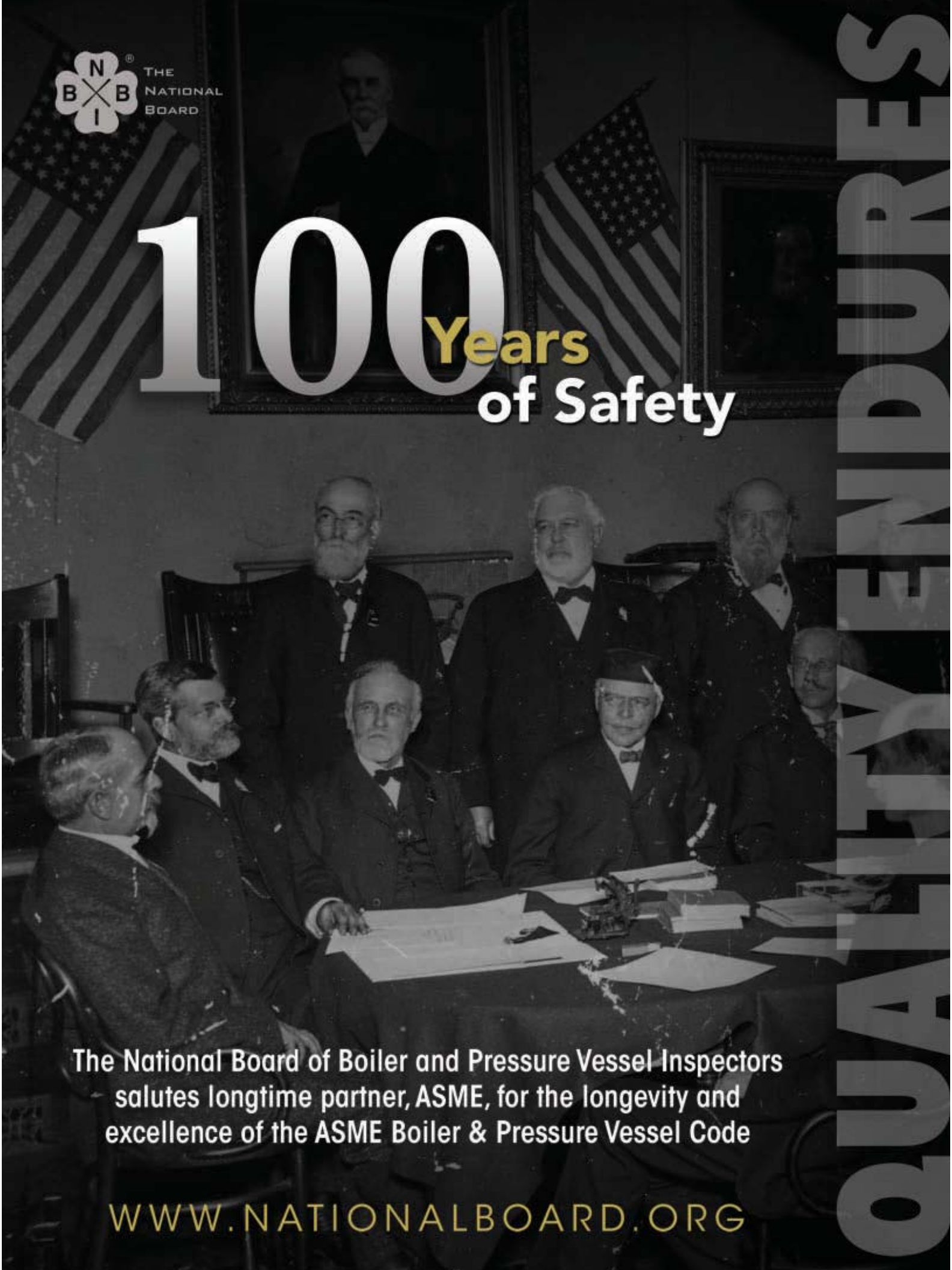
Foster Wheeler, along with our customers, recognizes that the Code Certification Mark is the hallmark of qualification and acceptance to the highest standard of excellence. The Code is accepted internationally, in over 100 countries, as it applies to the design, workmanship, inspection, and most important, the safety of fabricated boiler components.

When our customers purchase boiler pressure parts built to the ASME BPVC, stamped or unstamped, they understand that we, as a holder of an ASME Certificate of Authorization have undergone a rigorous qualification process to achieve the level of this standard. It assures them that we have a comprehensive quality system and that it is effectively implemented and monitored for compliance with the Code. As such, all Foster Wheeler manufacturing facilities are proud holders of ASME Certificates of Authorization. For example, FWPMCL in China holds both 'S' and 'PP' stamps. And even though FWPMCL fabricates boiler pressure parts to many international Codes and Standards including GB (China), METI (Japan), IBR (India), MOM (Singapore) and PED/EN (Europe), the vast majority of those components are fabricated to the ASME Code.

Additionally, 90 percent of the goods we manufacture at FWPMCL are exported outside of China, and much of that product is built to the Code. In China, the fabrication of pressure parts for the power generation industry is generally handled by state-owned boiler manufacturers.

We do have a small market share here in China with some very loyal and discriminating customers. When we supply equipment to our Chinese customers we fabricate to the GB (China) Code. However, they recognize that we are a world-class boiler manufacturer that is located in their backyard and that we possess a comprehensive and mature quality management system that is rooted by the ASME Code. This assures that the quality of our GB products is no different from that of an ASME BPVC stamped manufactured item that we would ship anywhere else around the world. Simply put, they want our products in their plants.

Foster Wheeler would like to thank all the dedicated and talented people who have been involved with ASME over the years and congratulate you on your first century of excellent service. ■


THE NATIONAL BOARD
100 Years of Safety
QUALITY ENDURES
The National Board of Boiler and Pressure Vessel Inspectors salutes longtime partner, ASME, for the longevity and excellence of the ASME Boiler & Pressure Vessel Code
WWW.NATIONALBOARD.ORG

CELEBRATE ENGINEERING

ASME 2014 HONORS

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URSULA M. BURNS

Kate Gleason Award

The Kate Gleason Award, established in 2011, recognizes a female engineer who is a highly successful entrepreneur in a field of engineering or who has had a lifetime of achievement in the engineering profession. The award honors the legacy of Kate Gleason, the first woman to be welcomed into ASME as a full member.

Ursula M. Burns, chairman and chief executive officer of Xerox in Norwalk, Conn., is recognized for outstanding engineering and business leadership, and a distinguished career culminating in achieving the distinction of being the first black woman to lead a Fortune 100 company.

When Ms. Burns joined Xerox in 1980 as a mechanical engineering summer intern, the company was a leader in the global photocopying market. As she later assumed roles in product development and planning, Xerox was securing its leadership position in digital document technologies. From 1992 to 2000, Ms. Burns led several business teams including the company's color business and office network printing business.

In 2000 Ms. Burns was named senior vice president, Corporate Strategic Services, heading up manufacturing and supply chain operations. Alongside then-CEO Anne Mulcahy, Ms. Burns worked to restructure Xerox through its turnaround to emerge as a leader in color technology and document services. At the time Ms. Burns was responsible for leading global research as well as product development, marketing and delivery. In April 2007 she was named president of Xerox and was also elected a member of the company's board of directors.

Ms. Burns was named CEO in July 2009 and, shortly after, made the largest acquisition in Xerox history — the $6.4 billion purchase of Affiliated Computer Services, catapulting the company's presence in the $500 billion business services market and extending the company's reach into diverse areas of business process and information technology outsourcing. In May 2010 she became chairman of Xerox.

Ms. Burns is a board director of American Express Corporation and Exxon Mobil Corporation. She also provides leadership counsel to community, educational and nonprofit organizations. In March 2010 President Barack Obama appointed her vice chair of the President's Export Council. She was elected to the National Academy of Engineering in 2013.

Ms. Burns earned her bachelor's degree in mechanical engineering from Polytechnic Institute of NYU in 1980. In 1982 she earned her master's degree in mechanical engineering from Columbia University in New York. She holds several honorary degrees.

JAMES W. COAKER

Melvin R. Green Codes and Standards Medal

The Melvin R. Green Codes and Standards Medal was established in 1976 as the Codes and Standards Medal and renamed in 1996 to honor the memory and extraordinary contributions of Melvin R. Green, an ardent supporter of industrial standards.

James W. Coaker, P.E., principal of Coaker & Co., P.C. in Fairfax Station, Va., is honored for outstanding contributions in promoting the acceptance of ASME standards worldwide through personal engagement with key stakeholders, publications in industry journals, and professional development programs; and for leadership in the development of performance standards that facilitate the incorporation of new technology and encourage innovative engineering solutions.

After earning his bachelor's degree in 1968, Mr. Coaker spent four years on active duty in the U.S. Navy as a propulsion engineer. He continued his affiliation with the U.S. Naval Reserve and retired in 1998 at the rank of captain (engineering duty).

After active naval duty, Mr. Coaker worked in pump and condenser application engineering before joining a plate steel design/fabrication company. In 1987 he joined the design and construction staff of the United States Postal Service (USPS) headquarters in Washington, D.C., where he was responsible for national inspection and safety of boilers, elevators, escalators and compressed air systems.

Following his retirement from USPS in 2001, Mr. Coaker entered private practice; the engineering consultant practice is dedicated to supporting accident investigation and litigation involving elevator and escalator cases, and education in standards application.

An ASME Fellow, Mr. Coaker is chair of the Committee on Finance and Investment, and serves on the Board on Safety Codes and Standards. He has been a member of the A17.1 Standards Committee for Safety Code for Elevators and Escalators since 1991; and serves on the New Technology Committee, the A17.2 Inspectors' Guide Committee, the A17 Qualification of Elevator Inspectors Committee and the A17 International Standards Technical Advisory Group.

Mr. Coaker has served in other leadership positions including on the board of directors of ASME Foundation (2008-14). He received the Safety Codes and Standards Medal in 2010.

He is a member of the International Association of Elevator Engineers and NAESA International.

Mr. Coaker earned his bachelor's degree in mechanical engineering from Lafayette College in Easton, Pa., in 1968; and his master's degree in business from Virginia Commonwealth University in Richmond in 1976.

WARREN R. DEVRIES

Honorary Membership

WARREN R. DEVRIES, PH.D., A PROFESsor of mechanical engineering at the University of Maryland, Baltimore County (UMBC), is recognized for distinctive contributions to engineering education and research as a professor; for dedication to advancing the frontiers of discovery and innovation through public service; and for striving to advance the recognition of engineering's contributions to humankind through leadership in professional societies.

Dr. DeVries' research and educational expertise is in design and manufacturing systems and processes. For more than 25 years he was either the principal investigator or key technical resource for contracts and grants totaling $3.5 million from government and industry sources.

Dr. DeVries most recently served as dean of the College of Engineering and Information Technology at UMBC (2006-14). He worked with faculty and staff to build on UMBC's reputation for integration of education and research covering the whole spectrum of innovation. He also focused on giving students a multidisciplinary education, and on partnerships with government and industry to create new opportunities.

Prior to joining UMBC in 2006, Dr. DeVries was director of the National Science Foundation's (NSF) Division of Design, Manufacture and Industrial Innovation in Arlington, Va. He was on assignment to the NSF from Iowa State University in Ames, where, from 1996 to 2002, he was chair of the department of mechanical engineering.

Earlier, Dr. DeVries spent two years at the NSF as a program director for Manufacturing Machines and Equipment (1994-96); and he held faculty positions at Rensselaer Polytechnic Institute in Troy, N.Y. (1982-96), the University of Michigan in Ann Arbor (1977-82) and the University of Wisconsin (UW)-Madison (1975-77).

His publications include two textbooks.

An ASME Fellow, Dr. DeVries is currently the Society's secretary and treasurer. Previously he served on the 12-person Board of Governors; and, as senior vice president of the Council for Engineering, led the team of volunteers and staff responsible for ASME's technical programs. Among his honors, he received the Society's Charles Russ Richards Memorial Award in 2005 and Dedicated Service Award in 2006.

He is also a Fellow and member of various other societies.

Dr. DeVries received his bachelor's degree in letters and engineering from Calvin College in Grand Rapids, Mich., in 1971. He earned three degrees in mechanical engineering from UW–Madison: his bachelor's in 1971, his master's in 1973 and his Ph.D. in 1975.

ADAM HART-DAVIS

Ralph Coats Roe Medal

THE RALPH COATS ROE MEDAL, ESTABLISHED in 1972, recognizes an outstanding contribution toward a better public understanding and appreciation of the engineer's worth to contemporary society.

Adam Hart-Davis, DPhil, is recognized for educating the public about science, technology, engineering and mathematics by making STEM both inspirational and accessible in multiple media formats; and for celebrating engineers and the lasting impact of their contributions to the world.

Dr. Hart-Davis is a well-known scientist, author, photographer, historian, and radio and television personality. He is also a philanthropist who has a passion for raising awareness of the quality of life benefits that science, technology, engineering and mathematics bring, particularly for those in developing countries.

Following postdoctoral research in Canada and the U.K. (1968-71), Dr. Hart- Davis served as science editor at Oxford University Press in the U.K. In 1977 he joined the science department at Yorkshire Television in Leeds. There, through 1993, he worked as a researcher, producer and executive producer on programs such as "Arthur C. Clarke's Mysterious World"; "Scientific Eye," a television series used in 70 percent of U.K. secondary schools and in 35 other countries; and the equally successful "Mathematical Eye." He was a presenter on "Local Heroes"; "What the Romans Did for Us" and spin-off series on the Victorians, Tudors and Stuarts, and Ancients; "How London Was Built"; and many other programs. In addition to providing lively demonstrations of experiments, the programs provided Web links so young people could gain hands-on experience.

Dr. Hart-Davis has been a presenter on more than 100 radio programs about science and technology including two series of "Engineering Solutions." He is the author or editor of nearly 30 books including "Chain Reactions–Pioneers of British Science and Technology," "Eurekaaargh–A Spectacular Collection of Inventions That Nearly Worked," "Talking Science," and "Engineers–From the Great Pyramids to the Pioneers of Space Travel."

As a freelance writer, Dr. Hart-Davis has just finished editing a book about science for Dorling Kindersley. He also gives lectures to local history groups as well as national and international organizations.

He is president, patron or honorary fellow of some 35 organizations.

Dr. Hart-Davis received his bachelor's degree in chemistry (first-class honours) from Oxford University, U.K., in 1966; and his DPhil in organometallic chemistry from York University, U.K., in 1968. He holds 14 honorary degrees.

VAN C. MOW

ASME MEDAL

THE ASME MEDAL WAS ESTABLISHED IN 1920 and is awarded for eminently distinguished engineering achievement.

Van C. Mow, Ph.D., Stanley Dicker Professor of Biomedical Engineering and Orthopaedic Bioengineering at Columbia University in New York, is honored for significant contributions to biomechanical and biomedical engineering, particularly seminal breakthroughs in understanding the biomechanics of human joints; for educating and mentoring engineering students; for broad and critical leadership of the nascent bioengineering profession; and for service to ASME and other professional societies.

Following a postdoctoral fellowship and a brief career at Bell Labs, Dr. Mow returned to his alma mater, Rensselaer Polytechnic Institute (RPI) in Troy, N.Y., in 1969 as a faculty member in the mechanics department. Over the succeeding 45 years he became one of the most scientifically productive and well-recognized bioengineers.

At RPI (1969-86), Dr. Mow began his bioengineering research by concentrating on the musculoskeletal system. He developed rigorous constitutive laws that can be universally used for determining the complex deformational behaviors of soft-hydrated-charged biological tissues, such as articular cartilage, intervertebral discs and meniscus of the major joints of the body. The medical problems that motivated these studies stem from the need to understand the etiology of degenerative joint diseases, e.g., osteoarthritis, spinal degenerations and sports injuries.

On the faculty at Columbia since 1986, Dr. Mow founded the department of biomedical engineering and served as inaugural chair (1995-2011). He also served as director of the Liu Ping Laboratory for Functional Tissue Engineering Research (2003-12).

He has published more than 300 full-length peer-reviewed papers and invited monograph chapters, and more than 400 meeting abstracts; and has edited seven bioengineering monographs. His current Google Scholar citation count stands at 30,450, with an h-index of 97.

An ASME Fellow, Dr. Mow has served in various positions. He received numerous Society awards, and in 2004 the Bioengineering Division established the Van C. Mow Medal in his honor.

He is also a Fellow and member of numerous other societies.

Dr. Mow earned three degrees at RPI: his bachelor's degree in aeronautical engineering in 1962, his master's degree in applied mechanics in 1963 and his Ph.D. in applied mechanics (minor in applied mathematics) in 1966.

ROBERT E. NICKELL

HONORARY MEMBERSHIP

ROBERT E. NICKELL, PH.D., A CONSULTANT, is honored for significant contributions to the development of finite element methods for assessing material fatigue in nuclear reactor pressure vessels and piping, and the development of detonation chambers for the disposal of chemical weapons.

Dr. Nickell has made significant contributions to the engineering profession throughout a career that is approaching five decades. Early on, he developed finite element software for the analysis of solid propellant rocket motors and related structural systems, and did research on finite element analysis applied to fluid mechanics and dynamic buckling of structures subjected to explosive loadings. Since 1977 he has been a private consultant through Applied Science & Technology in San Diego.

Beginning in the late 1980s, Dr. Nickell has been consulting for EPRI on technical issues related to extending the operating lifetime of commercial nuclear power plants. In addition, he consults for the National Nuclear Security Administration on a wide variety of projects related to the technical maturity of technologies used in maintaining the U.S. nuclear weapons stockpile.

Dr. Nickell is currently providing consulting services to Kobe Steel, Ltd. on the design and operation of controlled detonation chambers for the destruction of chemical weapons; projects include Port Kanda in Japan (World War II weapons), Poelkapelle in Belgium (World War I weapons) and U.S. stockpile weapons. Through the law firm of Morgan, Lewis & Bockius LLP, he is providing technical expert services in the areas of environmental fatigue, embrittlement of reactor pressure vessel internals and nickel-alloy steam generator components related to Atomic Safety and Licensing Board license renewal hearings on Indian Point Units 2 and 3.

He has authored/co-authored more than 100 papers in refereed journals.

An ASME Fellow, Dr. Nickell is currently serving his third term as chair of the ASME Pension Plan Trustees. He has served in various leadership capacities including the 118th president (1999-2000) of the Society. He has also been involved in numerous Boiler and Pressure Vessel Code activities during the past 40 years.

He is a member of various other societies. For the National Academy of Engineering, he most recently served as chair (2012-14) of Section 10–Mechanical Engineering.

Dr. Nickell earned three degrees in engineering science from the University of California, Berkeley: his bachelor's in 1963, his master's in 1964 and his Ph.D. in 1967.

POL D. SPANOS

Honorary Membership

Pol D. Spanos, P.E., Ph.D., L.B. Ryon Endowed Chair in Engineering at Rice University in Houston, is recognized for seminal contributions to the dynamic analysis and design of diverse mechanical systems; for effective pedagogies that have advanced engineering education; and for achievements resulting from a resolute commitment to societal improvement through engineering innovation.

Dr. Spanos joined the faculty at Rice University in 1984. Previously he was at The University of Texas at Austin (1977-84).

His emphasis in the area of dynamics and vibrations has been on probabilistic, nonlinear and signal-processing aspects. His research group has created sophisticated computational models that have been applied to diverse themes including vibration and aseismic protection of structures and equipment; estimation of seismic spectra; wind loads simulation; vehicle and robot dynamics; certification of payloads in space shuttle and space station missions; flow-induced vibrations of offshore rigs, marine risers and pipelines; directional oil-well drilling; and signal processing for electrocardiograms, electroencephalograms and bone mechanics.

He has supervised the theses of more than 80 master's students and the dissertations of more than 50 doctoral students. An advocate of continuing education and training for engineers, Dr. Spanos has organized and presented short courses worldwide.

He is quite frequently involved in forensic engineering matters serving as master-of-the-court and technical expert for the federal courts.

Dr. Spanos has published more than 300 technical papers, and has authored or edited 18 books. He is editor-in-chief of the *International Journal of Non-Linear Mechanics* and the *Journal of Probabilistic Engineering Mechanics*.

An ASME Fellow, Dr. Spanos served in various capacities including chair of the Executive Committee of the Applied Mechanics Division and as a distinguished lecturer (1997-2003). He received the Society's Pi Tau Sigma Gold Medal in 1982, the Gustus L. Larson Memorial Award in 1991 and the Charles Russ Richards Memorial Award in 2012.

He is also a Fellow and member of various other societies.

Dr. Spanos received his diploma in mechanical engineering and engineering science from the National Technical University of Athens, Greece, in 1973. He earned his master's degree in civil engineering (dynamics) and his Ph.D. in applied mechanics from the California Institute of Technology in Pasadena in 1974 and 1976, respectively.

XIANG ZHANG

Nancy DeLoye Fitzroy and Roland V. Fitzroy Medal

The Nancy DeLoye Fitzroy and Roland V. Fitzroy Medal, established in 2011, recognizes pioneering contributions to the frontiers of engineering leading to a breakthrough(s) in existing technology or leading to new applications or new areas of engineering endeavor.

Xiang Zhang, Ph.D., Ernest S. Kuh Endowed Chair Professor at the University of California (UC), Berkeley, is honored for pioneering contributions in metamaterials and the creation of the first optical superlens to overcome the fundamental diffraction limit in imaging; and for the invention of plasmonic lithography technology to advance nanoscale manufacturing, which is important for microelectronics and data storage applications.

Dr. Zhang is also director of the Center for Scalable and Integrated Nanomanufacturing, a National Science Foundation Nanoscale Science and Engineering Center; and director of the Materials Sciences Division at the Lawrence Berkeley National Laboratory.

Prior to joining the UC Berkeley faculty in 2004, Dr. Zhang was at the University of California, Los Angeles. Earlier he was at The Pennsylvania State University in University Park (1996-99).

Dr. Zhang's groundbreaking demonstrations of optical metamaterials include the first magnetic response of metamaterials at far-infrared frequencies, which opened the door to the worldwide pursuit of optical metamaterials. He pioneered a new field in engineering – metamaterials composite – which uses the structure design to achieve acoustic and optical properties that do not exist in nature. Using metamaterials composite, he was the first to overcome the fundamental limit of diffraction, solving a 200-year-old problem and bringing about a shift in engineering materials design and applications. Based on this breakthrough, Dr. Zhang created the first optical superlens, the first 3-D bulk metamaterials with a negative optical refractive index and the first optical invisibility cloak. He also pioneered a new nanofabrication technology and coined the term plasmonic lithography; this technology has the ability to reach down to 10 nanometer scale.

An ASME Fellow, Dr. Zhang has been a member of the ASME Nanotechnology Institute since 2003. He is a Fellow and member of various other societies.

Dr. Zhang earned a bachelor's degree and a master's degree in solid state physics from Nanjing University, China, in 1985 and 1988, respectively. He earned a master's degree in mechanical engineering from the University of Minnesota in Minneapolis in 1992 and a Ph.D. in mechanical engineering from UC Berkeley in 1996.

Barnett-Uzgiris Product Safety Design Award

DONALD S. BLOSWICK

The Barnett-Uzgiris Product Safety Design Award was established as the Triodyne Safety Award by the Design Engineering Division. In 2008, it was elevated to an ASME award and renamed. The award recognizes individuals who have made significant contributions to the safe design of products through teaching, research and professional accomplishments.

Donald S. Bloswick, CPE, P.E., Ph.D., a professor in the department of mechanical engineering at The University of Utah in Salt Lake City, is recognized for significant contributions to safety and rehabilitation education and the mentoring of tomorrow's engineers through outstanding classroom teaching, highly supportive and productive advising, and the creation of various educational programs.

Dr. Bloswick is also director of The Ergonomics and Safety Program and Occupational Injury Prevention Research Program at The Rocky Mountain Center for Occupational and Environmental Health; and holds adjunct appointments in the university's department of family and preventive medicine, department of bioengineering, division of physical therapy and division of occupational therapy.

Bergles-Rohsenow Young Investigator Award in Heat Transfer

JONATHAN A. MALEN

The Bergles-Rohsenow Young Investigator Award in Heat Transfer, established in 2003, recognizes a young engineer who is committed to pursuing research in heat transfer and demonstrates the potential to make significant contributions in the field.

Jonathan A. Malen, Ph.D., an assistant professor at Carnegie Mellon University in Pittsburgh, is honored for the development of a new approach to studying thermal transport that experimentally identifies phonon mean free path dependent contributions to thermal conductivity in an effort to better understand size effects and non-Fourier thermal transport in nanomaterials and devices.

Dr. Malen joined the faculty at Carnegie Mellon in 2009. His research group's objective is to contribute in the development of new materials and devices that improve energy conversion efficiency and better manage heat that is a damaging byproduct of operation.

Blackall Machine Tool and Gage Award

MINGYANG LI
LIE TANG
ROBERT G. LANDERS
MING C. LEU

The Blackall Machine Tool and Gage Award was established in 1954 for the best paper or papers clearly concerned with, or related to, the design or application of machine tools, gages or dimensional measuring instruments.

Mingyang Li, a graduate research assistant in the department of mechanical and aerospace engineering at Missouri University of Science and Technology (Missouri S&T) in Rolla; Lie Tang, Ph.D., a control specialist at Quality Manufacturing Systems, Inc. in La Vergne, Tenn.; Robert G. Landers, Ph.D., a professor of mechanical engineering and associate chair for graduate affairs in the department of mechanical and aerospace engineering at Missouri S&T; and Ming C. Leu, Ph.D., Keith and Pat Bailey Missouri Distinguished Professor in the department of mechanical and aerospace engineering, and director of the Center for Aerospace Manufacturing Technologies and the Intelligent Systems Center at Missouri S&T, are recognized for the two-part paper titled "Extrusion Process Modeling for Aqueous-Based Ceramic Pastes–Part 1: Constitutive Model, and Part 2: Experimental Verification," which was published in the October 2013 issue of ASME's *Journal of Manufacturing Science and Engineering*.

Mr. Li joined the Virtual Reality and Additive Manufacturing Laboratory at Missouri S&T in the fall of 2010 as a Ph.D. candidate. He is a member of the freeze-form extrusion fabrication group.

Dr. Tang earned his Ph.D. in mechanical engineering from Missouri S&T in 2009. In his current position, his major responsibilities include control system development for mail-order pharmacies and pharmacy automation system development.

Dr. Landers has been on the faculty at Missouri S&T since 2000. His research and teaching interests are in the areas of modeling, analysis, monitoring and control of manufacturing processes; control of alternative energy systems and electro-hydraulic systems; and digital control applications.

Before joining Missouri S&T, Dr. Leu was program director for manufacturing processes and equipment (1996-99) at the National Science Foundation in Arlington, Va. For this appointment he was on leave from the New Jersey Institute of Technology (NJIT) in Newark, where he was state chair professor in manufacturing productivity since joining NJIT in 1987.

Per Bruel Gold Medal for Noise Control and Acoustics

ANDREW N. NORRIS

The Per Bruel Gold Medal for Noise Control and Acoustics was established in 1987 in honor of Dr. Per Bruel, who pioneered the development of sophisticated noise and vibration measuring and processing equipment. The medal recognizes eminent achievement and extraordinary merit in the field, including useful applications of the principles of noise control and acoustics to the art and science of mechanical engineering.

Andrew N. Norris, Ph.D., distinguished professor of mechanical and aerospace engineering in the School of Engineering at Rutgers University in Piscataway, N.J., is recognized for pioneering theoretical and applied work in acoustic wave propagation and scattering, homogenization, poromechanics and acoustic cloaking that has led to the development of improved geologic exploration and acclaimed theoretical tools for the development of acoustic metamaterials.

During his 35-year research career Dr. Norris has worked on topics including ultrasonic nondestructive evaluation for detecting cracks, modeling of underground sound for geophysical prospecting and structural acoustics for naval applications. He has been a member of the faculty at Rutgers since 1985.

Edwin F. Church Medal

JOHN W. CIPOLLA

The Edwin F. Church Medal, established in 1972, is awarded to an individual who has rendered eminent service in increasing the value, importance and attractiveness of mechanical engineering education.

John W. Cipolla, Ph.D., Donald W. Smith Professor of Mechanical Engineering and College of Engineering distinguished professor at Northeastern University in Boston, is honored for inspired leadership and devoted service in the activities of the ASME Center for Education including the Mechanical Engineering Department Heads Committee and the Committee on Engineering Accreditation; and for effective teaching, research and administration at the university level.

Dr. Cipolla joined the faculty at Northeastern in 1971. He was appointed chair of the department of mechanical engineering in 1991; he implemented the merger with the department of industrial engineering in 1995 and served as chair of the combined department until 2003. His research has been in the areas of the kinetic theory of gases and plasmas, radiative transfer and aerosol mechanics.

Daniel C. Drucker Medal

LALLIT ANAND

The Daniel C. Drucker Medal, established in 1997, is conferred in recognition of distinguished contributions to the field of

applied mechanics and mechanical engineering through research, teaching, and service to the community.

Lallit Anand, Ph.D., Warren and Towneley Rohsenow Professor of Mechanical Engineering at the Massachusetts Institute of Technology (MIT) in Cambridge, is recognized for seminal contributions to the formulation of constitutive theories for the plastic response of a variety of engineering solids including polycrystalline metals, metallic glasses, glassy polymers and granular materials.

Dr. Anand joined the faculty at MIT in 1982. He was the program director for the National Science Foundation's Mechanics of Materials and Manufacturing Processes programs (1989-91) and head of the mechanics area at MIT (2008-13).

William T. Ennor Manufacturing Technology Award

PLACID MATHEW FERREIRA

The William T. Ennor Manufacturing Technology Award was established in 1990 by the ASME Manufacturing Engineering Division and the Alcoa Company to recognize an individual or team for developing or contributing significantly to an innovative manufacturing technology, the implementation of which has resulted in substantial economic or societal benefits.

Placid Mathew Ferreira, Ph.D., department head and Tungchao Julia Lu Professor of Mechanical Science and Engineering at the University of Illinois at Urbana-Champaign, is recognized for innovations in precision machine tools and metrology that led to new software calibration and self-calibration techniques, and minimum zone tolerance verification methods; for novel parallel kinematic stages for micro and nanoscale applications, and novel processes for micro and nanoscale manufacturing; and for new provably correct and scalable algorithms for the control of flexibly automated manufacturing systems.

Dr. Ferreira has been a member of the faculty at Illinois since 1987. He served as director of the National Science Foundation-funded Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems.

Fluids Engineering Award

EFSTATHIOS E. MICHAELIDES

The Fluids Engineering Award was established by the Fluids Engineering Division in 1968. In 1978 it was elevated to an ASME award recognizing outstanding contributions over a period of years to the engineering profession and, in particular, to the field of fluids engineering through research, practice, and/or teaching.

Efstathios E. Michaelides, P.E., Ph.D., the W.A. Tex Moncrief Chair of Engineering at Texas Christian University (TCU) in Fort Worth, is recognized for pioneering analytical and numerical work on the transient flow and transient convection of particles, bubbles and drops; and for communicating those results to the multiphase flow community through highly regarded publications.

Prior to joining TCU, Dr. Michaelides was chair of the department of mechanical engineering at The University of Texas at San Antonio (2007-11), where he also held the Robert F. McDermott Distinguished Chair in Engineering and was the director of the National Science Foundation-supported Center on Simulation, Visualization and Real Time Computing.

Freeman Scholar Award

STEVEN CECCIO

The Freeman Scholar Award is given biennially in even-numbered years. Established in 1926, it is bestowed upon a person of wide experience in fluids engineering. The recipient is expected to review a coherent topic in his or her specialty, including a comprehensive statement of the state of the art, and suggest future research needs.

Steven Ceccio, Ph.D., the chair of naval architecture and marine engineering; and a professor of naval architecture and marine engineering, mechanical engineering and applied mechanics at the University of Michigan (U-M) in Ann Arbor, presented the Freeman Scholar lecture, "Skin Friction Reduction in External Flows," at the 2014 Fluids Engineering Division Summer Meeting held in Chicago.

A member of the faculty at U-M since 1990, Dr. Ceccio is also the director of the Naval Engineering Education Center, which is supported by the Naval Sea Systems Command.

Y.C. Fung Young Investigator Award

W. DAVID MERRYMAN

The Y.C. Fung Young Investigator Award, established in 1985, recognizes a young investigator who is committed to pursuing research in bioengineering and has demonstrated significant potential to make substantial contributions to the field of bioengineering.

W. David Merryman, Ph.D., an assistant professor of biomedical engineering, pharmacology, medicine and pediatrics at Vanderbilt University in Nashville, Tenn., is recognized for singular achievements in the study of heart valve mechanobiology, in the teaching of biomechanics, and through tireless service to the profession including the ASME Bioengineering Division.

Dr. Merryman also serves as director of graduate recruiting for the department of biomedical engineering at Vanderbilt. The primary goal of his research laboratory is to elucidate the mechanisms leading to multiple cardiovascular diseases and to develop nonsurgical strategies to prevent or treat them.

Gas Turbine Award

GRAHAM PULLAN
ANNA M. YOUNG
IVOR J. DAY
EDWARD M. GREITZER
ZOLTAN S. SPAKOVSZKY

Established in 1963, the Gas Turbine Award recognizes outstanding contributions to the literature of combustion gas turbines or gas turbines thermally combined with nuclear or steam power plants. The award is sponsored by the ASME International Gas Turbine Institute.

Graham Pullan, Ph.D., MHI Senior Lecturer in Turbomachinery at the Whittle Laboratory at the University of Cambridge, U.K., and a fellow in engineering at Trinity Hall in Cambridge, U.K.; Anna M. Young, Ph.D., the Maudslay-Butler Research Fellow at the Whittle Laboratory at the University of Cambridge; Ivor J. Day, CEng, Ph.D., Senior Rolls-Royce Research Fellow at the Whittle Laboratory at the University of Cambridge; Edward M. Greitzer, Ph.D., the H.N. Slater Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology (MIT) in Cambridge; and Zoltan S. Spakovszky, Ph.D., professor of aeronautics and astronautics, and director of the Gas Turbine Laboratory at MIT, are recognized for the paper titled "Origins and Structure of Spike-Type Rotating Stall" (GT2012-68707), which was presented at Turbo Expo 2012.

Dr. Pullan's research interests are the aerodynamic design of turbomachinery and the development of computational tools, particularly accelerated computational fluid dynamics, to enhance the design process.

Dr. Young completed her Ph.D. work on axial compressor stall in June 2012 under the supervision of Dr. Ivor J. Day. Her current research is in two areas: the effect of tip-clearance on compressor performance and tidal power generation.

Dr. Day received his Ph.D. from the University of Cambridge in 1976. After working in industry for 11 years, he returned to the Whittle Laboratory. His work has covered such subjects as stall and surge in axial compressors, unsteady combustion, and rain ingestion and ejection in aeroengines.

Dr. Greitzer joined MIT in 1977. He has served as director of the Gas Turbine Laboratory (1984-96) and associate/deputy head (1996-2002/2006-08) of the department of aeronautics and astronautics.

Dr. Spakovszky's principal fields of interest include internal flows in turbomachinery, compressor aero-

dynamics and stability, dynamic system modeling of aircraft gas turbine engines, microscale gas bearing dynamics and aeroacoustics.

Heat Transfer Memorial Awards

The Heat Transfer Memorial Award was established in 1959 by the Heat Transfer Division. In 1974, it was elevated to an ASME award recognizing outstanding contributions to the field of heat transfer through teaching, research, practice and design, or a combination of such activities.

JACOB NAN-CHU CHUNG – ART

Jacob Nan-Chu Chung, P.E., Ph.D., the Andres H. Hines Jr./Progress Energy Eminent Scholar Chair Professor at the University of Florida (UF) in Gainesville, is recognized for pioneering and seminal contributions to the science and engineering of heat transfer and phase-change of droplets and bubbles, transition in heated flows, microgravity and nano to microscale boiling fundamentals, thermal transport in the synthesis of nanocluster materials, space cryogenic boiling heat transfer and fuel cell thermal transport modeling.

Dr. Chung joined UF in 1998 after 19 years on the faculty at Washington State University in Pullman. Earlier he worked as a nuclear reactor safety engineer for six years.

XIANFAN XU – GENERAL

Xianfan Xu, Ph.D., the James J. and Carol L. Shuttleworth Professor of Mechanical Engineering at Purdue University in West Lafayette, Ind., is recognized for pioneering theoretical and experimental research on heat transfer in nanoscale materials, microsystems, and materials processing and manufacturing; and on fundamentals of nanoscale radiation and its application to material processing and manufacturing.

Dr. Xu has been on the faculty at Purdue University since 1994. He has written approximately 400 publications and given more than 100 invited talks worldwide.

KENNETH E. GOODSON – SCIENCE

Kenneth E. Goodson, Ph.D., Robert Bosch Chairman of the Mechanical Engineering Department and Davies Family Provostial Professor at Stanford University in California, is recognized for seminal contributions to the science and technology of phonon and electron transport and scattering in films and nanostructures through publications, lectures, short courses and mentoring of the next generation of university thermal science faculty.

Dr. Goodson joined the faculty at Stanford in 1994. He and his students bring fundamental science to applications in thermal management and energy conversion. He holds 34 U.S. patents.

Mayo D. Hersey Award

JOHN A. TICHY

The Mayo D. Hersey Award, established in 1965, is bestowed for distinguished and continued contributions over a substantial period of time to the advancement of the science and engineering of tribology. Distinguished contributions may result from significant original research in one or more of the many scientific disciplines related to lubrication.

John A. Tichy, Ph.D., professor at Rensselaer Polytechnic Institute in Troy, N.Y., is recognized for wide-ranging contributions to the field of tribology including the understanding and application of various types of lubricant rheology to tribological systems such as squeeze films, dampers, artificial joints, seals and chemical mechanical polishing.

Dr. Tichy has been a member of the faculty at Rensselaer for 38 years and, since 1986, is a professor in the department of mechanical, aerospace and nuclear engineering. He served as department head from 1996 to 2005.

For most of his career Dr. Tichy has worked in the tribology area, specializing primarily in hydrodynamic lubrication. He has spent many summer periods at laboratories in France and spent a sabbatical year at INSA Lyon in 2006.

Patrick J. Higgins Medal

BRIAN PARRY

The Patrick J. Higgins Medal recognizes an individual who has contributed to the enhancement of standardization through contributions to the development and promotion of ASME codes and standards or conformity assessment programs. It was established in 2007 in remembrance of ASME's past vice president of the standardization department.

Brian Parry, P.E., an associate technical fellow at The Boeing Company in Seattle, is honored for outstanding leadership, extraordinary perseverance and tireless collaboration in developing and promoting a broad range of standards spanning dimensional metrology and machine tools; and in crafting consensus within the framework of disparate national and international communities of professionals.

Mr. Parry has been working at Boeing for 35 years. Prior to 2006 he led a group tasked with providing solutions to complex measurement problems. Among his achievements, Mr. Parry was a major contributor to the development of a patented laser-based system for airplane assembly tooling, which allows for real-time correction.

Soichiro Honda Medal

THOMAS MOREL

The Soichiro Honda Medal recognizes an individual for an outstanding achievement or a series of significant engineering contributions in developing improvements in the field of personal transportation. This medal was established in 1983 in recognition of Soichiro Honda's exemplary achievements in the field of personal transportation.

Thomas Morel, Ph.D., president and CEO of Gamma Technologies, Inc. (GT) in Westmont, Ill., is honored for the visionary, focused and dedicated development of GT-POWER, which has become the industry standard for engine simulations; and GT-SUITE, the virtual simulation that is used by major engine, powertrain and vehicle manufacturers worldwide.

Founded by Dr. Morel in 1994, GT develops, supplies and supports advanced computer-aided engineering tools for engine, vehicle and power-generating industries. Today, all leading engine and vehicle manufacturers worldwide, in total more than 500 customers, rely on GT-SUITE for the design of their engines. GT-POWER is part of the GT-SUITE software package.

Internal Combustion Engine Award

ROBERT M. WAGNER

The Internal Combustion Engine Award, established in 1966, is given in recognition of eminent achievement or distinguished contribution over a substantial period of time, which may result from research, innovation or education in advancing the art of engineering in the field of internal combustion engines.

Robert M. Wagner, Ph.D., director of the Fuels, Engines and Emissions Research Center at Oak Ridge National Laboratory (ORNL) in Knoxville, Tenn., is recognized for leadership in innovative research in the area of unstable combustion fundamentals in internal combustion engines, and for distinctive contributions in the scaling and harmonization of low-temperature combustion processes to production-viable multicylinder engines.

Dr. Wagner's responsibilities include coordination and development of strategic internal and external collaborations at ORNL to better support the mission of the U.S. Department of Energy's Vehicle Technologies Office. He is also a faculty member of the Bredesen Center for Interdisciplinary Research and Graduate Education at the University of Tennessee in Knoxville.

Warner T. Koiter Medal

GURUSWAMI RAVICHANDRAN

The Warner T. Koiter Medal was established in 1996 to recognize distinguished contributions to the field of solid mechanics with special

emphasis on the effective blending of theoretical and applied elements, and on a high degree of leadership in the international solid mechanics community. The medal honors the late Dr. Warner T. Koiter, world-renowned authority in the field of solid mechanics, and it commemorates his vast contributions as research engineer and teacher. The medal was funded by the Delft University of Technology in the Netherlands.

Guruswami Ravichandran, Ph.D., the John E. Goode Jr. Professor of Aerospace and Professor of Mechanical Engineering at the California Institute of Technology (Caltech) in Pasadena, is honored for outstanding scientific, engineering and mentoring contributions in the areas of ultrahigh strain rate mechanics of ceramics and metals; and for pioneering and innovative experiments to advance the understanding of coupled phenomena in the fields of smart materials and cellular mechanics.

Dr. Ravichandran is also director of GALCIT, the Graduate Aerospace Laboratories at Caltech.

Robert E. Koski Medal

HUBERTUS J. MURRENHOFF

The Robert E. Koski Medal recognizes an individual who has advanced the art and practice of fluid power motion and control through education and/or innovation. It was established in 2007 by the Fluid Power Systems and Technology Division to honor Mr. Koski's contributions to the field of design engineering and dynamic systems and control.

Hubertus J. Murrenhoff, Dr.-Ing., the executive director of the Institute for Fluid Power Drives and Controls at RWTH Aachen University in Germany, is honored for two decades of exceptional leadership of one of the largest and most renowned fluid power research centers; and for leading fluid power into the 21st century through outstanding research results and through education that provides engineers with excellent skills to support industry.

Dr. Murrenhoff was appointed to his current position in October 1994 upon the retirement of Dr. Wolfgang Backé, and the name of the institution Dr. Backé established in 1968 was simultaneously changed.

Allan Kraus Thermal Management Medal

PETER EMILE RAAD

The Allan Kraus Thermal Management Medal, established in 2009, recognizes individuals who have demonstrated outstanding achievements in thermal management of electronic systems and their commitment to the field of thermal science and engineering.

Peter Emile Raad, P.E., Ph.D., professor of mechanical engineering and Linda Wertheimer Hart Professor at Southern Methodist University (SMU) in Dallas, is recognized for innovative research in deep-submicron thermal metrology; for determining 3-D temperature fields in electronic devices using 2-D thermal measurements; for exemplary teaching and mentoring; and for leadership in incubating cross-disciplinary research and educational initiatives at the intersection of industry and academia.

Dr. Raad joined the faculty at SMU in 1986. In 2000 he founded the Linda and Mitch Hart eCenter, a universitywide center to help business and society address the consequences of interactive network technologies, particularly the Internet. In 2002 he founded The Guildhall at SMU, a novel, industry–university, cross-disciplinary graduate program in the fast-growing field of digital game development.

James N. Landis Medal

SUSUMU MOCHIDA

The James N. Landis Medal was established in 1977 in honor of James N. Landis, who served as president of ASME in 1958. It is presented for outstanding personal performance related to designing, constructing, or managing the operation of major steam-powered electric stations using nuclear or fossil fuels, coupled with personal leadership in some humanitarian pursuit related to a committee activity, section leadership, or the broad nontechnical professional activity of the individual's engineering society.

Susumu Mochida, director and general manager of the Technology and Engineering Division at Nippon Furnace Co., Ltd. (NFK) in Yokohama, Japan, is honored for outstanding contributions to the development of a clean and efficient combined heat and power system to harness energy from waste materials, biomass and plastics using innovative high-temperature steam gasification technology, and for providing applications to a wide range of thermal platforms.

Mr. Mochida joined NFK in 1982. His current responsibilities include providing solutions for technology and engineering issues related to the company's industrial burner/thermal energy equipment.

Bernard F. Langer Nuclear Codes and Standards Award

DOUGLAS SCARTH

The Bernard F. Langer Nuclear Codes and Standards Award was established in 1977 and is presented to an individual who has contributed to the nuclear power plant industry through the development and promotion of ASME nuclear codes and standards or the ASME Nuclear Certification Program.

Douglas Scarth, Ph.D., technical director of fracture programs at Kinectrics Inc. in Toronto, is recognized for outstanding work that continues to expand and clarify the use of fracture mechanics in the nuclear industry; and for providing leadership and expertise in support of ASME's Boiler and Pressure Vessel Committee on Nuclear Inservice Inspection.

Dr. Scarth has participated in the development of engineering codes and standards for fitness-for-service assessments of plant components. At Kinectrics Inc., he is responsible for the development and improvement of methods for evaluating the structural integrity of nuclear pressure boundary components.

Gustus L. Larson Memorial Award

WEI LU

The Gustus L. Larson Memorial Award was established in 1974 and honors Gustus L. Larson, Fellow and founder of Pi Tau Sigma. It is awarded to the engineering graduate who has demonstrated outstanding achievement in mechanical engineering within 10 to 20 years following graduation.

Wei Lu, Ph.D., a professor in the department mechanical engineering at the University of Michigan (U-M) in Ann Arbor, is honored for outstanding achievements in mechanical engineering.

Dr. Lu joined the faculty at U-M in 2001. He has made seminal contributions to the scientific understanding and engineering application of mechanics and materials systems involving interface motion, structure evolution and deformation. He is recognized as a leader in the extension of mechanics principles and approaches to self-assembly and electrochemical systems.

H.R. Lissner Medal

KYRIACOS A. ATHANASIOU

The H.R. Lissner Medal was established in 1977 and is presented for outstanding accomplishments in the area of bioengineering.

Kyriacos A. Athanasiou, P.E., Ph.D., a distinguished professor of biomedical engineering and orthopaedic surgery at the University of California (UC), Davis, is recognized for sustained and outstanding leadership in biomechanical engineering, and for pioneering work in soft tissue regeneration.

Dr. Athanasiou is also chair of the department of biomedical engineering and holds the Child Family Endowed Chair in Engineering. At UC Davis, he has established one of the most recognized research groups in bioengineering, specializing in the musculoskeletal system. His group has demonstrated the fabrication of entire sections of cartilage by self-assembly, without the use of any scaffolds, with properties approaching those of native cartilage.

Machine Design Award

LARRY L. HOWELL

The Machine Design Award, established in 1958, recognizes eminent achievement or distinguished service in the field of machine design.

Larry L. Howell, P.E., Ph.D., a professor at Brigham Young University (BYU) in Provo, Utah, is recognized for research, application, teaching and service contributions that have had a lasting impact on compliant mechanisms including making it possible to create devices with unprecedented performance, such as origami-inspired mechanisms, microelectromechanical systems, space mechanisms and medical devices.

Dr. Howell is past chair of the department of mechanical engineering at BYU, where he holds a university professorship (2007-17). He has been a member of the faculty since 1994. His pioneering research addresses the challenges of compliant mechanisms to provide a foundation for research and application.

Charles T. Main Student Section Awards

The Charles T. Main Student Section Award was established in 1919 to recognize, at the Societywide level, an ASME student member whose leadership and service qualities have contributed, for a period of more than one year, to the programs and operation of a Student Section. In 1983, the award was expanded to include a second-place award.

MEREDITH ANNE CAMPBELL – GOLD

Meredith Anne Campbell, an undergraduate student at Daniel Webster College (DWC) in Nashua, N.H., is recognized for outstanding contributions to ASME including service as chair of the DWC Student Section and the District A Student District Operating Board, and involvement with the Human Powered Vehicle Challenge and the Student Section Enterprise Committee; and for creating change in the community through numerous other campus activities.

Ms. Campbell is pursuing a bachelor's degree in mechanical engineering, with a minor in business management. She expects to receive her degree from DWC in May 2016. She has been serving as student body president since May 2014 and has been a research assistant since 2011.

CLAIRE HARPER – SILVER

Claire Harper, an undergraduate student at The University of Alabama (UA) in Tuscaloosa, is recognized for dedicated leadership within the ASME Student Section at UA including tireless efforts to promote section growth and provide robust leadership for the future; and for service as vice chair and chair of the District F Student District Operating Board.

Ms. Harper is pursuing a bachelor's degree in mechanical engineering, with a minor in aerospace engineering. Her projected graduation date is May 2015. She is a member of UA's Honors College and Computer-Based Honors Program.

McDonald Mentoring Award

NAEL BARAKAT

The McDonald Mentoring Award, established in 2007, recognizes the outstanding mentoring of other professionals by an engineer in industry, government, education or private practice.

Nael Barakat, P.Eng., Ph.D., a professor and chair of mechanical engineering at Grand Valley State University (GVSU) in Grand Rapids, Mich., is honored for outstanding contributions to ASME for nearly two decades, particularly for integrating succession planning with a focus on early career engineers and for encouraging active involvement in the profession through leadership and mentoring.

Dr. Barakat joined the faculty at GVSU's School of Engineering in 2005 after three years of university teaching and four years of industrial experience and consulting. His areas of interest include mechatronics, controls, robotics, automation, systems integration, and metrology, as well as engineering ethics, professionalism, leadership, and education.

M. Eugene Merchant Manufacturing Medal of ASME/SME

DEAN L. BARTLES

The M. Eugene Merchant Manufacturing Medal was established in 1986 by ASME and SME to honor an exceptional individual who has had significant influence and responsibility for improving the productivity and efficiency of the manufacturing operation.

Dean L. Bartles, Ph.D., executive director for the Digital Manufacturing and Design Innovation (DMDI) Institute led by UI LABS in Chicago, is honored for pioneering contributions to tank, mortar and artillery ammunition production processes, as well as the multiple launch rocket system demilitarization process, which resulted in improvements in production rate efficiency, environmental control and energy utilization.

Dr. Bartles was selected to serve in his current position in March 2014. DMDI Institute, a public-private consortium of more than 70 organizations, will address the life cycle of digital data interchanged among myriad design, engineering, manufacturing and maintenance systems, and flowing across a networked supply chain, to drive U.S. manufacturing leadership. Previously Dr. Bartles was with General Dynamics in St. Petersburg, Fla.

Van C. Mow Medal

CHRISTOPHER R. JACOBS

The Van C. Mow Medal was established by the ASME Bioengineering Division in 2004. It is presented for significant contributions to the field of bioengineering through research, education, professional development, leadership in the development of the profession, mentoring of young bioengineers, and service to the bioengineering community.

Christopher R. Jacobs, Ph.D., professor of biomedical engineering at Columbia University in New York, is honored for outstanding contributions to biomechanics including novel anisotropic computer simulations of bone adaptation, studies of loading-induced dynamic fluid flow on bone cell adaptation, evidence of the role of primary cilia in mechanosensing, and the first fluid-structure interaction models of cilia bending.

Dr. Jacobs joined the faculty at Columbia University in 2008. Previously he was at Stanford University in California and, earlier, The Pennsylvania State University in University Park. His career focus has been on uncovering the mechanisms that allow cells to sense and respond to mechanical stimulation.

Nadai Medal

L. CATHERINE BRINSON

The Nadai Medal was established in 1975 to recognize significant contributions and outstanding achievements which broaden the field of materials engineering.

L. Catherine Brinson, Ph.D., Jerome B. Cohen Professor at Northwestern University in Evanston, Ill., is honored for significant contributions to the synthesis and characterization of polymer nanocomposites through research that has provided a fundamental understanding of the interphase and how nanoreinforcements affect polymer behavior, thus shedding light on material design for industry; and for educational contributions and service to the engineering profession.

Dr. Brinson is currently the Jerome B. Cohen Professor of Engineering with appointments in mechanical engineering, and materials science and engineering. She joined the faculty at Northwestern in 1992 following postdoctoral research at the DLR, Germany's aeronautics and space research center.

Sia Nemat-Nasser Early Career Award

KEVIN T. TURNER

The Sia Nemat-Nasser Early Career Award recognizes research excellence in experimental, computational or theoretical aspects

of mechanics of materials by a young investigator within 10 years following receipt of their Ph.D. degree. Established by the Materials Division in 2008, it was elevated to a Society award in 2012.

Kevin T. Turner, Ph.D., the Gabel Family Term Associate Professor of Mechanical Engineering and Applied Mechanics at the University of Pennsylvania in Philadelphia, is honored for outstanding research in experimental and theoretical solid mechanics, particularly for advancing the understanding of interfacial mechanics with applications to microscale and nanoscale manufacturing, wafer bonding, layer transfer processes, failure and reliability in microsystems, and advanced lithography.

Dr. Turner also serves as the director of the Quattrone Nanofabrication Facility at Penn. Previously he was on the faculty of the department of mechanical engineering at the University of Wisconsin–Madison (2005-11).

Burt L. Newkirk Award

BART RAEYMAEKERS

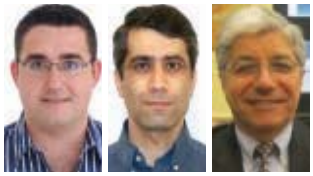
The Burt L. Newkirk Award was established in 1976 and is presented to an individual who has made a notable contribution in tribology research or development, as evidenced by important tribology publications prior to his or her 40th birthday.

Bart Raeymaekers, Ph.D., an assistant professor in the department of mechanical engineering at The University of Utah in Salt Lake City, is honored for significant contributions in the area of hydrodynamic lubrication, particularly surface texturing to reduce friction between sliding surfaces in magnetic storage devices and, most recently, prosthetic joints.

Dr. Raeymaekers has also made important contributions through research on contact mechanics, fretting wear, and design and analysis of precision instrumentation for tribology applications. He joined the faculty at The University of Utah in 2010. Earlier he was a postdoctoral fellow at Los Alamos National Laboratory in New Mexico.

Edward F. Obert Award

GHASSAN JAWDAT NICOLAS
MOHAMMAD JANBOZORGI
HAMEED METGHALCHI



The Edward F. Obert Award was established in 1987 by the Advanced Energy Systems Division to recognize an outstanding paper on thermodynamics. It was elevated to a Society award in 1996.

Ghassan Jawdat Nicolas, Ph.D., a fracturing and stimulation engineer at Schlumberger in Al-Udhailiyah, Eastern Province, Saudi Arabia; Mohammad Janbozorgi, Ph.D.; and Hameed Metghalchi, Sc.D., a professor of mechanical and industrial engineering at Northeastern University in Boston, are recognized for the paper titled "Constrained-Equilibrium Modeling of Methane Oxidation in Air."

For the world's largest oilfield services company, Dr. Nicolas performs hydraulic fracturing treatments to stimulate wells, increase their effective permeability and improve their production. He was selected for Schlumberger's elite Access Program, which includes spending 18 months in operations (well production services) followed by 21 months in data and consulting services.

Dr. Janbozorgi worked on various funded projects as a postdoctoral researcher at Northeastern University in Boston. He then spent a year as a postdoctoral research associate at the University of Southern California in Los Angeles, where he was focused on developing new concepts and approaches for chemical kinetic modeling of combustion of heavy hydrocarbon fuels relevant to high-speed combustion.

Dr. Metghalchi joined the faculty at Northeastern University in 1979. His research deals with scientific issues in combustion, fluid mechanics, thermodynamics and chemical reactions specifically using the second law of thermodynamics to predict evolution of nonequilibrium reacting gas mixtures. He is a pioneer in flame speed measurements and the development of the rate-controlled constrained-equilibrium method in chemical kinetics.

Old Guard Early Career Award

ANDRES E. RONDON MARIN

The Old Guard Early Career Award was established in 1994 to help the young engineer bridge the gap between college and professional life. Its intent is to bring that individual closer to the activities of ASME by providing encouragement for graduating student members to upgrade to member and actively become involved in the work of the Society.

Andres E. Rondon Marin, a graduate student at the Université Pierre et Marie Curie (UPMC)–Sorbonne in Paris, is recognized for inspirational leadership within ASME that has had an impact on young engineers in more than 10 countries; and for extraordinary career achievements including ongoing educational pursuits.

Mr. Rondon Marin is currently working on obtaining his Ph.D. in biomedical engineering under a three-year research contract at the Laboratoire d'Imagerie Biomedicale at UPMC–Sorbonne. As part of a combined Ph.D. Program in Science and Management, he is also pursuing an MBA diploma at the Collège des Ingénieurs in Paris.

Rufus Oldenburger Medal

ROBERT RONALD BITMEAD

The Rufus Oldenburger Medal was established in 1968 and is given in recognition of significant contributions and outstanding achievements in the field of automatic control through any of the following: education, research, development, innovation, and service to the field and profession.

Robert Ronald Bitmead, PE, Ph.D., a distinguished professor of mechanical and aerospace engineering at the University of California (UC), San Diego, is honored for sustained contributions, in both theory and application, to joint system modeling and control design; and for work that has had major impact on model predictive control and controller certification based on experimental data.

Dr. Bitmead is a control theorist with a long history of experience in control applications in many industrial sectors: sugar, steel, mining, telecommunications, aerospace, transportation, energy and photolithography. Prior to joining the faculty at UC San Diego in 1999, he spent 16 years at The Australian National University in Canberra.

Performance Test Codes Medal

W. GLENN STEELE JR.

The Performance Test Codes Medal, established in 1981, is awarded to an individual or individuals who have made outstanding contributions to the development and promotion of ASME Performance Test Codes, including the Supplements on Instruments and Apparatus.

W. Glenn Steele Jr., P.E., Ph.D., William L. Giles Distinguished Professor Emeritus of Mechanical Engineering at Mississippi State University (MSU) in Starkville, is recognized for significant contributions to the methodology of uncertainty analysis and its application to experimental programs; for serving ASME with exemplary dedication for more than three decades; and for current service as vice chair of PTC 19.1, the Society's Performance Test Code Committee on Test Uncertainty.

Dr. Steele joined the faculty at MSU in 1979 and focused on education, research and service in the energy area with special emphasis on the applications of uncertainty analysis. He retired in 2012.

Marshall B. Peterson Award

BRANDON A. KRICK

The Marshall B. Peterson Award, established in 1997, is given to a young engineer in recognition of an early-career achievement and for promising research within the field of tribology.

Brandon A. Krick, Ph.D., an assistant professor at Lehigh University in Bethlehem, Pa., is recognized for the design and execution of the first tribological experiments of

candidate solid lubricants in an extraterrestrial environment, part of MISSE-7, NASA's Materials International Space Station Experiment program.

In 2013 Dr. Krick joined the faculty at Lehigh, where he now directs the Surface Interfaces and Materials Tribology Laboratory. His current focus is utilizing in situ experiments to characterize and understand the complex mechanical, material, chemical and physical interactions of tribological interfaces.

Pi Tau Sigma Gold Medal

IBRAHIM TARIK OZBOLAT

The Pi Tau Sigma Gold Medal was established in 1938 by Pi Tau Sigma in coordination with ASME to recognize outstanding achievements by a young engineering graduate in mechanical engineering within 10 years following receipt of the baccalaureate degree.

Ibrahim Tarik Ozbolat, Ph.D., an assistant professor in the department of mechanical and industrial engineering at The University of Iowa in Iowa City, is honored for outstanding achievements in mechanical engineering within 10 years of graduation.

Dr. Ozbolat is the founder and co-director of the Advanced Manufacturing Technology Group. He is also affiliated with the Center for Computer-Aided Design as a research professor. His major research thrust is in the area of design, manufacturing and tissue engineering with a special focus on biomanufacturing, additive manufacturing and electronics manufacturing. Dr. Ozbolat is a globally known expert in 3-D bioprinting, particularly in organ fabrication.

James Harry Potter Gold Medal

MICHAEL R. VON SPAKOVSKY

The James Harry Potter Gold Medal was established in 1980 in recognition of eminent achievement or distinguished service in the appreciation of the science of thermodynamics and its applications in mechanical engineering.

Michael R. von Spakovsky, Ph.D., professor at Virginia Polytechnic Institute and State University in Blacksburg, is recognized for pushing the boundaries of science by delving into the most basic elements of physics and thermodynamics, and applying these insights to the modeling of complex nonequilibrium/equilibrium phenomena at scales ranging from single particle systems to large stationary cogeneration and high-performance aircraft systems.

Dr. von Spakovsky has more than 27 years of teaching/research experience and more than 17 years of industry experience in mechanical engineering, power utility systems, aerospace, and software engineering. Since 1997 he has been professor of mechanical engineering at Virginia Tech and director of the Center for Energy Systems Research.

Prime Movers Committee Award

ROBERT J. BELL
ALBERT S. BIRKS

The Prime Movers Committee Award, established in 1954, recognizes outstanding contributions to the literature of thermal electric station practice or equipment which are available through public presentation and publication.

Robert J. Bell, P.E., director of engineering/president and founder of Heat Exchanger Systems, Inc. (HES) in Weymouth, Mass.; and Albert S. Birks, P.E., are recognized for the paper titled "An Engineer's Guide to Eddy Current Testing," presented at the ASME 2013 Power Conference.

Mr. Bell founded HES in 1982. The firm provides specialized engineering, testing and examination services for power plant feedwater heaters, condensers, miscellaneous heat exchangers, and associated systems.

Mr. Birks recently retired from the Indian Head Naval Surface Warfare Center in Maryland. At Indian Head, part of the Naval Sea Systems Command, he served as the site radiation safety officer, and as senior engineer and scientist with the Energetics, Test and Evaluation Division.

Dixy Lee Ray Award

LEO P. DUFFY

The Dixy Lee Ray Award, established in 1998, recognizes significant achievements and contributions in the broad field of environmental protection. It honors not only those who have contributed to the enhancement of environmental engineering, but also those who have contributed to disciplines outside environmental engineering where accomplishments have indirectly impacted environmental protection.

Leo P. Duffy is honored for advancing the public good through the design of standardized naval nuclear power plant systems that were adopted internationally, and through comprehensive national nuclear waste policy development.

Mr. Duffy served as the first assistant secretary of the Department of Energy's Office of Environmental Restoration and Waste Management (1989-93). Subsequently, he was principal of Duffy Group in West Chester, Pa., through which he provided strategic counsel and management support on critical initiatives until his retirement in 2003.

Charles Russ Richards Memorial Award

SURESH V. GARIMELLA

The Charles Russ Richards Memorial Award, established in 1944, was named in honor of a founder of Pi Tau Sigma. It is given to an engineering graduate who has demonstrated outstanding achievements in mechanical engineering for 20 years or more following graduation.

Suresh V. Garimella, Ph.D., Goodson Distinguished Professor and executive vice president for research and partnerships at Purdue University in West Lafayette, Ind., is honored for outstanding achievements in mechanical engineering for 20 years or more following graduation.

Dr. Garimella joined the faculty at Purdue in 1999. He is also director of the National Science Foundation's Cooling Technologies Research Center. Among his prior experience, Dr. Garimella was on the faculty at the University of Wisconsin–Milwaukee (1990-99). His areas of expertise include micro and nanoscale transport phenomena, thermal management and energy efficiency in electronics systems, renewable and sustainable energy systems technology and policy, and global academic–public–private partnerships.

Safety Codes and Standards Medal

ROBERT BOLEN

The Safety Codes and Standards Medal was established in 1986 to recognize contributions to the enhancement of public safety through the development and promotion of ASME safety codes and standards or through ASME safety accreditation activity.

Robert Bolen, a consultant, is honored for more than 35 years of dedicated service advocating for the use of ASME safety standards; and for outstanding contributions as a member of the B30 Safety Standards Committee for Cranes and Related Equipment including 21 years as chair of Subcommittee B30.11–Monorails and Underhung Cranes.

Mr. Bolen spent his career at DuPont Co. in Wilmington, Del., where he worked for 37 years in the central engineering department. During his last 25 years at DuPont, he was the company consultant on overhead and vertical material handling systems. Although Mr. Bolen retired in 2002, he continues to provide engineering consulting services.

R. Tom Sawyer Award

REZA S. ABHARI

The R. Tom Sawyer Award, established in 1972, is bestowed upon an individual who has made important contributions toward the advancement of the gas turbine industry, as well as the ASME International Gas Turbine Institute (IGTI), over a substantial period of time.

Reza S. Abhari, Ph.D., a full professor at ETH Zurich, is recognized for significant contributions to the gas turbine industry in both the U.S. and Europe, and for exemplary service to the IGTI.

Dr. Abhari is also head of the Laboratory for Energy Conversion (established in 1892) at ETH Zurich. With 75 students and staff, current research at the laboratory includes renewable energy technology and economics, fossil fuel power generation and laser produced plasma. Prior to joining ETH Zurich in 1999, Dr. Abhari was at The Ohio State University in Columbus, where he cofounded the Gas Turbine Laboratory.

Milton C. Shaw Manufacturing Research Medal

ALBERT SHIH

The Milton C. Shaw Manufacturing Research Medal, established in 2009, recognizes significant fundamental contributions to the science and technology of manufacturing processes.

Albert Shih, Ph.D., professor of mechanical engineering and biomedical engineering at the University of Michigan (U-M) in Ann Arbor, is recognized for fundamental contributions to abrasive grinding in high-volume production; and for leadership that has broadened manufacturing research into the design of advanced medical devices and healthcare operations.

Dr. Shih is also associate chair, Integrative Systems + Design, a division in the College of Engineering; and director of the global automotive and manufacturing engineering program. Prior to joining the faculty at U-M in 2003, Dr. Shih was at North Carolina State University in Raleigh. Earlier he worked at Cummins Inc. in Columbus, Ind. (1991-98), where he was the lead manufacturing process development engineer.

Ben C. Sparks Medal

TIMOTHY W. SIMPSON

The Ben C. Sparks Medal, established in 1990, recognizes eminent service by an individual or collaborative team in promoting innovative, authentic, practice-based, engineering design/build experiences in undergraduate mechanical engineering or mechanical engineering technology education.

Timothy W. Simpson, Ph.D., a professor at The Pennsylvania State University in University Park, is recognized for exemplary leadership of the Learning Factory that has provided unparalleled student access to innovative and authentic practice-based design/build experiences, fostering the largest collegewide and industry-sponsored capstone design program in the U.S.

Dr. Simpson is a professor of mechanical engineering and industrial engineering at Penn State, with affiliations in engineering design and the College of Information Sciences and Technology. He is also the co-director of the Defense Advanced Research Projects Agency-funded Center for Innovative Materials Processing through Direct Digital Deposition. Dr. Simpson served as director of the Learning Factory (2007-12); under his leadership student involvement doubled, industry sponsorship tripled, department engagement quadrupled, and cross-college participation increased fivefold.

Ruth and Joel Spira Outstanding Design Educator Award

KEVIN CRAIG

The Ruth and Joel Spira Outstanding Design Educator Award was established as a division award in 1998. The award was elevated to an ASME award in 2001 to recognize a person who exemplifies the best in furthering engineering design education through vision, interactions with students and industry, scholarship, and impact on the next generation of engineers, and a person whose action serves as a role model for other educators.

Kevin Craig, Ph.D., the Robert C. Greenheck Chair in Engineering Design and professor of mechanical engineering at Marquette University in Milwaukee, Wis., is honored for transforming engineering design education—students, faculty, curricula and facilities—for more than 30 years through a focus on human-centered, model-based multidisciplinary design, with a balance between theory and industry best practices, taught in the context of actual engineering practice.

Dr. Craig's mission at Marquette is to integrate multidisciplinary design and discovery learning throughout the College of Engineering. While at Rensselaer Polytechnic Institute in Troy, N.Y. (1989-2007), he developed the Mechatronics Program. Earlier he received tenure at the United States Merchant Marine Academy in Kings Point, N.Y., and Hofstra University in Hempstead, N.Y.

Student Section Advisor Award

ANTONIOS KONTSOS

The Student Section Advisor Award, established in 1990 as the Faculty Advisor Award and renamed in 2000, is awarded to an ASME member who is a current or former Student Section advisor whose leadership and service qualities have contributed, for at least three years, to the programs and operation of a Student Section of the Society.

Antonios Kontsos, Ph.D., the P.C. Chou Endowed Assistant Professor in Mechanical Engineering at Drexel University in Philadelphia, is recognized for dedicated service as advisor for the ASME Student Section at Drexel University since the fall of 2010, particularly for enhancing the visibility of the section through increased membership, activities and funding; student attendance at Philadelphia Section and Society events; and personal and professional development opportunities.

At Drexel since 2009, Dr. Kontsos is also the director of the Theoretical and Applied Mechanics Group. His research group specializes in applying experimental, analytical and computational tools to understand material deformation and damage across time and length scales.

J. Hall Taylor Medal

CHARLES BECHT IV

The J. Hall Taylor Medal was established in 1965 by the ASME Codes and Standards Board as a gift from Taylor Forge and Pipe Works to commemorate the pioneering work of J. Hall Taylor in the standardization of industrial products and safety codes for their usage. It is awarded for distinguished service or eminent achievement in the codes and standards area pertaining to the broad fields of piping and pressure vessels.

Charles Becht IV, P.E., Ph.D., president of Becht Engineering Co., Inc. in Liberty Corner, N.J., is honored for distinguished leadership and professionalism in the technical advancement of ASME codes and standards for pressure vessels and piping; and for dedication to the engineering profession, public safety and component reliability in the construction of pressure equipment.

He is also CEO of Helidex, LLC and director/owner of Sonomatic Ltd. Among his accomplishments, Dr. Becht has developed new fundamental understandings, such as the behavior of bellows and elevated temperature structures; and many new code rules.

Technical Communities Globalization Medal

UPENDRA SINGH ROHATGI

The Technical Communities Globalization Medal, established in 2011, is awarded to an ASME member who has demonstrated a sustained level of outstanding achievement in the promotion of international activity related to mechanical engineering.

Upendra Singh Rohatgi, Ph.D., a senior mechanical engineer at Brookhaven National Laboratory (BNL) in Upton, N.Y., is honored for career efforts devoted to reducing the risk of the proliferation of weapons of mass destruction and increasing global security through the engagement of scientists and engineers from former Soviet Union countries and Iraq, previously involved in WMD development, in the creation of new technologies for U.S. industries under the U.S. Department of Energy's program of Global Initiatives for Proliferation Prevention, and for institutions in the European Union, Japan and Canada; and through scientific collaborations at the International Science and Technology Center–Moscow and the Science and Technology Center in Ukraine, Kiev.

Dr. Rohatgi started his career at BNL in 1975. He contributed to the

development of methodologies including the uncertainty methodology used internationally for reactor safety analyses.

Robert Henry Thurston Lecture Award

KEN P. CHONG

The Robert Henry Thurston Lecture Award was established in 1925 in honor of ASME's first president. It provides an opportunity for a leader in pure and/or applied science or engineering to present to the Society a lecture that encourages stimulating thinking on a subject of broad interest to engineers. The Robert Henry Thurston Lecture Award was elevated to a Society award in 2000.

Ken P. Chong, P.E., Ph.D., a research professor at George Washington University in Washington, D.C., and a National Institute of Standards and Technology (Gaithersburg, Md.) associate, is honored for fostering new research directions to meet national needs through efforts including visionary leadership in the fields of nanomechanics and materials; for mentoring and nurturing a new generation of engineering educators; and for pioneering work in architectural sandwich panels and brittle-fracture testing methods.

Dr. Chong is the former engineering advisor, and director of mechanics and materials (1989-2009) at the National Science Foundation in Arlington, Va.

Timoshenko Medal

ROBERT M. McMEEKING

The Timoshenko Medal was established in 1957 and is conferred in recognition of distinguished contributions to the field of applied mechanics. Instituted by the Applied Mechanics Division, it honors Stephen P. Timoshenko, world-renowned authority in the field, and it commemorates his contributions as author and teacher.

Robert M. McMeeking, Ph.D., Tony Evans Professor of Structural Materials and professor of mechanical engineering at the University of California, Santa Barbara (UCSB), is recognized for pioneering contributions to broad areas of applied mechanics including nonlinear fracture mechanics, transformation toughening, mechanics of composites, powder consolidation, and ferroelectric fracture and constitutive modeling.

Dr. McMeeking joined the faculty at UCSB in 1985. He is also Sixth Century professor of engineering materials (part time) at the University of Aberdeen, Scotland.

Worcester Reed Warner Medal

VIGOR YANG

The Worcester Reed Warner Medal was established in 1930 and is awarded for outstanding contributions to the permanent literature of engineering. Contributions may be single papers, treatises or books, or a series of papers.

Vigor Yang, Ph.D., the William R.T. Oakes Professor and chair of the Daniel Guggenheim School of Aerospace Engineering at the Georgia Institute of Technology in Atlanta, is honored for extensive and fundamental contributions to the literature of combustion dynamics for propulsion and power-generation technology development.

Prior to joining the faculty at Georgia Tech in 2009, Dr. Yang was a member of the faculty at The Pennsylvania State University, University Park, since 1985. He is the author/co-author of nearly 400 technical papers in the areas of propulsion and combustion, and he has published 10 comprehensive volumes on rocket and air-breathing propulsion.

George Westinghouse Gold Medal

RYOICHI SAMUEL AMANO

The George Westinghouse Gold Medal was established in 1952 to recognize eminent achievement or distinguished service in the power field of mechanical engineering to perpetuate the value of the rich contribution to power development made by George Westinghouse, honorary member and 29th president of the Society.

Ryoichi Samuel Amano, Ph.D., a professor in the mechanical engineering department at the University of Wisconsin (UW)–Milwaukee, is honored for sustained efforts in education and research for the power industry, particularly outstanding contributions to the development and application of mathematical and experimental methods for innovations in power plant technologies that have resulted in significant improvement in efficiency and performance.

Dr. Amano joined the faculty at UW–Milwaukee in 1981. He has been teaching thermal engineering there for nearly 33 years; and has directed significant research programs in the areas of power, energy and aerospace.

Arthur L. Williston Medal

MAVILA MARINA MILLER

The Arthur L. Williston Medal, established in 1954, recognizes the best paper submitted on a subject chosen to challenge the abilities of engineering students. The annual competition is open to any ASME student member or member who received a baccalaureate degree within two years of the submission deadline.

Mavila Marina Miller, a junior at Yale University in New Haven, Conn., is recognized for the paper titled "Engineering – Learning from the Past and Building the Future."

Ms. Miller expects to receive her B.S. in mechanical engineering and B.A. in architecture in 2016. Before coming to Yale, Ms. Miller lived in Shanghai, where she discovered her passion for creative industrial design and development. As a design aide at the Yale Center of Engineering Innovation and Design, she has had the opportunity to manufacture prototypes of some of her ideas. She started a student-run organization called Creative Product Design Inc.; and launched her own company, KuKy World (www.kukyworld.com), an online e-commerce platform.

Henry R. Worthington Medal

GERALD L. MORRISON

The Henry R. Worthington Medal, established in 1980, is bestowed for eminent achievement in the field of pumping machinery including, but not limited to, research, development, design, innovation, management, education or literature.

Gerald L. Morrison, P.E., Ph.D., a professor of mechanical engineering at Texas A&M University in College Station, is honored for more than three decades of pump research and development ranging from the space shuttle main engines to multiphase electric submersible pumps; and for advanced experimental and computational techniques that have expanded the understanding of pump operation and characterization.

Dr. Morrison began his career at Texas A&M in 1977. His current responsibilities include managing multiple research projects that support the work of 12 graduate students and a research engineer. He holds several patents in the area of flow meters and has been developing a Doppler global velocimeter for many years.

S.Y. Zamrik PVP Medal

ARTHUR G. WARE

The Pressure Vessel and Piping Medal was established in 1980. Renamed the S.Y. Zamrik PVP Medal in 2010, it is bestowed for outstanding contributions in the field of pressure vessel and piping technology including, but not limited to, research, development, teaching, and significant advancements of the state of the art.

Arthur G. Ware, P.E., Ph.D., a consultant, is recognized for providing numerous services to ASME including Codes and Standards, and the Pressure Vessels and Piping Division; and for significant contributions to the design, analysis, licensing and license renewal of nuclear power plants worldwide.

Dr. Ware spent the majority of his career at the Idaho National Laboratory in Idaho Falls. Since 2001, as a private consultant, he has reviewed/performed Department of Energy performance category 3 and 4 seismic analyses, and reviewed new reactor licensing and licensing renewal applications for the Nuclear Regulatory Commission. He also worked part time as the principal analyst for Applied Engineering Services, Inc., of Idaho Falls.

ASME
SETTING THE STANDARD

THE ASME BOARD OF GOVERNORS confers the Fellow grade of membership on worthy candidates to recognize their outstanding engineering achievements.

Nominated by their peers, these 2013–2014 Fellows have had 10 or more years of active practice and at least 10 years of active corporate membership in ASME.

There are 144 new Fellows out of a total of 90,972.

THE ASME FELLOW

A MEMBERSHIP GRADE OF DISTINCTION

ASME 2014 FELLOWS

Avinash K. Agarwal

Avinash Kumar Agarwal has made significant scientific and practical contributions in the areas of biofuels, locomotive engines, laser ignition, engine tribology, particulates and engine aerosol toxicity and HCCI combustion. He has published many influential papers in these fields and built a modern engine research laboratory at I.I.T. in Kanpur, India to enable research and teaching. Agarwal has received numerous teaching and research awards and has directly instructed over 500 undergraduates, 30 master's and five doctoral students. Ph.D. (1999), Indian Institute of Technology, Delhi.

Philip L. Andrew

Philip Andrew is recognized throughout the gas turbine industry for his significant technical and professional achievements in the fields of gas turbine performance and operability, aerodynamics, and product development. He earned mechanical engineering degrees at Rochester Institute of Technology, The University of Tennessee Space Institute, and Virginia Tech, and completed the Diploma Course at the von Karman Institute for Fluid Dynamics. Andrew's distinguished career at General Electric has benefited the aircraft engine, generator, and industrial gas turbine businesses. He also has been a strong supporter and participant of ASME, particularly the International Gas Turbine Institute. Ph.D. (1992), Virginia Polytechnic Institute.

Asif H. Arastu

Asif Arastu has 37 years of experience in nuclear and mechanical engineering and has worked with more than 60 nuclear and non-nuclear power plants worldwide. His work involves thermal hydraulic and radiation dose/shielding analysis, research and development, computer code development, project management, and power plant systems reviews. He serves as Vice Chair of the ASME Nuclear Engineering Division Executive Committee and has played a significant role in organizing ASME International Conferences (ICONE, PVP and IMECE) for over 15 years. Arastu has published 30 technical papers in conferences, including a journal publication. He has received "Outstanding Technical Paper" awards from Bechtel. Ph.D. (1978), Queen Mary College, University of London.

Shiva Om Bade Shrestha

Shiva Om Bade Shrestha started his professional career more than 28 years ago as a lecturer at the Institute of Engineering, Tribhuvan University, Nepal. He worked as a chief scientist and technology officer for energy and environment companies before joining Western Michigan University ten years ago. His contributions to mechanical engineering, particularly in the area of alternative fuel combustion, IC engine knocking modeling, and flammability limits, are noteworthy and exemplary. He has over fifty scientific papers published in various international refereed journals and conferences, as well as four patent applications. Shrestha has been involved for many years in engineering education and has contributed to training hundreds of engineers. Ph. D. (1999), The University of Calgary, Alberta.

Judith Ann Bamberger

Judith Bamberger's research, conducting scaled experiments characterizing unsteady mobilization and mixing of Newtonian and non-Newtonian slurries applied to remediation of nuclear waste stored in underground tanks, led to development and application of in-situ real-time instrumentation to characterize slurry physical and rheological properties, measurements of concentration of particulate-laden fluids and multi-phase suspensions in vessels and pipelines and development and assessment of fluids-based remediation technologies. She has had ASME leadership roles (Air Pollution Control Division Chair, North American Pacific District Leader, Fluids Engineering Division Committee Chairs), and was awarded the ASME Dedicated Service and US Department of Energy Honor Award. Ph.D. (2013), Washington State University.

Alan A. Barhorst

Alan Barhorst's career includes several years at Lockheed in Houston contracting for NASA. He worked with structural engineers regarding easing the work stream for NASTRAN data input for space shuttle payloads, and with space station control engineers developing efficient simulations. Barhorst analyzed the inch-worm-like motion of the Canada Robot Arm relative to attitude station keeping. Since joining the faculty at Texas Tech University in 1991, he has authored over 60 peer reviewed articles. He is co-author of a dynamics textbook, and he directed the research of 30 students, in diverse areas, including bio-mechanics, flexible multi-body dynamics, nonlinear

dynamics, orthotics, robotics for plutonium disposition, structural health monitoring, and wavelet based acoustic emissions. Barhorst served internationally as ME Program Coordinator at Texas A&M University at Qatar, prepping for initial ABET accreditation. Ph.D. (1991), Texas A&M University.

Joseph Batty

Joseph Clair Batty has enjoyed a long and distinguished career as a teacher, researcher, academic leader and entrepreneur. He has been recognized multiple times as an outstanding professor by students and peers. He has been directing major research programs for more than 45 years while mentoring over 70 M.S. and Ph.D. candidates, and is the author or coauthor of more than 150 publications emphasizing thermal management. Batty is the principal inventor for a number of innovative thermal management technologies being prepared for commercialization by Thermal Management Technologies, LLC. He co-founded the company in 2008 and is currently the CEO. Sc.D. (1969), Massachusetts Institute of Technology.

Christopher C. Berndt

Christopher Berndt has been involved in teaching and research within the materials engineering and mechanical engineering disciplines for the past 32 years. He has taken on leadership roles within professional societies for the past 15 years, including the presidency of ASM International, a society with affinities to ASME. Berndt has taught thousands of undergraduates as well as some 60 graduate students and a dozen post docs whom he has mentored. He has published more than 450 articles on thermal spray manufacturing technology and been invited as keynote speaker to many conferences. Berndt's Hirsch Index is 42. Ph.D. (1981), Monash University, Melbourne, Australia.

Charanjit S. Bhatia

Charanjit Singh Bhatia is known for his contributions to head-media interfaces and tribology for increasing the areal recording density of hard disk and tape drives. Bhatia also developed and implemented novel materials for head/media interface for magnetic data storage systems. Ph.D. (1979), University of Minnesota.

Sherrill B. Biggers

Sherrill Biggers joined the Department of Mechanical Engineering at Clemson University in 1989, as an Associate Professor. He was promoted to Professor in 1995, and now serves as Associate Chair. He has been a leader in transforming the undergraduate curriculum so that it has a greater focus on active student learning. Previously, Biggers was Manager of NASA Composite Structures Programs at Lockheed where he worked for over 10 years. He began his academic career as an Assistant Professor at the University of Kentucky. Biggers' research has centered on composite structures analysis and design, with applications in aerospace, marine and land vehicles, and biomechanics. Ph.D. (1971), Duke University.

Kevin C. Bodenhamer

Kevin C. Bodenhamer has demonstrated significant technical contributions related to the transportation of hazardous liquids. Bodenhamer has spent the majority of his career working for three different pipeline operators where he held leadership positions in operations, technical services, compliance, major projects, and engineering. During this time, he also served as Chair for ASME B31.4 for 13 years, and currently is a member of the Joint Technical Committee and B31 Committee. His leadership and personal integrity are recognized across the pipeline industry. B.S. (1978), University of Missouri, Rolla.

Warren Brown

Warren Brown has spent years engaged in technical training experimental work, industry surveys, service experience, and participation in PVP Conferences. This work prepared him to serve as Technical Project Manager for the development of a guideline document entitled "Training and Qualification of Bolted Joint Assembly Personnel" for inclusion as Appendix A in ASME PCC-1-2013, entitled "Guidelines For Pressure Boundary Bolted Flange Joint Assembly." Appendix A will advance efforts to assure the pressure integrity of bolted joints by establishing uniform criteria for training and qualifying assembly personnel, as well as guidelines for quality control. Ph.D. (2001), Ecole Polytechnique at the University of Montreal.

Stuart Cameron

Stuart Cameron has extensive experience in numerous fields of international Mechanical Engineering. He has used this experience efficiently in ASME Code developments and committee participations. Cameron has also provided important international technical liaisons for the advancement of ASME Codes, specific technologies, and the management of ASME Codes. He has been, and continues to be, an active member of the ASME Boiler and Pressure Vessel Code committees involved in the development and application of technologies and requirements for construction materials for power boilers. He is also a member of ASME supervisory management Councils and Boards. BSc (1970), University of Strathclyde & University of Glasgow.

Luciano Castillo

Luciano Castillo is the Don-Kay-Clay Cash Distinguished Engineering Chair in Wind Energy, and the executive Director and President of the National Wind Resource Center at Texas Tech University. His research has led to new ideas in turbulent boundary layers and the understanding of initial conditions on large scale turbulence, particularly on wind energy. His awards include the NASA Faculty Fellowship, the Martin Luther King Faculty Award, and the ASME Robert T. Knapp Award. Castillo has published over 100 articles, including a seminal paper on turbulent boundary layers and scaling laws. He has also developed novel approaches for drag reduction and smart wind farms. Ph.D. (1997), SUNY, Buffalo.

Nicholas P. Cernansky

Nicholas Cernansky is known for his work in the fields of combustion chemistry and internal combustion engines. This research has contributed significantly to the fundamental understanding of internal combustion engine systems, pollution from stationary and vehicular sources, fuel and energy conservation, fuels technology and environmental sciences. It has provided significant insights into a range of topics including air quality and pollutant formation, hydrocarbon kinetics mechanisms at low and intermediate temperature, advanced combustion systems and next generation fuels. His work in this area includes critical information for developing detailed descriptions of the phenomena responsible for knock in spark-ignited engines and plasma assisted combustion. B.S. (1967). University of Pittsburgh.

Chang-Po Chao

Chang-Po (Paul) Chao has made outstanding research contributions in the area of dynamic systems and controls, and is also recognized for extensive service to his professional community. His research has resulted in fundamental results and a wide range of applications, including passive and active vibration control, biomedical sensors, and input/output display technologies. Chao has authored or coauthored over 90 journal papers on these topics, and is listed as an inventor on seven U.S. patents. He and his former students have founded three startup companies aimed at producing commercial products based on these technologies. Ph.D. (1997), Michigan State University.

Geoff Chase

Geoff Chase's research in Model-based Therapeutics integrates innovative engineering models and methods, with physiology and clinical medicine. His research aims at mitigating the impact of demographic and health trends on society's ability to pay for healthcare. It has demonstrated several novel results, the most salient of which, SPRINT, saves 60-100 lives per year in Christchurch Hospital's

ICU, and saves $500k-$1M/year—at a total cost of $150 per year. His research has provided significant health benefits, been taken up in several hospitals and companies worldwide, and demonstrated the ability of engineering to radically improve "everyday" healthcare at low, or even no, cost to society. Ph.D. (1996), Stanford University.

Jharna Chaudhuri

Jharna Chaudhuri's career spans thirty-three years. She has performed defect characterization of metallic, semiconductors and nano materials for engineering applications. These include x-ray diffraction, synchrotron x-ray topography and transmission electron microscopy analysis of aluminum-lithium alloys, GaN, AlN, etc. Chaudhuri has received research grants from NSF, ARO, FAA, Boeing and Cessna, and has published in highly reputed journals. For her outstanding research accomplishments, she received a best educator award and became a Boeing Fellow. She has supervised thirty eight M.S. and fourteen Ph. D. students. As a Chair of the department, she improved the national ranking of the graduate program by about 30, to 81st position. Ph.D. (1982), Rutgers University.

Anne Chaudouet

Anne Chaudouet has extensive experience in numerous fields of Mechanical Engineering. With it she has made efficent contributions to ASME Code developments. She has also provided important international technical liaisons for the advancement of ASME Codes, and specific technologies. Chaudouet has been and continues to be an active member of the ASME Boiler and Pressure Vessel Code committees involved in the development and application of technologies and requirements for construction materials, heat transfer equipment, fitness for service, post construction evaluations, and major Code updates, such as the incorporation of international materials. Mechanical Engineering Degree (1976), Ingénieur de l'Ecole Nationale Supérieure des Mines de Paris.

Chien-Pin Chen

Chien-Pin Chen has made significant contributions to the modeling of multi-phase flows involving particles and droplets and to the numerical methodology that underlies these models. His work has advanced the understanding of particle dispersion and the modulation effect of particles in turbulent flows. His research in atomization, droplet breakup and coalescence and multicomponent evaporating spray has advanced the state of the art in spray combustion systems. Chen has graduated 22 masters and 14 doctoral students. He received the Outstanding Engineering Professor Award from the University of Alabama in Huntsville and the University of Alabama Foundation Award for Outstanding Research. Ph.D. (1983), Michigan State University.

Jiun-Shyan Chen

Jiun-Shyan Chen has made fundamental contributions to computational mechanics through his work on meshfree methods and multiscale materials modeling. He is one of the early developers of the Reproducing Kernel Particle Method. Chen's work has increased the efficiency, accuracy, and robustness of meshfree methods, allowing them to be used commercially for industrial analysis in areas as diverse as manufacturing, crash and impact analysis, geomechanics, biomechanics, and fragmentation modeling in homeland security applications. Ph.D. (1989), Northwestern University.

Quanfang Chen

Quanfang Chen has earned an outstanding reputation in both scholarship and education, while providing exemplary service and citizenship at local, national, and international levels. He has been a significant contributor to chemical sensors, robust microvalves, miniature robust pump/actuators realized with piezoelectric motors and high speed valves, the mechanics of materials at small scales, and the synthesis and conduction of nanocomposites. Chen has received several teaching awards and he has directly instructed about 1000 undergraduates and over 200 graduate students. Ph.D. (1989), Tsinghua University.

Xi Chen

Xi Chen has made outstanding research achievements in new and interdisciplinary frontiers of applied mechanics, including novel energy conversion and harvesting mechanisms based on nanofluids, advanced nanomaterials for water purification and desalination, mechanics and morphogenesis of natural and biological systems, mechanical self-assembly of micro and nanostructures, and mechanics of nanomaterials and nanoindentation. He has earned distinctive reputations in both scholarship and education, and received numerous awards at national and international levels. Chen has published over 220 peer-reviewed journal papers (with an h-index over 33), and supervised over a dozen doctoral students. He has been a consultant to many clean energy companies. Ph.D. (2001), Harvard University.

Victor A. Chiriac

As the Senior Thermal Technologist for Qualcomm Technologies, Victor Adrian Chiriac is defining the company's overall thermal technology roadmap for developing state of the art cooling solutions at the die, electronic package and systems level product implementation. He has made industry wide contributions to the art and science of thermal management, and the cooling of electronic packages and portable consumer electronic devices, with focus on wireless technologies in smart phones and tablets. Chiriac has developed new figure of merit and industry guidelines for heat spreading over the surface of mobile electronic devices. He implemented new energy recovery solutions in small form factor products and developed novel methodologies for extracting transient thermal behavior of smart phones with reduced time implementation versus a full scale numerical approach. Ph. D. (1999), University of Arizona.

Yaroslav Chudnovsky

Yaroslav Chudnovsky has made significant contributions to the mechanical engineering profession as a technical leader and applied researcher. He has distinguished himself by leading innovative research programs based on the needs of emerging industrial markets. Most of his work has involved successful collaboration with a wide spectrum of industrial and academic partners. As a member of both Heat Transfer and Process Industries Divisions, Chudnovsky has served on several technical and executive ASME committees. He is currently an editor for the *Heat Exchanger Design Handbook, International Journal of Energy for a Clean Environment*, and *Journal of Enhanced Heat Transfer*. Ph.D. (1990), Bauman Technical University, Moscow, USSR.

Mark R. Cutkosky

Mark Cutkosky has made significant contributions in robotics and mechanical design. He is best known for his work on robotic hands and bioinspired running and climbing robots. His papers on grasping are among the most cited in the field and his robots have appeared extensively in the media (*NOVA, New York Times, National Geographic*). Cutkosky pioneered Shape Deposition Manufacturing to create prototypes with embedded electronics, reinforcing fibers, and hard and soft materials for tuned mechanical properties. He has graduated 40 Ph.D. students in leading industry and faculty positions (e.g., Harvard, MIT, U. Michigan, Stanford, CMU, Purdue). Ph.D. (1985), Carnegie-Mellon University.

Kalyanmoy Deb

Kalyanmoy Deb has made outstanding contributions in conceiving, developing and applying evolutionary multi-objective optimization methodologies for solving engineering problems since 1991. His suggested algorithms are routinely used by optimization researchers and practitioners and are adopted in major optimization software programs. He educates mechanical engineering students in the areas of design and optimization. Deb has

written two popular optimization textbooks, one of which was the first ever on EMO, and more than 365 research papers with more than 60,000 citations. He has received numerous awards and serves on the editorial boards of 20 international journals. Ph.D. (1991), University of Alabama, Tuscaloosa.

Ralph M. Drewfs

Ralph Drewfs is an esteemed expert in engineering management, with particular application to mass transit. He has overseen all aspects of the design and construction of more than $960,000,000 of light rail and street car facilities in the Portland, Oregon, vicinity on behalf of the Oregon Department of Transportation and Washington County. M.S. (1981), University of Dayton.

Prashanta Dutta

Prashanta Dutta's seminal works have contributed to the fundamental understanding of electric field driven transport in micro/nano/bio-fluidic devices. His scientific contributions include: introduction of multi-dimensional electrophoretic models to design microchips for protein sensing, separation and preconcentration; the design of field-effect transistors for precise flow control in microdevices; fabrication of microscale ion mobility sensors for explosive and environmental contaminant detection; development of analytic models for electromagnetic heating for industrial and food processing; demonstration of dielectrophoretic particle chaining and self-assembly for reconfigurable antennas. Dutta has pioneered the use of transport phenomena in multidisciplinary fields for the betterment of human health and safety. Ph.D. (2001), Texas A&M University.

Paul Edwards

Paul Edwards has been an ASME Member for 35 years and made significant contributions impacting the ASME Codes and Standards Community through conformity assessment. Edwards has been a member of the ASME Board on Conformity Assessment since 1997, serving as ASME Vice President, Conformity Assessment from 2006 to 2009. He has been a member of the Subcommittee on BPVCA since 1991, currently serving as Chair. Edwards is a member of the QAI Subcommittee on Accreditation, serving as Chair from 1996 to 2005 and a Member of the QAI Standards Committee, serving as Vice Chair. B.S. (1972), University of Massachusetts, Dartmouth.

Mohamed El-Sayed

Mohamed El-Sayed has made significant contributions to the engineering profession with over thirty years of research, teaching and professional leadership. He is responsible for over a hundred research publications, and has made several original contributions. He has also contributed to the education of thousands of engineering students through his undergraduate and graduate teachings. In recognition of his continued professional services and leadership, he was recognized by ASME for "Valued Service in Advancing the Engineering Profession" in 1994, selected as WIT Fellow in 2003, and SAE Fellow in 2011. El-Sayed is currently Editor for CEJE, topic organizer for ASME IMECE 2013, and track co-organizer for IMECE 2014. Ph.D. (1983), Wayne State University.

Roxann L. Engelstad

Roxann Engelstad is an internationally recognized expert on the mechanical issues associated with the design, fabrication, and usage of advanced masks (and processes) for the next-generation lithographic technologies. She has developed a powerful set of numerical tools that correlates nano-scale models to macro-scale models, which track the distortion of features in the lithographic process. Her research results have been applied to many different types of lithography. As Chair of Mechanical Engineering, she facilitated innovations in communication, career advising, and practical experience that have significantly improved student education. Ph.D. (1988), University of Wisconsin-Madison.

Susan Finger

Susan Finger has made major contributions in the field of engineering design education and research, starting with her appointment in 1985 as the founding Program Director at the National Science Foundation and Director for the Design Theory and Methodology Program. At Carnegie Mellon University, her numerous contributions to engineering design education have been transformational. Finger played a key role in the Engineering Design Research Center and was the founding Director of the Engineering Design Research Lab at the Institute for Complex Engineering Systems. She continues to have an impact on engineering education as an NSF Program Director in the Division of Undergraduate Education. Ph.D (1981), Massachusetts Institute of Technology.

Datta V. Gaitonde

Datta Gaitonde is a world leader in advanced computational methods and their application to turbulent flows. Over the course of 25 years, first as a researcher and team leader at the Air Force Research Laboratory, and now as John Glenn professor at Ohio State University, his research has provided insight into jet noise, shock/turbulent boundary layer interactions and flow control with advanced plasma-based techniques. Gaitonde's methods are used worldwide by industry and academia for direct and large-eddy simulations. His vision has benefitted numerous national review panels and advisory boards. Ph.D. (1989), Rutgers University.

John Gardner

John Gardner is recognized for his contributions in research and education and his service to the field of mechanical engineering. He has made high-impact contributions in the fields of mobile robotics, artificial hearts, and integrated energy systems. He has authored textbooks in the area of mechanical systems modeling and simulation and holds three US patents. Gardner has also contributed to engineering education through pioneering work in STEM education support programs and engineering course development. Gardner has also served the profession through work at all levels of university administration and in public speaking and writing aimed at the general public. Ph.D. (1987), The Ohio State University.

Michael Goldfarb

Michael Goldfarb is an international leader in the design and control of mechatronic assistive devices for the purpose of improving quality of life for people with physical disabilities. Among his technical and scholarly contributions, Goldfarb has authored more the 20 pending or awarded patents, and has published over 160 technical papers on mechatronics topics, including ones that were awarded best-paper awards in 1997, 1998, 2003, 2007, 2009, and 2013. Recent honors include the NIH NIBIB Edward Nagy Award in 2011, the Wyss Institute Translational Award in 2012, and the IEEE EMBS Outstanding Paper Award in 2013. Ph.D. (1994), Massachusetts Institute of Technology.

Saneshan S. Govender

Saneshan Govender has made outstanding achievements in scholarship, education, and at Eskom Holdings as a corporate specialist in gas turbines and thermo-flow systems. In addition, he has been appointed as honorary professor at the University of KwaZulu-Natal, Durban, South Africa. In scholarship he has published a large number of articles (some of a pioneering nature) in engineering journals. He has received awards from his university and other organizations, and has published three books on thermo-flow systems. D.Eng. (2008), University of Pretoria; Ph.D. (2000), University of Durban, Westville.

Samuel Graham

Samuel Graham is an Associate Professor and the Joseph H. Anderer Faculty Fellow in the School of Mechanical Engineering at the Georgia Institute of Technology. He is also the Associate Director of the NSF Science and Technology Center MDITR and a key member of the

High Reliability Electronics Virtual Center sponsored by the Air Force Research Laboratory. His group focuses on the packaging and thermal phenomena in wide band gap semiconductors including GaN HEMTs and LEDs. Graham also leads efforts in the packaging technology for flexible electronics and organic electronic devices. Ph.D. (1999), Georgia Institute of Technology.

Robert E. Grimes

Bobby Grimes has spent his more than 35-year career at Baker Hughes, working in all aspects of technology development for rotary drill bits for the Oil & Gas, Geothermal, and Mining industries, as evidenced by his numerous drill bit related patents and technical papers. He has visited most of the major drilling areas around the world, introducing new product lines and technologies to customers and BHI engineers. Grimes has also been active in ASME for over 25 years, currently serving as Senior VP—TEC Sector. He has mentored engineers in both industry and in ASME throughout his career. MSME (1989), University of Houston.

Maurice E. P. Gunderson

Maurice Gunderson has made contributions in industrial leadership, management, and research and development for over 39 years. He has been a driving force for many energy technology startups. He has had the roles of initial innovator and designer and, more recently, investor and steward of concepts for technologies from initial spin-out to viable business units or companies. His high level of entrepreneurship and industrial leadership are evidenced by his roles on Boards of Directors and as Engineering and Corporate Strategy Advisor in numerous significant energy related start-ups. MBA (1985), Stanford University.

Rahul Gupta

Since 2006, Rahul Gupta has been a mentor for undergraduate and graduate mechanical engineering students from universities through the Army Research Laboratory summer intern and guest researcher programs. He has also contributed much towards understanding complex mine blast modeling and simulation encompassing blast, structural, and occupant response, leading to the development of the 50th percentile mine blast human dummy. Gupta is an ARL Special Act Award recipient for developing enhanced underbody protection for U.S. Army tactical wheeled vehicles. His team's work on energy absorbing structures is important in designing safer and more survivable future military and civilian transportation systems. Ph.D. (2005), North Carolina A&T State University.

Levent Guvenc

Levent Guvenc is recognized for his significant contributions in research and development and education, in the field of mechanical engineering. He has made high-impact research contributions to automotive engineering in the areas of chassis control, hybrid electric vehicles, active safety, and cooperative mobility, as well as robust control theory and control applications to other areas including atomic force microscopy. Guvenc has been instrumental in the development of premier laboratories and programs in mechatronics and automotive engineering in Turkey, as well as course and curriculum development in these areas. Ph.D. (1992), The Ohio State University.

David W. Hahn

David Hahn has established a career of excellence in research, scholarship, and education, while providing state, national and international leadership and service. He has earned international recognition and has collaborated widely on laser-induced plasmas, with an emphasis on physical and transport processes. In his 20 years of research and education, Hahn has published journal papers, book chapters and secured U.S. patents. He is co-author of the third edition of *Heat Conduction*. In 15 years at University of Florida, he has taught more than 1,250 students, chaired 50 graduate committees, including 13 Ph.D. graduates, earned numerous awards, and currently chairs the largest academic department on campus. Ph.D. (1992), Louisiana State University

John Hainsworth

John Hainsworth has the well earned respect and admiration of his clients and associates in the power industry. His forty years of experience in steel fabrication, research, and ASME code development have resulted in safer and more efficient rules governing boiler, pressure vessel and power piping construction. After more than 35 years with Babcock and Wilcox, Hainsworth continues to influence and benefit the power industry community as a metallurgical consultant and as a member of code and standard development organizations. M.S. (1969), Sheffield Polytechnic.

Hai-Chao Han

Hai-Chao Han has made significant contributions in cardiovascular biomechanics for over two decades. He discovered residual stress in the trachea, advanced measurements of residual strain in blood vessels, and developed models to predict cardiac function improvement for patients undergoing revascularization. He established new theory and model equations for blood vessel buckling that enrich vascular biomechanics. Han has authored over 80 peer-reviewed journal papers. He has been an excellent educator and mentored numerous students, postdoctoral fellows and junior researchers. He has been an active member of ASME technical committees and the San Antonio ASME Section and advises the UTSA Student Section. Ph.D. (1991), Xi'an Jiaotong University, China.

MD Aman Haque

Aman Haque has pioneered research on in-situ quantitative tests on thin films inside transmission electron microscopes. He has advised eight Ph.D. and seven M.S. students, and has published more than 70 refereed journal articles. He received the PSEAS Outstanding Research Award in 2011 and the NSF Career Award in 2006. Haque also received the Agilent Best Student Paper Award in the ASME, Microelectromechanical Systems Division, in 2001. He received the PSEAS Outstanding Teaching Award in 2009. Haque has served as Chair, Vice Chair, and Secretary position of the ASME MEMS Division executive committee. Ph.D. (2002), University of Illinois, Urbana Champaign.

John F. Hawkins

John Hawkins has successfully served in engineering management, engineering, and sales roles in the field of flow borne noise, heat recovery, and exhaust emissions control for industrial engines and gas turbines, and heavy truck and bus exhaust systems, as well as noise control of high pressure venting of gases, for more than 40 years. Through design, innovation, streamlined processes, and application tools, he created new markets, market share, and customer acceptance of products ranging from truck and stationary mufflers, specialty catalytic converters, modular three-way and oxidation catalytic silencers, high pressure vent silencers, and heat recovery systems. Hawkins has also served in ASME leadership positions in Section, Region, Global Communities, District, and ASME level committees for more than 35 years. B.S. (1969), Louisiana Tech University.

Terry J. Hendricks

Terry Hendricks is recognized for continuing effective technical management and development of advanced energy systems. He has made innovative and foundational contributions to the engineering profession in the areas of transportation and industrial energy recovery systems, energy conversion system design, thermoelectric system design and analysis, nano-scale structures for enhanced boiling heat transfer, and thermal radiative properties of key ceramic materials for solar receiver and radiant burner designs. Hendricks' contributions and programs have led to critical advances in hybrid vehicle technology, automotive waste heat recovery systems, more comprehensive approaches to thermoelectric energy recovery design, high-performance stable microchannel boiling designs, and new volumetric solar receiver designs. Ph.D. (1993), The University of Texas, Austin.

Walter M. Hendrix

Walter Hendrix is a senior engineering manager at CommScope, responsible for wireless systems development. His areas of focus include network design and advances in thermal design. His past work experience includes development of long haul optical systems for Xtera Communications, access optical systems for Fujitsu Network Communications, and airborne active radar for Raytheon. Hendrix holds twelve U.S. patents and is a registered Professional Engineer in Texas. He has served on the leadership team of the North Texas Section of ASME, including Chair in 2009-2010. He received the ASME North Texas Engineer of the Year Award in 2010. M.S. (1985), Southern Methodist University.

Stephen Hensel

Stephen Hensel has established an outstanding record of technical accomplishment in over 23 years at the Department of Energy, Savannah River Site. His technical contributions include thermal analysis of radioactive materials packagings, design authority engineering for nuclear processing facilities, and managing analytical groups at the Savanah River National Laboratory. His work on nuclear materials packaging and storage safety has been important to the management of these materials at Department of Energy Facilities. Hensel has nine journal and twenty-nine conference publications. He has been active in the OAC Committee of the PVP Division for over seventeen years, serving as a Technical Program Representative and Technical Committee Chair. Ph.D. (1990), Texas A&M University.

Justus L. Herder

Just Herder is a professor at the Delft University of Technology and the University of Twente. His research interests include static and dynamic balancing, underactuated grasping and compliant mechanisms and their application in medical, rehabilitation and high-tech systems. His research has generated over 180 publications, 23 patents, several awards, and six start-up companies. He has served in the ASME Mechanisms and Robotics Committee and is currently the elected Executive Council member and Treasurer of IFToMM. Herder serves on boards of several scientific journals and of various international conferences. He held visiting positions at Laval University in Canada and at MIT in the U.S. Ph.D. (1998), Delft University of Technology.

Dewey H. Hodges

Dewey H. Hodges is a Professor of Aerospace Engineering at the Georgia Institute of Technology and an internationally recognized authority in the areas of dynamics, structural dynamics, structural mechanics, computational mechanics, and aeroelasticity. He has made fundamental contributions in the areas of nonlinear deformation of rotor blades; flexible multi-body dynamics; finite element schemes for aeroelastic stability; plate and shell dynamics and asymptotically exact theories for anisotropic structures. Hodges has authored four books and numerous refereed journal papers. He has advised 35 Ph.D. graduates and 35 M.S. graduates. Ph.D. (1973), Stanford University.

Haoran Hu

Haoran Hu has made contributions to the development of powertrains for commercial vehicles, specifically, in chemical kinetic modeling, the invention and development of the lost motion variable valve actuation engine retarding mechanism, and the development of the first high pressure common rail fuel injection engine for on-highway heavy duty diesel engines. He also invented and developed an advanced non-urea aftertreatment system for heavy diesel engine emissions reductions. Hu is also recognized for his leadership for commercialization of advanced hybrid powertrains for the Asia Pacific market. Sc.D. (1987), Massachusetts Institute of Technology.

George P. G. Huang

George P. G. Huang is a leader in turbulence modeling and validation. He has more than 27 years of experience in computational methods and their application to turbulent flows. His work on turbulence model validation has led to the creation of the turbulence model resources website. Huang helped NASA to develop a number of CFD codes including OVERFLOW. With support from NASA, he also worked on turbulence modeling for hypersonic flows and low pressure turbine transition models. In the past five years, he was supported by the Air Force to establish the Ohio Center of Excellence for Micro Air Vehicles Studies, where he and his teammates developed a number of flapping wing air vehicles. His work was cited by *WIRED* magazine. Ph.D. (1986), University of Manchester Institute of Science and Technology, England.

Hanchen Huang

Hanchen Huang is well-known for his contributions to nanomechanics and nanofabrication. He and his research team discovered two key physical mechanisms that dominate the mechanical stiffening of nanomaterials. The discovery expanded knowledge of the behavior of nanomaterials in physics and material science. Huang also developed a theoretical framework of nanorod growth which enabled the fabrication of the smallest well-separated metallic nanorods known today. The research resulted in a novel, patented, metallic sealing technology that can be done in an ambient environment. Ph.D. (1995), University of California, Los Angeles.

Rui Huang

Rui Huang is recognized for his research and creative use of mechanics to understand the instability of materials and structures at micro and nano scales. Ph.D. (2001), Princeton University

Laurence J. Jacobs

Laurence Jacobs' research focuses on the development of quantitative methodologies for the nondestructive evaluation, monitoring, and life prediction of structural materials. He applies advanced measurement techniques and signal processing for the quantitative characterization of material states. This includes the application of nonlinear ultrasound for the characterization of fatigue, creep, stress-corrosion, thermal embrittlement and radiation damage in metals. His work in cement-based materials includes the application of linear and nonlinear ultrasonic techniques to quantify microstructure and progressive microcracking in concrete. As Associate Dean, Jacobs is responsible for the academic programs at the largest College of Engineering in the U.S. Ph.D. (1987), Columbia University.

Ratneshwar Jha

Ratneshwar Jha has an outstanding record as a scholar, educator, and practicing engineer through his contributions of more than 25 years. He has been recognized for his research in smart structures and structural health monitoring and his leadership roles in the AIAA and ASME professional societies. Jha has taught over 700 students, published over 100 archival journal and conference proceedings papers, advised 28 graduate students, and received awards for research and teaching excellence. He led a team of engineers for 10 years working on design and development of combat aircraft. Ph.D. (1999), Arizona State University.

Ramdev Kanapady

Ramdev Kanapady leads a high technology consulting firm providing multiphysics modeling, simulation solutions to industries in the U.S. He's an accomplished engineer with over 20 years in design, research, analysis, and technology development with a professional career that spans academics and industry. Starting as affiliate graduate faculty, he transitioned into industry first as principal investigator, then as consultant, and finally as founder of MSCWorks, in 2008. He is actively involved in ASME's Santa Clara Valley Section as a volunteer, Treasurer and Chair. As a Chair, he elevated SCVS to one of the top ranking sections in the country. Ph.D. (2001), University of Minnesota.

Thomas W. Kenny

Thomas W. Kenny is a Professor of Mechanical Engineering at Stanford University. He is widely recognized for his research in Micro-

ElectroMechanical Devices and Systems. Kenny's research leverages analytical and experimental studies of silicon MEMS devices with fundamental results related to atto-newton forces, van der Waals adhesion of geckos, and the observation of fatigue-free behavior in smoothed crystalline beams. His applied results include development of liquid cooling systems, and MEMS-based resonators for electronics timing. His recent work has focused on the development of wafer-scale MEMS encapsulation processes that enable enhanced device performance as well as manufacturability at low cost. Ph.D. (1989), University of California, Berkeley.

T. Kesavadas

T. Kesavadas has had a long and distinguished career in the Department of Mechanical and Aerospace Engineering at SUNY Buffalo. He has authored more than 125 papers in the areas of Robotics and Automation, Virtual Reality, Medical Simulation, and Haptics. He is also the co-founder of Simulated Surgical Systems, developer of the first stand-alone surgery simulator for the da Vinci surgical robot. His ASME activities include serving as Chair of the Material Handling Division and the Futures Team, founded by the Board of Governors. Kesavadas also served as a Leadership Development Intern from 1997 to 1998. Ph.D. (1995), The Pennsylvania State University.

Ali M. Khounsary

Ali Khounsary, a scientist and engineer from Argonne National Lab, is recognized for his contributions to thermal engineering and X-ray optics development. These include design, analysis, fabrication, testing, installation and evaluation of major scientific instruments and components. His international leadership extends to organizing/chairing over one hundred conferences, workshops, and sessions of interdisciplinary challenges in design, development, and operation of the nation's largest X-ray facility. Khounsary is a SPIE Fellow, Adjunct Professor of Mechanical Engineering at UIC and of Physics at IIT. He is associate editor of ASME's *Journal of Heat Transfer* and holder of several U.S. patents with over 150 publications and reports. Ph.D. (1987), University of Illinois.

Minjun Kim

MinJun Kim has served as Program Chair/Co-Chair for three ASME conferences, Conference Session Chair/Co-Chair for four ASME conferences, and a Technical and Program Committee Member for five years on ASME Micro Nano Fluidic Dynamics. He has also developed the Fundamentals of NanoManufacturing and Applications, and the Fundamentals of Nano Metrology and Best Practices for ASME's Online Nano Educational Series. Academically, Kim has received the NSF CAREER award, the Human Frontier Science Program Young Investigator Award, the ARO Young Investigator Award, an Alexander von Humboldt Fellowship for Experienced Researcher, a Brain Pool Fellowship, a Stein Fellowship, the Drexel University Faculty Career Development Award, and a Bionic Engineering Outstanding Contribution Award. Ph.D. (2005), Brown University.

Carlos E. Koeneke

Carlos Koeneke is well known in the energy and power Sector for his expertise in the field of gas turbine technologies, rotor dynamic analysis and vibration troubleshooting. His in-depth knowledge on vibrations helped to eliminate severe vibration problems in natural gas compression systems for offshore applications that had caused recurring outages with millions of dollars in production losses. After completing his Ph.D., which focused on rotor dynamics of high speed rotating machines, he joined MHI and diagnosed challenging vibration issues which have been referred to in several publications. Koeneke has actively participated in the ASME/IGTI, PowerGen International, PowerGen Europe and Electric Power committee. Ph.D. (1993), Tokyo University.

George B. Komora

George Komora has served the ASME Boiler & Pressure Vessel Committee with passion for over 22 years. His experience includes over 24 years of extensive design and manufacturing experience with boilers, heat exchangers, HRSG's, piping, pressure vessels, storage tanks, and associated equipment. Komora's design and analysis experience includes experimental stress analysis, fatigue analysis, finite element analysis, structural analysis, fitness for service, and engineering software development. His work in pressure vessel codes and standards includes ASME Sections I, II, III, V, VIII, IX and XI, API, ANSI, AD Merkblatter, AS1210, PD-5500, CODAP, EN 12952, EN 13445, and the European PED. M.S. (1975), Southern Illinois University.

Gül Kremer

Gül Kremer's research in engineering design and education has had a profound impact on a generation of students and practitioners all over the world. At The Pennsylvania State University she puts this research into practice, implementing techniques to improve student design team experiences and bringing research on engineering design to the classroom. Kremer has co-authored 3 books on engineering design and published numerous research papers. A leader in the ASME Design Engineering Division, she is serving as a program director in the Division of Undergraduate Education at the National Science Foundation, defining the future direction of engineering education research. Ph.D. (1997), University of Missouri-Rolla.

Miroslav Krstic

Miroslav Krstic is recognized for his pioneering contributions to PDE control and delay systems, nonlinear and adaptive control, extremum seeking, and applications to fluid flows and autonomous vehicles. Ph.D. (1994), University of California, Santa Barbara.

Waruna D. Kulatilaka

Waruna Kulatilaka has earned an outstanding reputation in fundamental and applied research and development through personal contributions as well as various leadership positions over the past decade. His primary scientific and technical contributions include development and application of advanced laser-based optical diagnostics for fundamental combustion studies, aerospace propulsion and transportation applications, as well as plasma-flow systems. These diagnostic methods are becoming key enabling tools for designing clean and efficient next generation power systems. In addition, Kulatilaka has an outstanding track record of community service for the mechanical engineering profession with numerous leadership roles at ASME and other engineering/scientific organizations. Ph.D. (2006), Purdue University.

Foluso Ladeinde

Foluso Ladeinde, Professor of Mechanical Engineering at the State University of New York at Stony Brook, is known for exceptional work and sustained dedication to the use of advanced mathematics and modern computational techniques for the analysis of high-speed reacting and non-reacting flows. His pioneering work on supersonic combustion has won awards and his ability to communicate highly-advanced mathematical and engineering analysis concepts to others, in simple, ordinary language, enabled him to launch a highly-successful technology company with over twenty sensitive U.S. Department of Defense contracts.Ph.D. (1988), Cornell University.

Ming-Chia Lai

Ming-Chia Lai has significant achievements and contributions in engineering education and research. His outstanding research and effective teaching have been acknowledged by the many awards he has received and by many national and international competitions won by his students. Lai is active in the ICE, IGTI, Fluid Engineering, Fuel Cell, and Heat Transfer Divisions of ASME, and is a leading authority in the research on combustion engines, particularly fluid sprays and their applications, using advanced optically based diagnostic techniques and computational simulations. This is demonstrated by more than 300 refereed papers he published, including 40 at ASME. Ph.D. (1985), The Pennsylvania State University.

Robert G. Landers

Robert Landers has made many contributions to the mechanical engineering community in terms of research, education, and professional service. He advanced the field of dynamic modeling and control of manufacturing processes, specifically machining, laser metal deposition, freeze–form extrusion fabrication of ceramic pastes, friction stir welding, and wire saw cutting. His educational contributions include the development of three internet–accessible courses, two undergraduate emphasis areas, and three certificate programs. Landers' professional service includes serving as an associate editor for three journals, chairing two technical committees, serving on several conference program committees, and serving as a conference program co–chair. Ph.D. (1997), University of Michigan.

Chad M. Landis

Chad M. Landis is recognzied for his pioneering contributions to the development of analytical and computational methods to understand the behavior of ferroelectrics. Ph.D. (1999), University of California at Santa Barbara.

Philip Leduc

Philip Leduc is recognized for his outstanding contributions to the development and application of cell and molecular biomechanics through original research and innovative methods. Leduc is also known for his mechanical engineering education through interdisciplinary educational efforts and the development of culinary mechanics. He has contributed to the engineering profession through significant leadership roles in professional societies. Ph.D. (1998), the Johns Hopkins University.

Kunwoo Lee

For over 25 years, Kunwoo Lee has made pioneering contributions in the area of assembly CAD algorithms, multi-resolution of parts in assemblies, and human-centered CAD for simulating both the user and the artifact. He has published more than 150 papers in top journals and received numerous Best Paper awards. He served as Associate Editor of ASME Transactions, JCISE, and is the Chief Editor of CAD. He is the current president of the Korean Society of Mechanical Engineers, a member of the Korean National Academy of Engineering, and founder of the Korean CAD/CAM Society. Lee is Professor of Mechanical Engineering at Seoul National University. Ph.D. (1994), Massachusetts Institute of Technology.

Robert A. Leishear

Robert Leishear has served as lead engineer or principal investigator on projects that resulted in more than 48 million dollars in cost savings for the Savannah River Site, which is a nuclear facility in South Carolina. To complete these successes, he invented new theories and published his research in a book for ASME Press, several magazine articles, and forty–four conference and journal papers. These publications include the ASME *Mechanical Engineering* magazine, the *Mensa World Journal*, ASME journals, and many conferences. Leishear's research includes fluid mechanics, mass transfer, structural dynamics, fluid dynamics, machinery dynamics, piping design, pumps, and failure analysis. Ph.D. (2005), University of South Carolina.

Brian W. Leitch

Brian Leitch has made significant contributions to research and development in the Canadian nuclear industry. He has contributed to the understanding of delayed hydride cracking and creep of Zr-Nb pressure tubes. His research has contributed to the fitness-for-service guidelines of pressurized heavy water reactors. Leitch has also researched the consequences of pressure tube bursts, and his experimental data has been used to validate computer codes used for licensing power reactors. Leitch has also advanced the use of finite element modeling for nuclear-related applications. M.S. (1978), University of Strathclyde, Glasgow, Scotland.

Milton K. Leonard

Milton Kay Leonard has practiced Mechanical Engineering in the areas of Design, Manufacturing, and Management over the past fifty years. He has served as the Chief Engineer for several large companies covering a broad range of product areas. He is an expert in medium to large pump design and manufacturing for applications from process industries to hazardous/flammable material installations, including hydraulic and vacuum pumping systems. Leonard has worked in the design of large commercial HVAC systems for high-rise buildings, in the mechanical design of missile service equipment, and the improvement of equipment used in the pulp industry for manufacturing paper. He holds three patents. B.S. (1954), Washington State University.

Thomas W. Lester

Thomas Lester has been active in leadership and has developed an outstanding reputation in the areas of advanced education fundamental research and services, both nationally and internationally. He has contributed personally and directly to fundamental research in the field of combustion; to engineering management and to technical committees of professional and scientific societies; and as a consultant to industry. Lester has been associated with colleges of engineering of three State Universities, and for the last two decades as Dean, where he significantly increased both undergraduate and graduate student enrollment with improved student quality, increased research programs, and remarkable improvement in education and research facilities. Ph.D. (1974), Purdue University.

Xiaodong Li

Xiaodong Li is an internationally recognized pioneer in the development of novel experimental methodologies in mechanics with a focus on nano/biomaterials. His experimental techniques are well recognized by semiconductor and automotive researchers. He is a pioneer in the area of green manufacturing of composites and flexible energy storage systems with cotton textiles. Li has an outstanding record in engineering curriculum development and is an excellent instructor and mentor. He has served ASME by organizing symposia, serving on committees, presenting invited papers, and serving as Associate Editor for ASME, *Applied Mechanics Reviews*. Ph.D. (1993), Harbin Institute of Technology, China.

Ching-Long Lin

Chin-Long Lin is recognized internationally for his outstanding contributions in the areas of computational fluid dynamics, multi-scale algorithms, and human lung modeling. Lin received the NSF CAREER award, has given several keynote/invited lectures, is an invited chapter author of *Comprehensive Physiology*, the landmark series Handbook of Physiology, is the lead Guest Editor of the special issue of the *Journal of Computational Physics* on multi-scale modeling and simulation of biological systems, and is a Fellow of the American Institute for Medical and Biological Engineering. Lin has also made significant contributions in teaching and has provided service and leadership to the multi-scale modeling and computational engineering communities. Ph.D. (1994), Stanford University.

Yuyi Lin

Yuyi Lin has been a member of ASME since 1988. He received his Ph.D from U.C. Berkeley in 1989, and has been teaching at the University of Missouri since 1990. He is a registered Professional Engineer, serving actively in ASME, SME, ASEE, SAE, and the Chinese Society of Mechanical Engineers, as chapter chair, technical committee member, and journal editor. Lin is a leading expert in helical spring dynamics research. He is an inventor and practicing engineer, has designed unique machines in hydraulic press, pressure vessel, and metal-ceramic materials. Ph.D. (1989), University of California, Berkeley.

Cliff J. Lissenden

Cliff Lissenden, an expert on the mechanics of materials, has contributed new insights into the hardening behavior of high tem-

perature alloys and composites, an algorithm implemented in NASA's Micromechanical Analysis of Composites software, and solutions to the challenging ultrasonics problem of the generation of higher harmonic guided wave modes in a hollow cylinder. As founder of the Ben Franklin Center of Excellence in Structural Health Monitoring, his research is leading to reduced life cycle costs and earlier predictions of service lives. Lissenden served as recording secretary for the AMD and on the 2010 Technical Program Committee of the 16th U.S. National Congress of Theoretical and Applied Mechanics. Ph.D. (1993), University of Virginia.

Erdogan Madenci

Erdogan Madenci has been a faculty member of aerospace and mechanical engineering at the University of Arizona. Prior to his academic appointment, he worked in the aerospace industry for many years. He has authored more than 300 technical articles on structural dynamics, fracture mechanics, failure analysis, finite and boundary element methods, plates and shells, buckling/post-buckling of aerospace structures, and peridynamic theory. Madenci is the lead author of three books: *Peridynamic Theory and its Applications, The Finite Element Method and Applications in Engineering Using ANSYS,* and *Fatigue Life Prediction of Solder Joints in Electronic Packages with ANSYS.* Ph.D. (1987), University of California, Los Angeles.

Pedro Mago

Pedro Mago, TVA Professor of Mechanical Engineering at Mississippi State University, has earned a reputation as an outstanding educator and researcher. He was inducted into the Bagley College of Engineering Academy of Distinguished Teachers for his outstanding teaching career at MSU. He has made significant contributions to the field of energy, especially in combined heat and power and waste heat recovery technologies. Mago has published over 130 journal articles, conference papers, and book chapters. He was recognized as the BCoE 2013 Outstanding Faculty Researcher for all his accomplishments. Ph.D. (2003), University of Florida.

Harry F. Martin

Harry Martin has a Bachelor and Master of Science Degree in Mechanical Engineering. His experience includes design, product and technology development, and the operation of steam turbines. His published papers have included the subjects of turbine design, blading development and operation of steam turbines, including transient analysis. Martin has 10 patents. His technical specialization is in thermodynamics, fluid mechanics, and heat transfer. He is past Chairman of the Turbines, Generators and Auxiliaries Committee of the Power Division of the American Society of Mechanical Engineers. Martin authored the chapter on steam turbines for power generation, published in the *Energy and Power Generation Handbook*, ASME Press 2011. MSME (1966), Drexel University.

David F. Merrion

David Merrion has been involved with diesel engine engineering for 60 years and has distinguished himself as an engine designer, exhaust emissions expert, engineering manager, company executive, emission compliance auditor, consultant, and member of the board of directors. His accomplishments include designing five new diesel engines, discovering the cause of hydrocarbons and odor in diesel exhaust, leading the engineering department of a major diesel engine and transmission manufacturer, being a member of the team to purchase several companies after taking a company public, serving as compliance auditor reporting to EPA, and consultant to several companies and the National Academy of Science. MSME (1959), Massachusetts Institute of Technology.

Masaki Morishita

Masaki Morishita has 23 years of experience in structural design related research and development activities, with a focus on elevated temperature design and seismic issues of fast reactors. As a unit manager, he is currently responsible for R&D covering structural design and integrity, seismic issues, thermal-hydraulics and safety study for next generation sodium fast reactors. Morishita is a member of the BPV III Standards Committee and Chair of the Subgroup High Temperature Reactors, which is responsible for the development and maintenance of Division 5 of the Section III Code. He has also been deeply involved in developing of an elevated temperature design code for fast reactors as part of the JSME nuclear codes and standards. Ph.D. (1982), University of Tokyo.

Vivek Mukhopadhyay

Vivek Mukhopadhyay has 40 years of research and teaching experience in the areas of aerospace design, optimal control, aeroelasticity, and structural dynamics. He has published numerous technical papers in archival journals, NASA and AIAA publications. Mukhopadhyay has made key contributions to the following NASA Langley projects: Aeroelastic Research Wing; Active Flexible Wing; Flutter Suppression; Load Alleviation; Controller Performance Evaluation; Benchmark Active Control Technology; Hybrid Wing Body Vehicle Design; Aeronautical Systems Analysis, Design & Optimization; Truss Braced Wing Research; Advanced Composite; and the Environmentally Responsible Aviation Research Program. Mukhopadhyay is an AIAA Associate Fellow. Sc.D. (1972), Massachusetts Institute of Technology

Thomas J. Muldoon

Thomas Muldoon is recognized for his work in the thermal development of a feedwater heater desuperheating zone utilizing a No-Tube-In-Window baffle configuration. The development process included critical vibration analysis to address overload flow conditions and row by row thermal heat transfer evaluation. Muldoon presented supporting criteria in Code Case 2470 (BC04-490) which has been accepted and included in the ASME Codes Section VIII, Division 1 for the process for explosive tube to tubesheet welded joints. This process included specific procedure and process criteria including proof that the joint was as good as a similar TIG welded joint. MBA (1981), University of Wisconsin, Oshkosh.

Andrew P. Murray

Andrew Murray has made fundamental contributions in several areas of mechanism synthesis. Notable among these is his recent work on designing shape-changing mechanisms with applications in variable geometry extrusion dies and morphing airfoils. Murray teaches innovative design-based courses and has been recognized on multiple occasions for his excellence in teaching. He has served his community as Program Chair of the ASME Mechanisms and Robotics Conference, General Program Chair of the ASME International Design Engineering Technical Conferences and as Associate Editor for the ASME *Journal of Mechanisms and Robotics*. Ph.D. (1996), University of California, Irvine.

Nirm V. Nirmalan

Nirm Nirmalan has extensive experience in prototype testing on gas turbines, conducting experimental research, and development with emphasis in the area of gas turbine pyrometry and advanced turbine cooling. Nirmalan's experience includes program managing and execution, writing and presenting proposals and reports, designing engine tests and experimental rigs, modeling cooling techniques, writing data acquisition software, and acquiring and analyzing data. Applications for his research and development undertakings include optical temperature measurements, film cooling, liquid cooling of rotating and stationary airfoils, and thermal non-destructive evaluation. Ph.D. (1986), Iowa State University.

Marcia K. O'Malley

Marcia O'Malley has made significant contributions in the dynamics and control of mechanical systems, particularly those de-

signed to physically interact with humans. She has distinguished herself through high-impact research, education and service contributions. These include the design and clinical implementation of robotic exoskeletons for upper limb rehabilitation after neurological injury, the use of haptic feedback to enhance skill acquisition, training, and interaction in virtual environments, and the use of interactive haptic devices for education at the undergraduate level. O'Malley has also distinguished herself through service to the engineering profession through her activities in ASME. Ph.D. (2001), Vanderbilt University.

Kevin N. Otto

Kevin Otto is an outstanding engineer, an excellent researcher, and a noted educator. As an engineering consultant he has solved problems for companies in areas ranging from product development process improvement to energy management. As a design researcher, he has made important contributions in the areas of quality improvement, robust design methods, product portfolio definition, interpretation of customer needs, and the design of energy efficient buildings. Otto has received the Joseph Keenan Award and the Ralph Teetor Award, both for innovations in teaching. His range of accomplishments reflects both his versatility and his extraordinary engineering skills. Ph.D. (1992), The California Institute of Technology.

Brad E. Paden

Brad Paden is recognized for theoretical contributions in control, including nonsmooth stability theory, inversion of nonlinear systems, and control of robot manipulators. He has also led major design projects including the mechatronic design of left-ventricular assist devices (a form of artificial heart). He has over 120 technical publications and 17 patents. Paden has been awarded the ASME DSCD Kalman Best Paper Award, the ASME DSCD Draper Innovative Practice Award, and the IEEE Control Systems Society Technology Award. He is also an IEEE Fellow and AIMBE Fellow. Ph.D. (1985), University of California, Berkeley.

Robert I. Parry

Robert Parry has made outstanding and sustained contributions to ASME O&M Codes and Standards for over 20 years. He led the development of a ASME O&M Code process that allows flexibility in achieving check valve performance improvement through optimization of testing and maintenance activities. This breakthrough process, Condition Monitoring of Check Valves, is currently employed by more than 20 nuclear power plants worldwide. NRC and the industry regard Seabrook Station, where Parry is responsible for all the ASME in-service test programs, as the model in the nuclear industry. Parry has also been a leader in the nuclear industry. BS (1972), Worcester Polytechnic Institute.

Assimina A. Pelegri

Assimina Pelegri is professor and executive officer of the department of mechanical and aerospace engineering at Rutgers University and the director of the advanced materials and structures laboratories. In her academic career of the last fifteen years, she has made significant contributions to the areas of composites failure evolution, soft tissue behavior, nano-indentation, thin film characterization and bio-mechanics. Pelegri has organized numerous ASME symposia, has served as chair of the ASME AMD composites committee, JEMT and AIAA journal associate editor, technical program chair of ASME IMECE 2012 and 2013, and general program chair for IMECE 2014. Ph.D. (1997), Georgia Institute of Technology.

Yoav Peles

Yoav Peles is a leader in convective heat transfer in micro domains including single-phase flow, flow boiling, instability, and enhancement techniques. He has pioneered quantification of flow instabilities in microchannels through his extensive experimental and analytical modeling work, resulting in a number of publications and a book entitled *Contemporary Perspectives on Flow Boiling Instabilities in Microchannels*. Peles has organized several International Conferences and workshops. He chaired the ASME 11th ICNMM conference and recently chaired, together with professor Evelyn Wang, an NSF/ONR/DARPA sponsored International Workshop on Nano and Microstructures for Phase Change. He received the ONR Young Investigator Award and the DARPA/MTO Young Faculty Award. D.Sc. (1999), Technion—Israel Institute of Technology.

Pedro Ponte Castaneda

Pedro Ponte Castañeda is an accomplished mechanical engineer and scholar. His research, teaching, and service to the applied mechanics and mechanics of materials communities have greatly advanced the theory and use of composite materials in a wide range of technologies. The technique he established for estimating the effective properties of nonlinear materials based upon a linear comparison material is a highly-cited hallmark. Ponte has over 150 publications and has received many honors. He has taught countless numbers of mechanical engineers over 25-plus years and has supervised over 20 Ph.D. students and post-doctoral fellows. Ph.D. (1986), Harvard University.

Siddiq M. Qidwai

Siddiq Qidwai has a diverse portfolio of accomplishments in the field of smart material behavior, multifunctional composite design, microstructure-sensitive modeling of materials, and biomechanics of injury. His research focuses on multiphysics phenomena with emphasis on the use of computational mechanics and materials science techniques guided by experimental knowledge to understand the driving mechanisms of performance in complex materials systems. Qidwai has also provided sustained and energetic service to the mechanical engineering profession through leadership in ASME as Chair of the 2000-plus member Washington D.C., Section, member of various technical committees, symposium organizer, reviewer and monograph editor. Ph.D. (1999), Texas A&M University.

Jinhao Qiu

Jinhao Qiu has earned outstanding reputations in research of smart structures, including vibration and noise control, structural health monitoring, novel piezoelectric actuators and adaptive structures, while conducting university education at both undergraduate and graduate levels. Qiu began his research in smart structures in the early 1990s and has now published more than 260 journal papers. He has also received several research awards. He was promoted to full professor at Tohoku University in 2004. He moved to the Nanjing University of Aeronautics and Astronautics in 2007, where he continues his research. Ph.D. (1996), Tohoku University.

Dhanireddy R. Reddy

Dhanireddy Reddy, chief of the aeropropulsion division at NASA Glenn Research Center, has earned his outstanding reputation in research and development through personal contributions as well as serving in various leadership positions during his career. His focus has been in technology advancement in aerospace propulsion, including air-breathing propulsion as well as auxiliary and primary spacecraft propulsion for near-Earth and deep space missions. As a researcher, he has significantly advanced the state of computational fluid dynamics technology to enhance the understanding of key flow physics in advanced aerospace propulsion systems. In his 25 years of holding leadership positions, he has provided vision and motivation to the research groups he has led. Ph.D. (1983), University of Cincinnati.

Earl David Reedy

E. David Reedy, Jr. is known for developing techniques to predict the fracture of laminated, bonded, and coated materials. The hallmark of his work is the coupling of rigorous analysis with carefully planned experiments. He is best known for his development of a technique to predict failure at bi-material corners. He is the author of thirteen journal articles and one book chapter on various aspects on this topic. He has also made significant contributions that furthered the understanding of composite material failure, adhesive contact of coated materials, the strength of micromachined silicon, and the separation of patterned interfaces. Ph.D. (1977), Harvard University.

ASME 2014 FELLOWS

Christopher B. Rogers

Chris Rogers is an award winning teacher and research mentor with accomplishments in many disciplines. He has developed unique metrology techniques with Intel, worked with Steinway on piano analysis, studied aircraft noise with McDonnell Douglas (now Boeing), developed teaching tools with LEGO Education, developed software with National Instruments, and measured the burning of furniture in New Zealand. The Tufts Center for Engineering Education Outreach, which he co-founded and co-directs, is recognized internationally for its work on identification and understanding of learning and the development of tools that leverage that knowledge. Rogers has run workshops throughout the world on hands-on learning techniques. Above all, he loves to teach students ranging from grade school through post-docs. And has successfully flown over 700 parabolas on NASA's 0-g aircraft without getting sick. Ph.D. (1989), Stanford University

Paul D. Ronney

Paul Ronney is a professor in the department of aerospace and mechanical engineering at USC. His research interests include microscale combustion, flame ignition, turbulent combustion, edge flames, internal combustion engines, microgravity combustion, fire spread and biophysics of bacteria He's had experiments flown on three Space Shuttle missions and was a Payload Specialist Astronaut (Alternate) for two. Ronney received the National Science Foundation Presidential Young Investigator Award, a Best Paper Award from the *Journal of Automobile Engineering,* and the Bernard Lewis Lectureship Award of the Combustion Institute. Sc.D. (1983), Massachusetts Institute of Technology.

Virginia W. Ross

Virginia Ross has had a long and outstanding career as a mechanical and computer engineer and project manager. Her achievements in the field of project management include work on DARPA and Air Force programs dealing with cloud computing and computer facility management at the Air Force Research Laboratory in Rome, NY. Ross has chaired and co-chaired conference sessions on computer architecture, served on the ASME nominating committee, and is District A History and Heritage Chair. Through her involvement with ASME, she has been a role model for what can be accomplished through volunteering. Ph.D. (2010), Capella University.

Akshai K. Runchal

Akshai Runchal is an internationally recognized scholar, researcher, educator and entrepreneur. During his 45-year career, he has taught and conducted research at premier institutions including IIT Kanpur, Imperial College, London, UCLA, and Cal Tech, Pasadena. He has published over 200 technical papers and research reports and has consulted with over 200 clients in 22 countries. Runchal is a founder of the ACRI group of companies in the U.S., France, and India, and has set up the CFD Virtual Reality Institute to bring CFD tools and training to practicing engineers. Ph.D. (1969), Imperial College, London.

Kazuhiro Saitou

Kazuhiro Saitou is an expert in design optimization. His work on assembly synthesis advanced the practical application of structural optimization by incorporating design for manufacturing and assembly criteria in a rigorous optimization framework. He has co-authored more than 150 technical papers, which have been widely cited. Saitou served as the faculty adviser for the University of Michigan Solar Car team, which won two National Championships during his tenure. He provided outstanding leadership in the ASME Design Engineering Division by serving as conference chairs, technical committee chairs, and a journal associate editor. His services to other professional societies are equally impressive. Ph.D. (1996), Massachusetts Institute of Technology.

John Saylor

The career of John R. Saylor has included positions in industry, government, and academia. He is a professor of mechanical engineering at Clemson University where his research focuses on problems in interfacial hydrodynamics and transport. He has authored seminal papers on the role of surfactant monolayers in interfacial transport. He has also worked on the use of microfluidics for biomedical applications such as drop generation for the treatment of asthma, and miniaturized flow cytometry. Saylor was an NRC Postdoctoral Fellow at the Naval Research Laboratory where he later joined the scientific staff. His current work focuses on the use of ultrasonics to improve the scavenging capability of water sprays. Ph.D. (1993), Yale University.

Douglas A. Scarth

Douglas Scarth is an outstanding engineer involved in structural integrity evaluation of nuclear components. He is well known in ASME Codes and Standards as an active member of the Section XI Standards Committee as well as chair and member of a number of Working Groups. He is also involved in the ASME Pressure Vessel and Piping division as a member of the executive committee and chair of the Honors and Awards Committee. Scarth has served as Associate Editor of the ASME *Journal of Pressure Vessel Technology*. He has received numerous awards and has published over 60 technical papers. Ph.D. (2002), University of Manchester.

Dennis J. Schumerth

Dennis Schumerth has more than 45 years of technical and managerial service accomplishments within the electric power generation business and is currently considered by many to be the industry authority regarding titanium tubed main steam surface condensers. He is an acknowledged industry spokesperson and author of many published technical papers for ASME, EPRI, Power, Energy Tech Magazine and the Heat Exchange Institute. Schumerth has organized, chaired and served on numerous ASME and EPRI Technical Panels and Short Courses related to condenser experiences. He is a past or continuing member of professional societies including NACE, ASTM, HEI, ITA, SAE and is former Secretary and active member of the ASME Power Division Heat Exchangers Committee. Electrical Engineering Technology (1968), Milwaukee Institute of Technology.

Paul Shang

Paul Shang is recognized for his leadership and management of technology development programs that achieve and maintain stealth performance of naval platforms. Of particular note are the contributions he has provided to the design of current and future naval vessels. His technical and organizational leadership has been critical in addressing the challenges of providing both ship designs and on-board systems that achieve superior stealth performance and can be built and maintained affordably. All of these achievements are a testament to his skills as an engineer, program manager, and leader of a large and diverse organization. Ph.D. (1984), Rutgers University.

Kristina A. Shea

Kristina Shea has made original contributions to new computational design models, methods and tools that enable the design of more innovative and complex engineered systems and products as well as automate the design and fabrication processes. Her main contributions are in the areas of computational design synthesis and optimization, digital design-to-fabrication and model-based design. She has successfully applied her research internationally in the domains of transportation, mechatronics, consumer products and buildings. Shea has also made significant contributions to education in engineering design and computing at four top universities in Europe, and actively supports young women academics in engineering. Ph.D. (1997), Carnegie Mellon University.

Chiang Shih

Chiang Shih has made significant contributions in education and research and development in the FAMU-FSU College of Engineering during its formation years. He participated in curriculum development, research advancement, and service to the community. He served as the Chair for the department of mechanical engineering between 2002 and 2011, overseeing unprecedented growth of its educational program as well as the establishment of several research centers, including the Aeropropulsion, Mechatronics and Energy Center which he currently serves as Director. Shih has received teaching and advising awards. He is dedicated to engineering education with a focus on holistic professional preparation for engineering graduates. Ph.D. (1988), University of Southern California.

Hossein Shodja

Hossein Shodja is recognized for his work on various problems in the field of theoretical and applied mechanics, particularly, nano and micro-scale modeling of defects in ultra-small objects and thin films via atomistic approaches, augmented continuum theories, and micromechanical considerations. He's worked on capturing surface and size effects, and ab initio calculations of the characteristic lengths of the crystalline materials in first and second strain gradient elasticity. Shodja employed the combined analytical and first principles calculations based on density functional theory to study the mechanical behavior of carbon nanotubes. He determined the surface energy, surface stress, and surface elastic constants of ideal and reconstructed surfaces via combined first principles and analytical treatments. Ph.D. (1990), Northwestern University.

Rifat Sipahi

Rifat Sipahi is a productive researcher, highly committed to quality teaching, and a visible leader within the mechanical engineering profession as well as in the ASME community. His expertise in control systems and in time delay systems is nationally and internationally recognized. Sipahi is also dedicated to professional service as evidenced by his many roles taken in many capacities within ASME, IEEE, and IFAC communities. His quality of teaching and his scholarly work have been recognized with two awards from the College of Engineering at Northeastern University. He was also one of the recipients of the 2011 DARPA Young Faculty Award. Ph.D. (2005) University of Connecticut. (Photo: Courtesy of Mary Knox Merrill/ Northeastern University).

Bo Song

Bo Song has over twenty years of experience working on turbomachinery and gas turbines, with varying roles including lecturer, researcher, engineer, and entrepreneur. His extensive professional efforts have significantly contributed to academia and industry, promoting advanced technology for turbomachinery and gas turbines. As an entrepreneur, he led his team to produce a new broad centrifugal product line. This included development, manufacturing, testing, and marketing. He has 28 publications, 16 patents, and numerous honors and awards, including AIAA Associate Fellow, AIAA Outstanding Paper Award, ASME Journal Top 10 Most Downloaded Articles, and three China national awards. Ph.D. (2003), Virginia Tech.

Xubin Song

Xubin Song has made outstanding contributions to energy-efficient vehicle technology and has served the engineering community. He is a world-class professional in controllable suspensions and vehicle power management with application to automated manual transmissions and hybrid-electric and electric vehicles. His pioneering effort on adaptive shifting control with "Look Ahead Systems" can lead to considerable fuel economy improvments, using engine fuel map, GPS based geographic maps, and real-time traffic data. He has six U.S. and European patents with another 30 invention disclosures and more than 20 invited presentations to conferences and universities worldwide. Ph.D. (1999), Virginia Tech.

Zoltan Spakovszky

Zoltan Spakovszky is recognized for his achievements in two different venues. One is sustained and outstanding research contributions on unsteady flow and aeromechanical vibrations in turbomachinery and gas turbine engines, including first–of-a-kind descriptions of instabilities in axial and centrifugal compressors, rotor whirl, and acoustics of novel aircraft. A second is excellence in engineering education, on both undergraduate (thermodynamics and propulsion) and graduate (internal flow in fluid machinery) levels. Spakovszky's classes are marked by a strong interaction that promotes deep learning and enables students to apply, in new and innovative fashions, the concepts that are taught. Ph.D. (2000), Massachusetts Institute of Technology.

Natteri M. Sudharsan

Natteri M Sudharsan is a multifaceted personality. He has served with distinction in various academic capacities. He was teachers' nominee in the college academic council and has several highly cited publications in the area of engineering in medicine. Sudharsan is well known in the engineering services industry for his consultancy and training in Computational Fluid Dynamics. An ASME member for over 25 years, Sudharsan played a pivotal role in rejuvenating the India section that has the largest number of student members. He also leads a small business manufacturing specialized equipment for defense and aerospace industries on a turnkey basis.Ph.D. (2001), Nanyang Technical University, Singapore.

Yu Sun

Yu Sun is a professor at the University of Toronto and the Canada Research Chair in Micro and Nano Engineering Systems. He established an internationally recognized research program in physical manipulation and characterization of cells and nano-materials. A global leader in the development of micro-nano robotics and device technologies for biomedical, clinical, and precision instrumentation disciplines, he has invented automated processes for cell manipulation that are revolutionizing how genetic studies, cancer research, and clinical cell surgery and diagnostics are conducted. Sun is a Fellow of the Engineering Institute of Canada and currently holds an NSERC Steacie Fellowship. Ph.D. (2003), University of Minnesota, Twin Cities.

Kenichiro Takeishi

Kenichiro Takeishi earned the JSME award in education while contributing to the development of high temperature industrial gas turbines, research on cooling and heat transfer of gas turbine blades and vanes, and supersonic flow. He has already contributed more than 35 years to the society of engineers. Takeishi continues to be involved as a professor and devoted to fundamental research on heat transfer of gas turbines. After moving from industry to academia, he directly supervised 52 undergraduates and 35 graduate students. Ph.D. (1995), Osaka University.

Darryl G. Thelen

Darryl Thelen has conducted fundamental research in neuromuscular biomechanics. He has developed a number of unique computational and imaging tools for investigating the mechanics, dynamics, and control of motion of the human body, and he has applied these tools to study prevention and rehabilitation of injuries associated with the musculoskeletal system. He has also used these tools to analyze the design of rehabilitation devices and for predicting the functional consequences of orthopedic surgical interventions. Thelen's studies have established a body of knowledge on the role that age, injury, and disease have on musculoskeletal performance. Ph.D. (1992), The University of Michigan.

Fan-Gang Tseng

Fan-Gang Tseng is an internationally renowned expert in microfluidics and BioNEMS research and education. He co-invented a breakthrough micro droplet generator operated at an ultra-high droplet

generation rate without satellite droplets. The formed droplets can be self-propelled on a nano–engineered surface with world-record speed. Tseng also served as an Associated Vice President, Deputy director, and Department Chair at National Tsing Hua University. He received many awards, including the NSC Excellence in Research award, the National Innovation Awards, the NTHU Excellence in Teaching award, and numerous best papers/poster awards. Ph.D. (1998), University of California, Los Angeles.

Kimberly L. Turner

Kimberly Turner has made major contributions in the area of micro-electro-mechanical-systems and is also recognized for her extensive service to her professional community. She has served as Chair of the ASME MEMS Division and in numerous leadership roles for technical committees and for the organization of conferences. Her research has made significant contributions to bio-inspired adhesives and the use of resonant devices for sensing and signal processing. Turner has authored over 50 journal papers on these topics, is listed as an inventor on seven U.S. patents, and regularly serves as a consultant for leading micro-systems companies. Ph.D. (1999), Cornell University.

Herbert B. Voelcker

Herb Voelcker formed and led the team that established the mathematical foundations for solid modeling—the core technology in contemporary CAD systems—while also developing, with industrial collaborators, first-generation modeling-system technology. Even after the realization of his work in commercial CAD systems, Voelcker continued making significant contributions to solid modeling R&D and developed university courses and industrially oriented short courses to disseminate the new technologies. He continues to teach and to work with the Y14.5.1 committee charged with rigorizing the national tolerancing standard, and will soon release a needed teaching monograph on tolerancing. Ph.D. (1961), Imperial College of London, UK.

Chow Wan Ki

Chow Wan Ki is recognized for his thirty years of research in architectural science and fire engineering.He has made contributions to building fire safety, fire suppression systems, atrium fire engineering, building energy efficiency, and indoor environment quality. He helped develop the fire engineering discipline and led associated professional activities. Ki developed the master degree programme in fire and safety engineering with over 300 quality fire engineers graduated at Hong Kong Polytechnic University since 2001. He has published over 470 refereed journal papers and successfully graduated about 50 Ph.D. students. His research results have assisted the government in reviewing fire safety provisions for over 200 construction projects. Ph.D. (1983), University of Hong Kong.

Gaofeng Gary Wang

Gaofeng Wang is recognized for his work in both scholarship and education. He has also provided exemplary service and citizenship at local, national, and international levels. Wang has developed a series of leading algorithms in the area of metamodel based design optimization, which have been used by researchers worldwide. Wang has also developed innovative curriculums in engineering education, and taught numerous undergraduate and graduate students. He has also provided diligent services and leadership for the Technical Committee of Design Automation of ASME in the past years. Ph.D. (1999), University of Victoria, BC.

Lihui Wang

Lihui Wang is an internationally recognized front-runner in innovative manufacturing research and education. His contributions to mechanical engineering include the development of a novel technique that enables adaptive mesh generation for dynamic finite element analysis, and methods to improve responsiveness and dynamism of manufacturing operations with uncertainty through well-informed, adaptive decision making, by means of distributed process planning and Web-based Integrated Sensor-driven e-Shop Floor (Wise-ShopFloor). For these contributions, Wang has been recognized with honors and awards, including membership of the Swedish Production Academy Presidium and Fellow of the Society of Manufacturing Engineers. Ph.D. (1993), Kobe University, Kobe, Japan.

Xinwei Wang

Xinwei Wang has contributed greatly in micro and nanoscale thermal probing and characterization, and laser-material interaction. He has developed six novel technologies for thermal characterization at the micro and nanoscale. His work has built new knowledge about thermal/electrical transport in metallic films down to 0.6 nm thickness. His molecular dynamics research on laser-material interaction provides in-depth understanding of underlying complex physics, especially shockwave structure and behavior. Using Raman spectroscopy, Wang has achieved sub-nm resolution thermal probing and pioneered thermal transport study in optical near-field and graphene-substrate interfaces. He has authored 88 articles in highly visible journals, one book, and three book chapters. Ph.D. (2001), Purdue University, West Lafayette.

Gregory N. Washington

Gregory Washington is recognized for his scholarship and education, while providing exemplary service to ASME at local and national levels. He is internationally known for research on ultra-lightweight structurally active antenna systems and other structures using "smart materials." He has served as dean of two engineering programs and is the first permanent African-American dean of engineering at any of the University of California campuses. Washington has received numerous teaching awards, directly instructed hundreds of undergraduates, and graduated 40 graduate students. He has served as an advisor to the Air Force and the National Science Foundation. Ph.D. (1994), North Carolina State University.

Michael E. Webber

Michael Webber is recognized for his contributions to convergence of policy, technology, and resource management related to energy and the environment; for his groundbreaking research on the energy-water nexus; for mentoring the next generation of energy leaders through multi-disciplinary and high-impact research; for his educational work in the collegiate classroom; for his extensive efforts in energy literacy; through general interest articles, new educational programs on public television and radio; and for a globally-available online energy course that reached nearly 45,000 students. Webber's work has heightened public awareness to current energy issues and policy. He is engaged with policymakers through briefings and congressional testimony. Ph.D. (2001), Stanford University.

Kyle Wetzel

Kyle Wetzel is recognized for his original contributions to the development of advanced wind turbine airfoil aerodynamic designs and turbine blade manufacturing. Ph.D. (1995), University of Kansas.

David A. Willis

David Willis joined Southern Methodist University after completing his Ph.D. at Purdue in 2001. He developed the Laser Micromachining Laboratory which investigates short pulse laser-material interactions. His research has been published in the top applied physics and thermal science journals and he has received several teaching awards, including the Golden Mustang and the Altshuler Distinguished Teaching Professor Awards. Willis received the ASME North Texas Section Young Engineer of the Year Award in 2008. He has served on the ASME North Texas Section leadership team for several years, concluding with the Chair position in 2012-2013. Ph.D. (2001), Purdue University

Chee Wei Wong

Chee Wei Wong has made contributions to the control of nanostructures to modify light properties, addressing three themes simul-

taneously: sub-wavelength optics, nonlinear dynamics, and nanoscale optomechanics. He pioneered precision-nanofabricated nanostructures to achieve negative/zero-refractive indices and sub-diffraction focusing. He also demonstrated nonlinear dynamics in ultrafast frequency combs, solitons, and graphene, in the semiconductor chip and at mesoscopic length scales. Wong has examined micro and nano-electromechanical systems, driven by light radiation pressure for precision sensing at and beyond the Brownian noise limit, and laser cooling of nanomechanics. He has instructed more than 600 undergraduates, more than 150 graduate students, and has worked with 30 postdocs and Ph.D.s in his team. Ph.D. (2001), Massachusetts Institute of Technology.

Kristin L. Wood

Kristin L. Wood is an exceptional engineering educator with an outstanding record of research and scholarship in engineering design. Over his 24 year career, he has taught or co-taught 27 graduate and undergraduate courses, and has received 13 teaching awards. He has published over 300 technical papers and advised almost 100 graduate students. Wood has been a consultant for almost 50 companies. Ph.D. (1989), California Institute of Technology.

Christine Q. Wu

Christine Wu's theoretical research on nonlinear dynamic systems has been a significant contribution to engineering applications. Wu has received research awards and best paper awards. She has published over 50 journal papers and 90 conference papers. She has supervised over 70 undergraduate students, 20 graduate students and seven postdoctoral fellows and visiting scholars. Wu has also been active in her professional community and taken a leadership role. She is the current president of CSME and she has tirelessly promoted and supported women developing careers in engineering. Ph.D. (1996), University of Manitoba.

Xinran Xiao

Xinran Xiao has led a distinguished career in industry and academia. She has held a variety of positions, including associate professor of mechanical engineering at Michigan State University, senior engineer, staff researcher at General Motors, and faculty at Concordia University, Montreal. Xiao has authored over 130 papers. Her work on methods and material models for crashworthiness analysis, dynamic tensile testing, and multiphysics modeling of batteries is respected internationally. She has contributed widely to the engineering profession through her service on professional societies, working groups, and technical committees. She has mentored over 30 graduate students and instructed over 1400 students. Ph.D. (1987), Vrije Universiteit, Brussel.

Maria Yang

Maria Yang has established an exceptional record as a mechanical engineer, researcher and educator in the field of engineering design. Her research has consistently appeared in top international journals and conferences in her field, including the ASME *Journal of Mechanical Design* and ASME Design Engineering Technical Conferences. Several of these papers have received awards for their quality and impact on the larger engineering community. In education, Yang has developed a substantial record of inspiring students to think creatively about the design of products through hands-on projects that consider societal needs as well as engineering and technology. Ph.D. (2000), Stanford University.

Da-Jeng J. Yao

Da-Jeng Yao was the recipient of the 2009 Wu-Da-You Memorial Award from the National Science Council, Taiwan. He is internationally recognized for his seminal contributions to biomedical related microelectromechanical systems. He has contributed with research on fertilization on a chip, electronic noses, thermoelectrics, and digital microfluidic systems. Yao has been the associate editor of IEEE *Nanotechnology Magazine* and on the editorial board of the *Journal of Applied Chemistry*. He has also provided outstanding professional service, including his role as secretary at the Society of Theoretical and Applied Mechanics adhering under the International Union of Theoretical and Applied Mechanics. He has also developed the nanotechnology education program for ten years under the national project. He currently works for the Institute of NanoEngineering and MicroSystems, National Tsing Hua University, Taiwan. Yao has authored over 200 original papers (about 50 Journal papers), 21 patents, and organized many ASME/IEEE conferences. Ph.D. (2001), University of California, Los Angeles.

Jer-Liang Yeh

Jer-Liang Andrew Yeh recognized for his outstanding work as a reserachher, leader, and educator. He has received many awards, including the Distinguished Research Award in Taiwan. Yeh has served as an ASME member for 18 years and he has been an enthusiastic promoter of the ASME Taiwan Section. He was elected as the Chair of ASME Taiwan in 2010. Yeh continues to work to broaden and extend the impact of the ASME via his networking and profession. Ph.D. (1999), Cornell University.

Luzeng Zhang

Luzeng Zhang is a gas turbine cooling designer and industrial researcher. He is recognized for his work in both engineering design and industrial research with Solar Turbines for the past 20 years. He has extensive experiences in gas turbine hot section hardware design and technology development, film cooling and heat transfer, production support, manufacturing and test verification. Zhang is known for his numerical, analytical and experimental capabilities. He is an enthusiastic contributer to ASME heat transfer activities and has been a corporate member since 1993. He has served as a K-14 Gas Turbine Heat Transfer Committee member since 2001. Ph.D. (1993), Texas A&M University.

Xiang Zhang

Xiang Zhang's pioneering research on nanomanufacturing and metamaterial has made a profound impact on nanotechnology and engineering. Zhang developed plasmonic lithography, an enabling technology that has made a significant impact on modern manufacturing and uses very small wavelengths of plasmons to pattern nanostructures. He has also made many ground-breaking demonstrations of metamaterials, including the first optical super lens, the first optical negative index metamaterials, the first optical invisibility cloak, and the first plasmonic laser. He has contributed to the community with over 200 journal publications, including 50 papers published in *Science*, *Nature* and *Physical Review Letters*. Ph.D. (1996), University of California, Berkeley.

Yongxing Zhang

Yongxing (John) Zhang is a cardiovascular device professional having 20 years of experience in product development. He is currently the principal scientist at the Center for Innovation and Strategic Collaboration, St. Jude Medical. Among his major contributions, he was recognized for his significant role in the development of the technology for cardiac resynchronization therapy for chronic heart failure. More recently, he has been a key team member in developing a renal denervation system for the treatment of resistant hypertension. He has received 32 US patents and published 48 US patent applications. His research has been published in international journals and presented in international conferences. Ph.D. (1994), Old Dominion University.

Zhengji Zhang

Zhengji Zhang is a superb fluid dynamicist with a very wide level of experience. He has excelled at laser Doppler flow measurements and hydraulic engineering in water turbines, pumps, and other products, such as valves, sprays and process equipment. His theoretical approach and publications have been a major factor in changing the way in which the technical community understands problems in this area. He has also had a substantial impact on a number of improvements to products as well as design processes. In particular, his two monographs on laser anemometry and on Pelton turbines have become standard texts in their fields. Ph.D. (1989), Ruhr-University Bochum, Germany.

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FOR A COMPLETE LIST OF FELLOWS, VISIT THE ASME WEB SITE AT:
http://www.asme.org/member/fellow

AIR NOZZLE

EXAIR CORP., CINCINNATI.

The high power stainless steel super air nozzle produces a flat 1-inch (25 mm) wide airstream with a strong blowing force of 16 ounces (462 g) when mounted 12 inches (305 mm) from the target. Type 316 stainless steel construction makes it good for corrosive, high temperature, food, pharmaceutical, and chemical environments.

PHOTOELECTRIC SENSORS

AUTOMATIONDIRECT INC., CUMMING, GA.

The new QM series photoelectric sensors are IP67-rated and available in three-wire NPN or PNP styles and with visible red and infrared versions. The mini-rectangular photo eye sensors are constructed with plastic housings and have either an attached two-meter output cable or an M8 quick-disconnect connector. The series includes diffuse, diffuse with background suppression, retroreflective, retroreflective for transparent objects, and through-beam styles. All retroreflective models include one rectangular reflector and have a selectable light-on/dark-on output setting.

PORTABLE MEASURING ARM

HEXAGON METROLOGY INC., NORTH KINGSTOWN, R.I.

The Romer Absolute Arm 1.2 m portable coordinate measuring machine uses technology from the Romer Absolute Arm to provide high-accuracy 3-D measurement in a 1.2 m volume. It is for use within confined spaces, including inside a machining center for dimensional control of molds, parts, tooling, castings, and more. The CMM streamlines the measurement process as an alternative to a range of manual tools such as height gauges, dial calipers, bore gauges, gauge blocks, micrometers, and dial indicators.

BLOWDOWN CONTROL VALVES

SPIRAX SARCO, BLYTHEWOOD, S.C.

BCV43 blowdown control valves are based on the Spira-Trol platform and are designed to maintain total dissolved solids at a level that keeps blowdown to a minimum, thus maintaining a good steam and condensate system and conserving water and energy. The valves are suitable for applications where boilers are operated unsupervised for 24 to 72 hours. The BCV43 blowdown control valve range has been engineered to minimize seat erosion ensuring tight shut-off.

CONDUCTIVE THERMOPLASTICS

RTP CO., WINONA, MINN.

Conductive extrusion compounds provide electrical conductivity for electrostatic discharge protection. They can be engineered to provide the needed conductivity (both surface and volume resistance) as well as the required mechanical properties. The manufacturer can also incorporate other performance enhancements during compounding such as RoHS compliant flame retardant modifiers and processing aids. These properties can be incorporated into a wide range of elastomeric and rigid resin systems, including polyvinyl chloride, thermoplastic polyurethane, and thermoplastic elastomers.

FLANGED MAGMETERS

OMEGA ENGINEERING, STAMFORD, CONN.

The MG-2000 series of flanged magmeters has an easy set-up, minimal straight pipe, rate and total display . It is available as a meter mount or remote. The FMG-2000 has a tamper-evident seal, touch screen programming and is NSF-61 approved. It's suitable for municipal or industrial water, wastewater, pump stations, and packaged plant applications.

DIFFERENTIAL PRESSURE SWITCH

ASHCROFT INC., STRATFORD, CONN.

The Ashcroft DDS-Series differential pressure switch has a sensitive elastic element and a heavily constructed containment vessel. It can control differential pressures from 0-6 to 0-150 inches of water on pressure lines up to 1,500 psi. UL-listed NEMA 4 water-tight and NEMA 7 explosion-proof versions are available with a choice of electrical switches, wetted materials, and setpoint options.

COMPACT ROBOTICS

ABB ROBOTICS, AUBURN HILLS, MICH.

The IRB 1200 is a new family of small robots that features a compact footprint and a large work envelope, providing flexibility, ease of use, and short cycle times to a wide range of material handling, machine tending, and small parts assembly applications. The IRB 1200 is designed with no offset in axis two, delivering a longer stroke that allows the robot to be placed very close to the work piece and still be functional.

THERMOPLASTIC FOR 3-D PRINTER

STRATASYS LTD., MINNEAPOLIS.

ASA is an all-purpose material used for the production of prototypes, manufacturing tools, and finished goods. Applications include jigs and fixtures, electrical boxes, recreational vehicles and outdoor tools. Compatible with the Fortus 360mc, 400mc and 900mc 3-D production systems, ASA thermoplastic offers UV resistance, so parts will resist fading and remain durable with long-term exposure to direct sunlight.

MEMS ACCELEROMETER

SILICON DESIGNS INC., KIRKLAND, WASH.

Model 1410 is a family of digital pulse density output MEMS variable capacitive accelerometers, designed to measure both vibration and acceleration, with very low power consumption and high long-term bias stability (1,000 ppm typical). This makes them suitable for use within low current applications consuming only 2 mA with 5 volts excitation. The Model 1410 uses a clock frequency between 100 kHz and 1.0 MHz and produces a pulse density output relative to acceleration.

BAYLOR UNIVERSITY

TENURE TRACK FACULTY POSITION INMECHANICAL ENGINEERING

THE DEPARTMENT OF MECHANICAL ENGINEERING IN THE SCHOOL OF ENGINEERING AND COMPUTER SCIENCE AT BAYLOR UNIVERSITY seeks highly qualified candidates for a tenure-track faculty position in solid mechanics, materials, and/or biomaterials/biomechanics. Special consideration will be given to applicants with research in areas related to national initiatives in next generation and/or nano-materials, manufacturing, and energy. The position will begin in August 2015. Applicants at the Assistant Professor level are preferred, however, exceptional candidates with outstanding qualifications could be considered at a higher rank. Responsibilities include establishing an externally funded research program, undergraduate and graduate teaching, course curriculum development, and professional service. Requirements include an earned doctorate in Mechanical Engineering or a closely related field, outstanding English communication skills, a commitment to teaching and research excellence, and involvement in professional activities. The position will support the new Mechanical Engineering Ph.D. program that began in Fall 2014, and will include a highly competitive start-up package. In light of Baylor's strong Christian mission, the successful applicant must have an active Christian faith.

Baylor offers ABET/EAC-accredited B.S. programs in Mechanical Engineering, Electrical and Computer Engineering, and Engineering. The Department of Mechanical Engineering has state-of-the-art research facilities in the mechanics and materials areas and has plans for continued faculty hires in support of its growing research mission. Additional information about this position may be found at http://www.ecs.baylor.edu/mechanicalengineering/.

To receive full consideration, please submit a cover letter and the following: A current curriculum vitae, an individualized statement of teaching and research interests related to Baylor's programs, contact information for at least three professional references, a statement describing an active Christian faith. Review of applications begins December 15, 2014 and will continue until the position is filled. Further information, including official transcripts and letters of recommendation, will be required of finalists. Applicants should send electronic materials in PDF format to the search committee chair, Dr. Douglas Smith at Douglas_E_Smith@baylor.edu.

Chartered in 1845 by the Republic of Texas, Baylor University is the oldest university in Texas and the world's largest Baptist university. It is a member of the Big XII Conference and holds a Carnegie classification as a "high-research" institution. Baylor's mission is to educate men and women for worldwide leadership and service by integrating academic excellence and Christian commitment within a caring community. New faculty will have a strong commitment to the classroom and to discovering knowledge as Baylor aspires to become a top tier research university as described in Pro Futuris (http://www.baylor.edu/profuturis/).

Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Employment Opportunity employer, Baylor encourages minorities, women, veterans, and persons with disabilities to apply.

Bucknell UNIVERSITY

THE MECHANICAL ENGINEERING DEPARTMENT AT BUCKNELL UNIVERSITY SEEKS QUALITY APPLICANTS FOR AN OPEN RANK TENURE-TRACK FACULTY POSITION, STARTING IN AUGUST 2015.

A successful candidate must have a Ph.D. in mechanical engineering or a closely related discipline at time of appointment. A candidate should have the ability to teach broadly across the mechanical engineering curriculum and they may be asked to teach in manufacturing or dynamic systems. Candidates should clearly demonstrate their potential for excellence in interaction with undergraduate students.

We seek a teacher-scholar whose experience and expertise will contribute to working effectively with a diverse student body. Bucknell University values a diverse college community and is committed to excellence through diversity in its faculty, staff, and students.

Applications must include a letter of application, a teaching statement, a research statement, and a current C.V. Applicants to provide references upon request. Applications are only accepted through Interfolio ByCommittee. Please go to http://apply.interfolio.com/26624 to apply. Applications will be reviewed beginning November 15, 2014 in the order in which they are received until the position is filled.

ABOUT BUCKNELL

Bucknell University is a private, highly ranked, national liberal arts institution that also offers strong professional programs in engineering, business, education, and music. Located in Central Pennsylvania along the Susquehanna River, Bucknell is nestled in the Borough of Lewisburg, an appealing Victorian-style town ranked as one of America's best small towns. Lewisburg and the surrounding region offer a unique combination of outdoor recreation opportunities, small-town charm, and appealing amenities such as restaurants, art galleries, an art deco theater, museums, and boutiques. In addition to the many cultural and athletic events offered by the University and the Borough, the surrounding region offers outstanding schools, medical facilities, and an affordable cost of living. For those who crave the city, Bucknell is within an easy three-hour drive to Philadelphia, New York, Baltimore, and Washington, D.C.

Bucknell University, an equal opportunity employer, believes that students learn best in a diverse, inclusive community and is therefore committed to academic excellence through diversity in its faculty, staff, and students. We seek candidates who will be committed to Bucknell's efforts to create a climate that fosters the growth and development of a diverse student body. We welcome applications from members of groups that have been historically underrepresented in higher education.

VirginiaTech *Invent the Future®*

FACULTY POSITION IN
THE GRADO DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING
VIRGINIA TECH

The Grado Department of Industrial and Systems Engineering at Virginia Tech invites applications for a full-time tenure-track position in the emerging frontiers of industrial engineering. The research specialties of interest include, but are not limited to, advanced manufacturing systems and technologies, big data analytics, cybersecurity, bio-manufacturing, and renewable energy. The appointment is at the assistant professor level and begins in the 2015-2016 academic year.

Applicants should have achieved, or show potential to develop, a strong program of research and scholarship. The position requires a Ph.D. degree, with at least one degree in industrial engineering or a closely related field. We are seeking candidates with exceptional potential for leadership in research and education, and strong commitment to high quality research. The successful applicant will also be expected to provide skilled teaching of foundational and advanced courses at both the undergraduate and graduate levels.

Applications must be submitted online at www.jobs.vt.edu (posting number TR0140105) and include a cover letter, current vita, research statement, teaching statement, up to three relevant research publications, and names of three references providing recommendation letters (these must be submitted separately by the references to ise-search@vt.edu). Details on how to prepare and submit all materials can be found under "Apply to this Job" on the website. Review of applications will begin on January 5th, 2015. Applications submitted after this date may not be considered.

Virginia Tech has a strong commitment to the principle of diversity and inclusive excellence, and, in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. Virginia Tech is the recipient of a National Science Foundation ADVANCE Institutional Transformation Award to increase the participation of women in academic science and engineering careers.

Portland State UNIVERSITY

Assistant or Associate Professor in Mechanical and Materials Engineering: Building Science Focus

The Department of Mechanical and Materials Engineering at Portland State University seeks a highly qualified candidate to fill a tenure track position at the level of Assistant/Associate Professor with research and teaching interests in the area of Building Science. Applicants must have a Ph.D. in a relevant science or engineering discipline. Specific areas of interest include but are not limited to indoor air quality, building-environment interactions, sensors for building science applications, and building controls. Applicants with interests in related areas such as smart buildings, innovative materials for high performance buildings, and building energy efficiency are also encouraged to apply.

The successful applicant is expected to develop a funded research program, mentor graduate students, and participate in department and university-wide collaborations and initiatives. The successful applicant will also teach courses at both the undergraduate and graduate level on topics related to their areas of expertise. This may include courses in Thermodynamics, Heat Transfer, and Fluid Dynamics as well as specialty courses in Building Science.

Compensation is competitive and commensurate with experience, with an excellent benefits package including 95% premium paid healthcare; a generous retirement package; and reduced tuition rates for employee, spouse or dependent at any of the Oregon University System schools.

Applications must be submitted online, at https://jobs.hrc.pdx.edu/ for position #D95051 Applications must include cover letters, curriculum vita, teaching and research agendas and at least three references. Application review will begin on/after January 1, 2015 and continue until the position is filled. Non U.S. residents must state their visa status.

Portland State University is an Affirmative Action, Equal Opportunity institution and welcomes applications from diverse candidates and candidates who support diversity.

POSITIONSOPEN

THE DEPARTMENT OF MECHANICAL ENGINEERING AT THE UNIVERSITY OF CALIFORNIA, Santa Barbara invites applications for a tenure track faculty position at the level of Assistant Professor with a start date of July 1, 2015 or later. The Department is looking for exceptional individuals in the areas of solid mechanics, mechanics of materials, or mechanics of structures, including biomechanics. Applications must be submitted by December 10th, 2014 for a July 1, 2015 start date. For full details regarding the position and to apply, please visit https://recruit.ap.ucsb.edu/apply/JPF00380. The University of California is an Equal Opportunity/Affirmative Action Employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, or any other characteristic protected by law including protected Veterans and individuals with disabilities.

GEORGIA SOUTHERN UNIVERSITY'S DEPARTMENT OF MECHANICAL ENGINEERING invites applications for three (3) tenure track assistant professor positions in Mechanical Engineering (with emphasis in BioMechatronics, Automotive Design and Analysis, and Solid Mechanics Simulation and Analysis) and one tenure track assistant or associate professor position in Mechanical Engineering (with emphasis in Additive Manufacturing and Design for Manufacturability). The positions require teaching, research, and service as well as a terminal degree. The full text advertisements, including information about the department, faculty, and the complete position announcements with all qualifications and application instructions, is available at http://academics.georgiasouthern.edu/positions/. Screening of applications begins 21 November 2014, and continues until the positions are filled. Georgia is an open records state. Georgia Southern is an AA/EO institution. Individuals who need reasonable accommodations under the ADA to participate in the search process should contact the Associate Provost.

FACULTY POSITIONS IN MECHANICAL ENGINEERING The Department of Mechanical Engineering at the University of Utah (http://www.mech.utah.edu/) invites applications for multiple tenure track positions at the assistant or associate rank with a Fall Semester 2015 starting date. Candidates with exceptional background and experience may be considered at a higher rank. Candidates with interest and expertise in the areas of 1) mechanics of novel materials and structures, 2) whole body biomechanics and design, 3) design of mechanical/fluid systems, and 4) microscale/nanoscale devices are strongly encouraged to apply. Candidates should be qualified to teach courses aligned with their area of expertise as well as other core Mechanical Engineering courses at the undergraduate and graduate level. Candidates are expected to develop and maintain an active, externally-funded research program and to complement and collaborate with existing research programs in the department and College of Engineering. Rank and salary will be commensurate with qualifications and experience. Applicants are expected to have an earned Ph.D. or Sc.D. in Mechanical Engineering or a closely related field. The department currently has 32 tenure-line faculty members, over 850 undergraduate and 200 graduate students. Review of applications will begin on December 1, 2014 and continue until positions are filled. Applications must be submitted electronically and should include a cover letter highlighting the applicant's qualifications, current curriculum vitae, statements of research and teaching interests and teaching philosophy, and contact information for a minimum of three references. All documents must be uploaded at the specified link. Please check the complete position announcements at http://mech.utah.edu/department/open-positions/. For application submission questions, please contact department manager Sheila Olson (Sheila.Olson@utah.edu) at the Department of Mechanical Engineering, 50 Central Campus Dr., Salt Lake City, UT 84112. The University of Utah is fully committed to affirmative action and to its policies of nondiscrimination and equal opportunity in all programs, activities, services, and employment without regard to race, color, national origin, sex, age, disability, gender identity/expression, religion, sexual ori-

AUBURN UNIVERSITY
SAMUEL GINN COLLEGE OF ENGINEERING
AEROSPACE

Aerospace Engineering at Auburn University invites applications for multiple tenure track positions at the assistant or associate professor rank. Candidates with exceptional background and experience may be considered at a higher rank. Areas of interest include air-breathing and rocket propulsion, aerospace structures and structural dynamics, aeroelasticity, computational fluid dynamics, and combustion. Other areas related to aerospace engineering may also be considered. Applicants must have an earned doctorate in aerospace engineering, mechanical engineering, or a closely related field.

Applicants are encouraged to apply as soon as possible by submitting a cover letter, current CV, research vision, teaching philosophy, and three references to the job posting at: http://aufacultypositions.peopleadmin.com/postings/711

The review process will begin December 1, 2014, but applications will continue to be accepted until the position is filled. Additional information about the department may be found at: http://www.eng.auburn.edu/aero/

Auburn University is an EEO/Vet/Disability employer.

FACULTY POSITIONS IN MECHANICAL ENGINEERING UNIVERSITY OF KANSAS

The Department of Mechanical Engineering at the University of Kansas is seeking nominations and applications for one tenure-track faculty position at the rank of Assistant, Associate or Full Professor in the area of additive manufacturing. Exceptional candidates with outstanding qualifications could be considered for appointment at a higher rank. Research expertise is desired in the development of novel processes and devices using additive manufacturing in applications such as, but not limited to the net shape manufacture of: energy conversion and storage devices, lightweight components for transportation, biomedical devices, and reconstruction of legacy devices for defense applications.

The Department is also seeking applications for a second tenure-track faculty position at the rank of Assistant Professor in the area of water conservation in industrial processes. Exceptional candidates with outstanding qualifications could be considered for appointment at a higher rank. Research expertise is desired in the development of new and fundamental processes, as well as engineering devices, in applications such as, but not limited to, power generation and industrial processing.

Applications are sought from candidates with earned doctorates in mechanical engineering or closely related fields by the time of appointment. The successful candidate will be results-oriented, have a record of superior scholarship, have experience in externally-funded research commensurate with the rank of appointment, will develop and maintain an externally-funded research program, and will teach high quality courses at both the undergraduate and graduate levels.

The School of Engineering and the state of Kansas are currently investing in the School's Building on Excellence Initiative, which includes the addition of 30 engineering faculty positions, a targeted 60% increase in B.S. engineering degrees granted, a new research facility dedicated in 2012, and state-of-the-art classroom and research building facilities scheduled for completion in 2015. Together, the new buildings will add more than 180,000 square feet to the Engineering Complex. The Department of Mechanical Engineering currently has 19 tenured/tenure-track faculty, approximately 450 undergraduate students and 60 graduate students, with programs leading to bachelor's, master's, and doctoral degrees.

KU is a comprehensive educational and research-intensive AAU institution that operates through a diverse, multi-campus system, with 29,000 students and 2600 faculty members. Opened in 1866, KU's main campus is considered one of the most beautiful in the nation, occupying 1000 acres on Mount Oread in Lawrence, a thriving city of 91,000, located 30 minutes west of Kansas City in the forested hills of eastern Kansas. KU is focusing on new faculty hiring in four key campus-wide strategic initiatives: (1) Sustaining the Planet, Powering the World; (2) Promoting Well-Being, Finding Cures; (3) Building Communities, Expanding Opportunities; and (4) Harnessing Information, Multiplying Knowledge. The School of Engineering and KU have developed an overall Strategic Plan, which is available online (http://boldaspirations.ku.edu).

Screening of applications will begin on January 6, 2015 and continue until the position is filled. The target starting date is Fall, 2015. The successful candidates must be eligible to work in the U.S. prior to the start of the position. Applications for additive manufacturing must be submitted at http://employment.ku.edu/academic/1748BR. Applications for water conservations must be submitted at http://employment.ku.edu/academic/1760BR. Include a cover letter, complete curriculum vitae, a one-page vision statement for teaching and research and four professional references. Nominations for senior positions only should be sent to tlbergman@ku.edu. KU is an EO/AAE. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), age, national origin, disability, genetic information or protected Veteran status.

MULTIPLE ADDITIVE MANUFACTURING FACULTY POSITIONS AT THE UNIVERSITY OF ALABAMA

The College of Engineering at The University of Alabama (eng.ua.edu) seeks applications and nominations for multiple tenured or tenure-track faculty positions in the area of Additive Manufacturing — particularly for direct digital manufacturing of metallic, ceramic and/or composite components. These positions, with considerations at the rank of Assistant or Associate Professor, are to be filled in the Department of Mechanical Engineering. An earned doctoral degree in a relevant discipline is required. Successful candidates will be expected to develop strong, externally-funded research programs and to teach both undergraduate and graduate courses. Alabama has a large industrial base with concentrations in automotive, aerospace, primary metals, and energy. Manufacturing has been and continues to be a major economic strength in the state and region. The new faculty will leverage these burgeoning industries with research programs to meet the needs for next-generation manufacturing.

The University of Alabama has experienced unprecedented growth and prosperity over the last decade including significant increases in undergraduate and graduate enrollment within the College of Engineering. In July 2013, the final phase of a $300M, four-building science and engineering research complex was completed with state-of-the-art laboratories. The University of Alabama offers many opportunities to work within interdisciplinary research communities including the Center for Advanced Vehicle Technologies and the Center for Materials for Information Technology. The University, which currently enrolls more than 35,000 students, was founded in 1831 with the engineering program beginning in 1837. It is located in Tuscaloosa along the banks of the Black Warrior River in Central Alabama. The Tuscaloosa metropolitan area, with more than 150,000 residents, was named "The Most Livable City in America" in 2011 by the US Conference of Mayors and one of the "100 Best Communities for Young People" by America's Promise Alliance.

Review of applications will begin on November 1, 2014 and will continue until the positions are filled. Applicants must submit a cover letter, complete curriculum vitae, a research statement that outlines planned areas of pursuit, a teaching statement that captures teaching philosophy along with course topics of interests, and a list of at least three references with contact information. Applicants are required to apply electronically at http://facultyjobs.ua.edu/postings/35990. Inquiries should be addressed to Prof. Clark Midkiff, Search Committee Chair, Department of Mechanical Engineering, Box 870276, The University of Alabama, Tuscaloosa, AL 35487-0276, or sent by email to cmidkiff@eng.ua.edu.

Qualified women and minorities are encouraged to apply. The University of Alabama is an equal opportunity, affirmative action, Title IX, Section 504, ADA employer. Salary is competitive and commensurate with experience level.

MECHANICAL ENGINEERING THE UNIVERSITY OF ALABAMA TENURE-TRACK JOB OPENINGS

The Mechanical Engineering Department at The University of Alabama has two tenure-track positions open at the rank of Assistant Professor in the broad area of thermal/fluids sciences. Applicants in the area of experimental combustion, who will utilize existing extensive capabilities of the Engines and Combustion Lab and complement research of current faculty in experimental combustion, are of particular interest in this search. Candidates in thermal/fluids areas that support other research strengths of current faculty, e.g., industrial or building energy systems, are also of interest.

An earned doctoral degree in Mechanical Engineering or a closely related field is required, and successful candidates must have high potential for sustainable funded research in areas that complement strengths of existing faculty. The department has significant thrusts in energy and combustion/engines. The College of Engineering has recently moved into two new campus buildings that include extensive research laboratories with a preeminent automotive research and combustion engines facility.

The departmental has about 1,100 undergraduates and 65 graduate students in M.S. and Ph.D. programs. The present faculty size of 22 is expected to grow over the next several years through this search and other planned faculty searches. The University is committed to being a student-centered research university; therefore, excellence in both undergraduate and graduate teaching will be expected.

The University of Alabama currently enrolls about 35,000 students and was founded in 1831, with the engineering program beginning in 1837. The University is located in Tuscaloosa, Alabama, with a metropolitan population of over 150,000. The state of Alabama has a large industrial base with concentrations in primary metals, automotive, paper, and energy. In addition, the NASA Marshall Space Flight Center and Redstone Arsenal are located in state.

Review of applications will begin on December 1, 2014 but will continue until the positions are filled. To apply, submit an application including a letter of application, a detailed CV, statements of research and teaching interests, and a list of at least 3 professional references to the "Mechanical Engineering" position on The University of Alabama job search website, https://facultyjobs.ua.edu. Inquiries should be addressed to Dr. Keith Woodbury, Department of Mechanical Engineering, Box 870276, The University of Alabama, Tuscaloosa AL 35487-0276 or sent by email to keith.woodbury@ua.edu.

Please refer to the website http://ua.edu for more information on the university and department.

Qualified women and minorities are encouraged to apply. The University of Alabama is an equal opportunity, affirmative action, Title IX, Section 504, ADA employer. Salary is competitive and commensurate with experience level.

entation, and status as a protected veteran. The University seeks to provide equal access to its programs, services, and activities for people with disabilities. Reasonable prior notice is needed to arrange accommodations. Evidence of practices not consistent with these policies should be reported to the University's Title IX/ADA/Section 504 Coordinator: Director, Office of Equal Opportunity and Affirmative Action, 201 S Presidents Cr., Rm 135, Salt Lake City, UT 84112. (801) 581-8365 (V/TDD). The University of Utah values candidates who have experience working in settings with students from diverse backgrounds, and possess a strong commitment to improving access to higher education for historically underrepresented students.

MIAMI UNIVERSITY-OXFORD, OHIO, DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING The Department of Mechanical and Manufacturing Engineering at Miami University (Oxford, OH, http://miamioh.edu/cec/academics/departments/mme/) seeks applicants for multiple tenure-track Assistant/Associate Professor positions beginning fall 2015 to teach courses in topics related to manufacturing/mechanical engineering, conduct labs, establish a vibrant research program, undertake service duties and advise students in the program. The position requires a Ph.D. in Mechanical Engineering, Manufacturing Engineering or a closely-related field. Strong candidates will have research experience in manufacturing, materials, mechatronics, robotics, and/or dynamic systems along with a record of grant funding and scholarly publications. Specific areas of interest include

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- but are not limited to - digital manufacturing, additive manufacturing, design for manufacturing, machining, materials design, engineering manufacturing enterprise systems, cyber-physical systems and rehabilitation robotics. Teaching and/or industrial experience in these areas is desirable. ABDs will be accepted, but the doctorate must be completed by the time of appointment. To be appointed to the rank of associate professor, the successful candidate must have an established record of high quality teaching and scholarship/research, with scholarly publications and grants related to the specified areas. Submit letter of interest, vita, list of three references, statement of teaching philosophy and statement of research plans to www.miamiujobs.com/applicants/Central?quickFind=53943.Screening of applicants begins November 15, 2014 and will continue until the positions are filled. Inquiries can be directed to Dr. Carter Hamilton at hamiltbc@miamioh.edu. Miami University, located 35 miles north of Cincinnati, has 15,000 undergraduate and 2,400 graduate students. The department facilities include several well-equipped laboratories for projects, research, and laboratory instruction in a new building in the heart of the campus. The faculty are engaged in a variety of multi-disciplinary research collaborations conducted regionally and worldwide. U.S. News & World Report ranks Miami 3rd in the nation for "Best Undergraduate Teaching."SmartMoney ranks Miami 9th nationally for return on investment among both public and private universities. Miami is recognized as a top value in higher education by Forbes magazine and included in Kiplinger's annual list of the "100 Best Values

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in Public Colleges." Miami University, an equal opportunity/affirmative action employer with smoke-and tobacco-free campuses, is committed to a multicultural environment and strongly encourages applications from minorities, females, veterans and individuals with disabilities. Miami's Annual Security and Fire Safety Report with information on campus crime, fires, and safety may be found at: http://www.MiamiOH.edu/campus-safety/annual-report/index.html. Hard copy available upon request. Employment will require a criminal background check according to University guidelines.

LOUISIANA STATE UNIVERSITY ASSISTANT/ASSOCIATE/FULL PROFESSOR (Tenure-Track/Tenured) Department of Mechanical and Industrial Engineering College of Engineering Duties include undergraduate and graduate level teaching, initiating and sustaining independent, externally funded research, and supervising graduate students to successful degree completion. Candidates for Assistant Professor rank are expected to demonstrate potential to develop a viable and nationally visible research and educational program, while candidates for Associate or Full Professor ranks are expected to possess a well-established prominent record of excellence at the appropriate level for the rank. Required Qualifications: Ph.D. in Engineering with specialization in engineering mechanics and composite materials with experimental and modeling experience. Preferred Qualifications: A proven record in the mechanics, manufacturing and/or synthesis of composite materials, including smart, self-healing composite materials

MIAMI UNIVERSITY-OXFORD, OHIO, DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

The Department of Mechanical and Manufacturing Engineering at Miami University (Oxford, OH, http://miamioh.edu/cec/academics/departments/mme/) seeks applicants for multiple tenure-track Assistant/Associate Professor positions beginning fall 2015 to teach courses in topics related to manufacturing/mechanical engineering, conduct labs, establish a vibrant research program, undertake service duties and advise students in the program. The position requires a Ph.D. in Mechanical Engineering, Manufacturing Engineering or a closely-related field. Strong candidates will have research experience in manufacturing, materials, mechatronics, robotics, and/or dynamic systems along with a record of grant funding and scholarly publications.

Specific areas of interest include - but are not limited to - digital manufacturing, additive manufacturing, design for manufacturing, machining, materials design, engineering manufacturing enterprise systems, cyber-physical systems and rehabilitation robotics. Teaching and/or industrial experience in these areas is desirable. ABDs will be accepted, but the doctorate must be completed by the time of appointment. To be appointed to the rank of associate professor, the successful candidate must have an established record of high quality teaching and scholarship/research, with scholarly publications and grants related to the specified areas.

Submit letter of interest, vita, list of three references, statement of teaching philosophy and statement of research plans to www.miamiujobs.com/applicants/Central?quickFind=53943.

Screening of applicants begins November 15, 2014 and will continue until the positions are filled. Inquiries can be directed to Dr. Carter Hamilton at hamiltbc@miamioh.edu. Miami University, located 35 miles north of Cincinnati, has 15,000 undergraduate and 2,400 graduate students. The department facilities include several well-equipped laboratories for projects, research, and laboratory instruction in a new building in the heart of the campus. The faculty are engaged in a variety of multi-disciplinary research collaborations conducted regionally and worldwide. U.S. News & World Report ranks Miami 3rd in the nation for "Best Undergraduate Teaching."SmartMoney ranks Miami 9th nationally for return on investment among both public and private universities. Miami is recognized as a top value in higher education by Forbes magazine and included in Kiplinger's annual list of the "100 Best Values in Public Colleges." Miami University, an equal opportunity/affirmative action employer with smoke- and tobacco-free campuses, is committed to a multicultural environment and strongly encourages applications from minorities, females, veterans and individuals with disabilities. Miami's Annual Security and Fire Safety Report with information on campus crime, fires, and safety may be found at: http://www.MiamiOH.edu/campus-safety/annual-report/index.html. Hard copy available upon request. Employment will require a criminal background check according to University guidelines.

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and the associated manufacturing processes; experience with applications relating to lightweight piping, pressure vessel and automotive and aero structures; balanced experience in experimentation and modeling. Salary and rank are commensurate with qualifications and experience. An offer of employment is contingent on a satisfactory pre-employment background check. Application review will begin October 30, 2014 and continue until a candidate is selected. Apply online and view a more detailed ad at:www.lsusystemcareers.lsu.edu. Position #008843. Quick link at ad URL: https://lsusystemcareers.lsu.edu/applicants/Central?quickFind=57966 LSU IS AN EQUAL OPPORTUNITY/EQUAL ACCESS EMPLOYER

MARQUETTE UNIVERSITY'S DEPARTMENT OF MECHANICAL ENGINEERING invites applications for a tenure-track position in Mechanical Systems (including computational or theoretical mechanics, mechatronics, or mechanical design) at the Assistant Professor level. Applicants must have a doctorate in ME or related area. Candidates are expected to teach undergraduate and graduate (MS/PhD) courses in their area of specialization within mechanical systems, and establish an externally funded research program. Candidates who can collaborate within the college will be given preference. Applicants must submit their CV, teaching philosophy, research plan, and the names and contact information of at least three references to: https://employment.marquette.edu/postings/2926 Review of applications will begin on December 15, 2014 and will continue until position is filled. Interested persons can visit: http://www.marquette.edu/engineering/mechanical/ or contact Dr. Philip Voglewede, Chair, Search Committee, MEEN Dept., 1515 W. Wisconsin Ave., Milwaukee, WI 53233; Phone (414) 288-7278; email: philip.voglewede@marquette.edu.Marquette's College of Engineering, the largest Catholic, Jesuit College of Engineering in the nation with over 1,100 undergraduate and 180 graduate students, is committed to preparing graduates to be leaders in innovation and research on a global stage. Marquette Engineering is currently undergoing a transformation in teaching and research with the construction of the new $50 million Engineering Hall. Marquette is an EO/AAE.

ASSISTANT/ASSOCIATE/FULL PROFESSORS - MECHANICAL ENGINEERING UNIVERSITY OF MASSACHUSETTS LOWELL The Department of Mechanical Engineering at the University of Massachusetts Lowell is seeking to hire three full-time tenure-track faculty at the ranks of Assistant or Associate Professor; applications for Full Professor will also be considered for exceptional candidates. Applicants must have earned Bachelor and Doctoral degrees in mechanical engineering, or a closely related discipline, and are required to have a record of quality teaching and scholarship. Successful applicants will collaborate with existing faculty members, teach classes to support the undergraduate and graduate programs, develop new courses, advise and

Michigan Tech

MECHANICAL ENGINEERING-ENGINEERING MECHANICS (ME-EM)

ASSISTANT PROFESSOR LEVEL FACULTY POSITIONS

Michigan Technological University, Department of Mechanical Engineering-Engineering Mechanics (ME-EM) invites applications for two **tenure-track faculty positions** at the Assistant Professor level to begin in Fall 2015. Research thrust areas of interest include: robotics, vehicle mobility, hybrid electric vehicles, solar energy, photovoltaic battery technologies, biological systems engineering, wind energy, quality engineering, green building engineering, additive manufacturing, polymer processes, and micro/nano manufacturing and assembly.

To Apply:
http://www.jobs.mtu.edu/postings/1856

For full consideration, applications should be received by December 14, 2014; however, applications will be considered until the positions are filled. Only complete application packages are guaranteed full consideration. The ME-EM Department and Michigan Tech encourages minority and female applicants.

Michigan Tech is a AA/EEO educator and employer and aggressively recruits minority, female, protected veterans and individuals with disabilities in an effort to bring greater diversity to its workers.

For more information: www.me.mtu.edu

Michigan Tech

MECHANICAL ENGINEERING-ENGINEERING MECHANICS (ME-EM)

SENIOR LECTURER POSITION

Michigan Technological University, Department of Mechanical Engineering-Engineering Mechanics (ME-EM) invites applications for a non-tenure-track senior lecturer position. We seek candidates with expertise and experience in vehicle dynamics including the design of vehicle components and material handling, with at least five years of teaching experience.

To Apply:
http://www.jobs.mtu.edu/postings/1857

For full consideration, complete applications should be received by December 14, 2014; however, applications will be considered until the position is filled. Only complete application packages are guaranteed full consideration. The ME-EM Department and Michigan Tech encourages minority and female applicants.

Michigan Tech is a AA/EEO educator and employer and aggressively recruits minority, female, protected veterans and individuals with disabilities in an effort to bring greater diversity to its workers.

For more information: www.me.mtu.edu

Michigan Tech

MECHANICAL ENGINEERING-ENGINEERING MECHANICS (ME-EM)

COMPUTATIONAL FLUID DYNAMICS - FACULTY POSITION

Michigan Technological University, Department of Mechanical Engineering-Engineering Mechanics (ME-EM) invites applications for a **tenure-track assistant professor position** in Computational Fluid Dynamics (CFD) to begin in Fall 2015. We seek candidates with research, teaching and professional interests in fundamental and applied computational fluid and flame dynamics across a range of scales with applications in internal combustion engines, power generation, and energy systems or innovative laboratory applications.

To Apply:
http://www.jobs.mtu.edu/postings/1789

For full consideration, applications should be received by December 14, 2014; however, applications will be considered until the position is filled. Only complete application packages are guaranteed full consideration. The ME-EM Department and Michigan Tech encourages minority and female applicants.

Michigan Tech is a AA/EEO educator and employer and aggressively recruits minority, female, protected veterans and individuals with disabilities in an effort to bring greater diversity to its workers.

For more information: www.me.mtu.edu

recruit graduate students, and pursue external funding to support research in one of the following areas: (1) Sensing/Structural Health Monitoring: advanced sensing of structures and dynamic systems, modal analysis, structural dynamic modeling, signal processing. (2) Composite Materials: computational or experimental methods associated with either (a) composite processing/manufacturing and materials or (b) textiles manufacturing and mechanics. (3) Sustainable Energy: solar photo/thermochemical energy processes, advanced combustion and engines, biomass conversion, renewable energy storage, multi-scale energy transport. Note: Candidates must clearly specify a single research area in bold font in the first sentence of their Cover Letter. If an applicant wishes to apply to more than one area, he/she must submit separate applications – one for each area. In cases of demonstrated outstanding research productivity and scholarship, an appointment with tenure may be considered. To apply, visit: http://jobs.uml.edu. Applications received by January 1, 2015, will be considered in the first review of candidates. However, later applications may be considered for these positions. Each position will close after an adequate number of qualified applications is received. UMass Lowell is a Carnegie Doctoral High Research (RU/H) university ranked in the top tier of US News' National Universities, and is strategically located 30 miles northwest of Boston in the northeast Massachusetts high-tech region. The department has over 600 undergraduate students and over 100 graduate students. An optional co-op program is available to undergraduates. The undergraduate engineering program is

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based on a design-build-test methodology and is ABET accredited. The University of Massachusetts Lowell is committed to increasing diversity in its faculty, staff, and student populations, as well as curriculum and support programs, while promoting an inclusive environment. We seek candidates who can contribute to that goal and encourage candidates to apply and to identify their strengths in these areas. The University of Massachusetts Lowell is an Equal Opportunity/ Affirmative Action, Title IX employer. All qualified applicants will receive consideration for employment without regard to race, sex, color, religion, national origin, ancestry, age over 40, protected veteran status, disability, sexual orientation, gender identity/expression, marital status, or other protected class.

ASSISTANT PROFESSOR IN MECHANICAL ENGINEERING TECHNOLOGY, beginning August 2015 (2 tenure-track positions) The School of Engineering & Technology at Central Michigan University seeks energetic individuals for two Tenure Track Assistant Professor Positions to teach in Mechanical Engineering Technology, with engineering research interests in materials, energy or sustainability beginning August 1, 2015. Ph.D. in mechanical or civil engineering or closely related engineering field (candidates will be considered if degree completion is assured before duties commence) required. Review of applications will begin November 1st, 2014 and continue until the position is filled. For application to the position and Central Michigan University, please go to: https://www.jobs.cmich.edu/ CMU, an AA/EO institution, providing equal opportu-

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nity to all persons, including minorities, females, veterans and individuals with disabilities. (see http://www.cmich.edu/ocrie)

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA –ENGINEERING TECHNOLOGY DEPARTMENT: One tenure-track position is available for individuals with abilities to teach courses in the areas of Electrical and Mechanical Engineering Technology. For full Position Description and Applications Procedures please check the university website at www.csupomona.edu/et or contact the Engineering Technology Department by email et@csupomona.edu. The University is an Equal Opportunity / Affirmative Action Employer.

MECHANICAL ENGINEERING FACULTY POSITIONS ANNOUNCEMENT: 2014-2015 The Department of Mechanical Engineering, University of Michigan, Ann Arbor, seeks leading scholars and educators to apply for multiple full-time tenured or tenure-track faculty positions. We are especially interested in qualified candidates who can contribute to the diversity and excellence of the academic community. All candidates who have strong backgrounds in fundamental disciplines relevant to mechanical engineering are welcome to apply. Preference will be given to candidates in the following fields: Design and Innovation: This position is open to candidates of all ranks, including junior and senior-level appointments. The successful candidate will be a thought leader in design and innovation who is interested in advancing mechanical engineering research in a broad sense, while also providing leadership to enhance and sustain our core mechanical design curriculum. Computational Thermal/Fluids: This position is open to candidates of all ranks, including junior and senior-level appointments. The successful candidate will possess the ability to work across disciplinary boundaries and provide inspiration and leadership to research and teaching in areas such as: computational heat and mass transport, computational combustion, or computational fluid dynamics. Manufacturing - Metals Processing: This position is open to candidates of all ranks, including junior and senior-level appointments. The successful candidate will play a leadership role in advancing the manufacturing of structural metals through fundamental understanding of topics such deformation, forming, heat treatment, solid state and fusion joining, molten metal processing, advanced casting, and alloy design. Underrepresented minority and women candidates are strongly encouraged to apply. The University of Michigan is a non-discriminatory / affirmative action employer and is responsive to the needs of dual career families. More information about the Department can be found at: http://me.engin.umich.edu/. Applicants should have an earned Ph.D. in mechanical engineering or a related field. We seek candidates who will provide inspiration and leadership in research and who will contribute proactively to teaching and to the diversity of the academic community. For best consideration, candidates are encouraged to apply now and certainly before December 1, 2014 as applications will be reviewed immediately upon receipt. All applicants should submit, in PDF format (1) a detailed resume, (2) a statement of research and teaching interests, (3) up to three representative publications, and (4) the names and contact information of at least three referees. Applications must be submitted electronically at http://me.engin.umich.edu/facultysearch.

CLARKSON UNIVERSITY

Wallace H. Coulter School of Engineering Department of Mechanical and Aeronautical Engineering

TWO TENURE TRACK FACULTY POSITIONS

The Mechanical and Aeronautical Engineering (MAE) Department of the Wallace H. Coulter School of Engineering at Clarkson University invites applications for 2 tenure track positions at the Assistant or Associate Professor rank (starting date: July 2015 or earlier). A Ph.D. in Aeronautical Engineering and/or Mechanical Engineering, or related area is required. Applications are sought from individuals whose research interests are in the Aeronautical Engineering fields of Aircraft Design, Structures, Propulsion, Aerodynamics, and Flight Dynamics and Controls, or in the Mechanical Engineering fields of Experimental Solid Mechanics, Manufacturing, and Materials Processing. Candidates who have experience in design are especially encouraged to apply.

Clarkson's MAE Department offers B.S. degrees in Mechanical Engineering and Aeronautical Engineering, and M.E., M.S. and Ph.D. degrees in Mechanical Engineering. Successful candidates will be expected to teach fundamental undergraduate and graduate courses in mechanical/aeronautical engineering, and develop strong externally-funded research programs. Applicants should articulate a clear and substantiated vision of how their background can lead to sustained accomplishments through teaching, research, and an ability to engage in interdisciplinary activities and projects within one of the areas identified above.

Additional information about the MAE Department and the Coulter School of Engineering can be found at www.clarkson.edu. Direct inquires and applications, including a CV, a clear vision statement for sustained accomplishments and the names of at least three professional references to Clarkson University's Human Resources department. To submit your application, go to www.clarkson.edu/hr and click "Career Opportunities" on the left hand navigation bar. Review of applications will begin immediately and will continue until the positions are filled.

Clarkson University is an equal opportunity/affirmative action employer. Clarkson actively seeks and encourages applications from minorities, women and people with disabilities.

Job Postings Fac 2013000404.

University of Colorado Boulder

FACULTY POSITIONS AEROSPACE ENGINEERING SCIENCES

The Department of Aerospace Engineering Sciences in the College of Engineering and Applied Science at the University of Colorado Boulder invites applications for three tenure-track faculty positions in the areas of structures and materials, small satellites, and bioastronautics. Applicants in structures and materials are especially sought with the following research interests:

Design, modeling, fabrication, and characterization of structural and/or multi-functional materials and their integration into innovative aerospace systems; preference given to applicants with an experimental focus.

Although these positions are targeted at the assistant professor level, other levels will be considered for experienced candidates with outstanding credentials. Job duties include teaching, research, and service to the University and to professional communities. Applicants should show strong promise to develop a robust research program that complements the existing strengths of the department and also to excel at undergraduate and graduate teaching, and student mentoring. A Ph.D. degree in Aerospace Engineering or a related field is required.

Application materials are accepted electronically through Job Posting F01786 at https://www.jobsatcu.com. Please indicate in your cover letter which position you are interested in, and include a curriculum vitae, statements of research and teaching interests, and the names and contact information of four references. Address the cover letter to Search Committee Chair Prof. Jeffrey M. Forbes, Department of Aerospace Engineering Sciences, University of Colorado Boulder.

For information about the department, please visit http://www.colorado.edu/aerospace.

Review of applications will begin 1 December 2014 and continue until finalists are identified, no later than the end of January.

The University of Colorado Boulder is an Equal Opportunity/Affirmative Action Employer committed to building a diverse workforce. We encourage applications from women, racial and ethnic minorities, individuals with disabilities, and veterans. The University of Colorado Boulder conducts background checks for all final applicants.

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RECRUITMENT

CONSULTING

NOV. 18 MEETING ON PROPOSAL FOR CHANGES TO BOILER CODE

THERE WILL BE A TOWN HALL-STYLE MEETING Nov. 18 during the ASME Boiler and Pressure Vessel Code Week in Orlando, Fla., to present proposed changes in the scope rules of Section VIII, Division 1, of the code.

The scope defines the classes of vessels covered by the standard and those excluded. A task group created by the BPV VIII Executive Committee has proposed the introduction of a pressure and volume relationship to replace the current list of exclusions.

Members of the task group will present the proposed changes at the meeting, solicit comments, and answer questions from stakeholders. A copy of the proposed rule changes is available by contacting Steve Rossi at RossiSJ@asme.org.

E4C WEBINAR DISCUSSES INFORMATION HARDWARE

LAURA HOSMAN, assistant professor of political science at California Polytechnic State University, and Bruce Baikie, executive director of Inveneo, hosted an Engineering for Change webinar titled, "Emerging Markets: Top ICT4D Hardware Challenges" in September. "ICT4D" stands for "information and communications technologies for development." During the hour-long webinar, Hosman and Baikie shared key lessons from a study comprising insights from hundreds of experts, academics, practitioners and end-users.

To see an archived replay of that and other E4C webinars, go to: http://www.engineeringforchange-webinars.org/.

NCEES REMOVES MASTER'S REQUIREMENT FOR P.E.

REPRESENTATIVES FROM THE BOARDS THAT comprise the National Council of Examiners for Engineering and Surveying have voted to strike proposed changes to its model law and model rules that would require a master's degree or its equivalent for engineering licensure.

One reason the delegates voted, at the NCEES annual meeting in Seattle, to remove the requirement was that it was creating uncertainty for students entering engineering school and for engineers trying to speculate what future engineering licensing requirements might entail, according to Jerry Carter, executive officer for NCEES.

ASME has contested the requirement since it was suggested eight years ago.

ASME FORUM EXPLORES

DECLARING THAT IT IS "FUNDAMENTALLY changing the work of engineers," ASME President J. Robert Sims called advanced manufacturing a potential revolution in the way we make things. He made the prediction during his opening remarks at the Society's inaugural Advanced Design and Manufacturing Impact Forum in Buffalo, N.Y., in August.

The Advanced Design and Manufacturing Impact Forum featured more than 50 executives offering insight into how advanced design and manufacturing drives the growth of their companies. The forum was held during the ASME 2014 International Design Engineering Technical Conferences and the Computers and Information in Engineering Conference.

Advanced manufacturing "changes standards that ensure well-designed, durable products," Sims said. "It changes education, not only for the next generation, but also for today's workforce."

Among the industry leaders at the forum was Helmuth Ludwig, CEO of the Industry Sector USA at Siemens, who was full of optimism about the future of manufacturing in the United States. He emphasized that advances in manufacturing are now being driven by software that connects the manufacturing floor with design operations. Bringing "those two worlds together can only be done by software," Ludwig said. "And there I think the U.S. is in an incredible position. The U.S. can lead the transformation of manufacturing worldwide."

Tom Lange, director of modeling and simu-

ASME FOUNDATION AWARDS SCHOLARSHIPS TO

THE ASME SCHOLARSHIP PROGRAM WILL award nearly $150,000 in scholarships to 38 ASME student members this year. The program, funded by the ASME Foundation, awards graduate and undergraduate level scholarships to aspiring young engineers as they pursue their degrees.

More than 600 completed applications were submitted for the 2014-2015 academic year—50 percent more than last year.

Jamie Nagode, U. of Hartford.

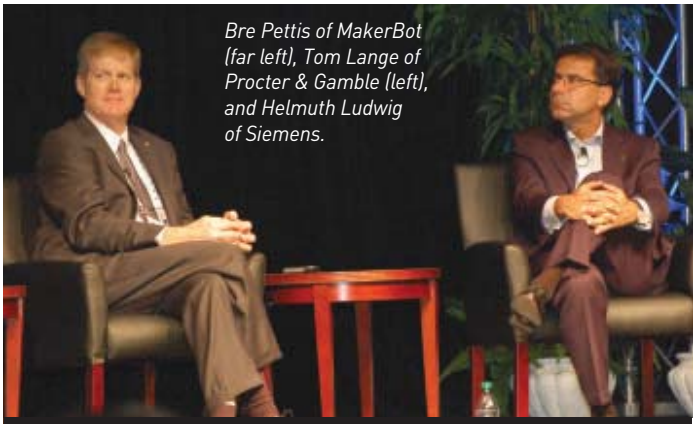
ASME student member Jamie Nagode, a senior at the University of Hartford in Connecticut, was selected this year's winner of the Kenneth Andrew Roe Scholarship. The $13,000 grant is the largest single-year scholarship ASME offers. The Roe Scholarship, which is awarded to juniors and seniors studying mechanical engineering, was established in 1991 in memory of the former ASME president and chairman of the ASME Foundation.

Nagode, who hopes to one day work on an ASME standards committee, is an active member in her school's student section where she works to promote awareness of the opportunities that the Society offers to undergraduate students.

"I aim to encourage the undergraduates in our chapter to explore mechanical engineering and find motivation in the practice that resonates within them on a personal level," Nagode said.

Not all of this year's scholarship winners are enrolled in traditional universities. The winner of this year's William J. and Marijane E. Adams Jr. Scholarship, for instance, is Andrew Florek, a community college student

MANUFACTURING REVOLUTION



Bre Pettis of MakerBot (far left), Tom Lange of Procter & Gamble (left), and Helmuth Ludwig of Siemens.

For further information, visit **go.asme.org/ImpactForum.**

lation corporate R&D at Procter & Gamble, said he wanted to "dispel one myth, that high tech is only high tech products." He said designing good diapers, for example, depends on computational fluid dynamics. And that packaging depends on structural mechanics.

"P&G uses simulation just like high tech companies," Lange said. "We do everything from molecular chemistry on formulations, to devices, to process, to machinery and equipment, to supply chain and throughput. Modeling and simulation runs through all that. I claim that computing has changed science and engineering for my products as much as aviation has changed travel for the rest of us."

Bre Pettis, the CEO of MakerBot, described an earlier era for today's do-it-yourselfers. "It used to be if you had an idea you wanted to make, you basically needed to be a tycoon and have a factory," Pettis said. "Now, you basically need a laptop, or a computer, a MakerBot, and you're off to the races."

Looking ahead, Pettis said software improvements would further lower the barrier to entry for 3-D printing. "I used to tell people when I started the company, 'You're gonna have to learn some CAD software. You have to be prepared to spend a couple of years getting good at it.' " Pettis said. He added, "Now, we have interns who get started when they are sixteen years old. And they are doing CAD drawings and CAD models that are as good as what engineers can produce in a couple of months."

Pettis also dispelled the myth that inexpensive 3-D printers are just for trinkets and toys. He described how Lockheed Martin used a MakerBot to rebuild a faulty part for the James Webb Space Telescope. "They reckon they saved six months of time," he said.

Next year's forum will be held August 2-5 at the Hynes Convention Center in Boston. ME

38 STUDENT MEMBERS

from San Francisco. The $3,000 Adams scholarship is awarded to an ASME student member attending a college or university in California, Hawaii, or Nevada who demonstrates a special interest in product development and design.

Since the City College of San Francisco does not have an ASME student section, Florek attends activities held by the University of California, Berkeley student section as a way to meet and network with other ASME student members.

"They have been very kind to include me even though I'm not a student there," he said. "I will continue to go to events and participate in interesting webinars this year, but I am really looking forward to attending a university that has an ASME chapter on campus."

The application period for the 2015-2016 scholarship year opens Dec. 1 and applications will be accepted through March 1, 2015. ME

STUDENTS PUT SIMULATION SKILLS TO THE TEST

STUDENTS FROM AROUND THE GLOBE competed in the finals of ASME's inaugural Innovative Design Simulation Challenge.

The final round was held during the Advanced Design and Manufacturing Impact Forum in Buffalo in August.

Thirteen students competed in three software simulation categories.

Student winners included Göknur Sirin from École Centrale Paris, for a simulation designed to improve efficiency in the design of automobiles through the early detection of inconsistencies in computer models, and Sohail Reddy from Florida International University for modeling airflow around airplane wings to optimize winglets.

Other winners include: Nathan Daley, Nick Selby, and Jia Li Liu of the Georgia Institute of Technology for determining the optimal differential gear for best performance in a quarter-mile drag race; Niti Agrawal and Vivek Nagal from IIT Kharagpur, India, for modeling the density fluctuations in nano-composites; Darshan Sarojini, Akahay Varik, and Anirud Katti of BMS College of Engineering in India, for determining how a chair might be built to help a mobility-impaired person rise from a sitting to standing position; Alex Buehler from the University of Wisconsin Madison for a demonstration that a machine part could be designed, optimized, and manufactured in a 3-D printer in one hour; and Henry Aguero, from Universidad Nacional Experimental Politecnica de La Fuerza Armada in Venezuela, for a simulation of thermo-fluid dynamic behavior of the air and gases in the pre-heater of a power plant.

The advisors for each winning simulation received a faculty advisor award for their work with the students. The students will be conducting ASME facilitated webinars to share their simulations and lessons learned with students worldwide. ■

The exterior (left) and interior (below) of a structure in England designed to test the effectiveness of cast-offs as building materials.

RUBBISH GOES FROM BIN TO 'WASTE HOUSE'

THERE ARE QUITE A FEW PEOPLE IN BRIGHTON, ENGLAND, WHO WILL TELL YOU, "THERE is no such thing as waste, just stuff in the wrong place." Duncan Baker-Brown, a senior lecturer and architect at the University of Brighton's Faculty of Arts, has set out to test that idea.

The test bed is the Brighton Waste House, which officially opened on June 10, 2014. It is the first permanent building in the U.K. to be constructed from waste, surplus material, and discarded plastic.

In a sense, the Waste House is the descendant of an earlier sustainable building project carried out for Britain's Channel 4 in 2008. Baker-Brown, who is also senior architect at BBM Sustainable Design, an architecture firm located in Cooksbridge, England, designed a prefabricated house out of organic materials such as timber, straw, grasses, hemp, and paper.

Construction was filmed over six days, and at the end of each day Channel 4 broadcast a one-hour recap. The project was a special version of a regular program hosted by Kevin McCloud called *Grand Designs*, and so Baker-Brown's design became known as the House that Kevin Built.

The house stood for a few days on the site where it was built in East London.

Baker-Brown had planned to rebuild the house at the University of Brighton, where he teaches. He saw it as a project to give his students practical experience, but the plan didn't work out. He decided instead to build an experimental building using materials that other people throw away.

Before it was over, the project involved more than 275 students, most of them from the nearby City College Brighton and Hove, where the curriculum includes instruction in construction trades.

Volunteers from Freegle UK, an online exchange for unwanted items, managed to source 20,000 plastic single-use toothbrushes from a sustainable cabin service company at Gatwick Airport. DVD cases were being discarded by a chain of movie rental shops, and the group was able to obtain about 10,000 of them. About half of them went into the Waste House.

Wood came from various sources, including damaged new stock from a retailer and residents' sheds.

Many of the collected waste materials, including the toothbrushes and denim from cut-off jeans, went into specially designed spaces in the walls, where they will be monitored for their insulative properties.

The 2,000 carpet tiles that cover the outside of the house, including colorful ones laminated with plastic bags, are what Baker Brown calls a "rain screen cladding system." They serve to keep the weather off the material behind them.

According to Brown, "All unusual materials in external walls are being monitored with electrical sensors measuring levels of condensation, temperature, etc." Data is sent to a Ph.D. student's computer, which is collecting data daily.

"If a wall begins to fail we will whip out the offending material and try something else," Brown says. "It is a real live research project that University of Brighton academics and students and other interested parties will be able to research and develop ideas from." ME

JAMES PERO

FOR FULL SESSION DESCRIPTIONS & ADDITIONAL INFORMATION, VISIT GO.ASME.ORG/FRACTURING

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