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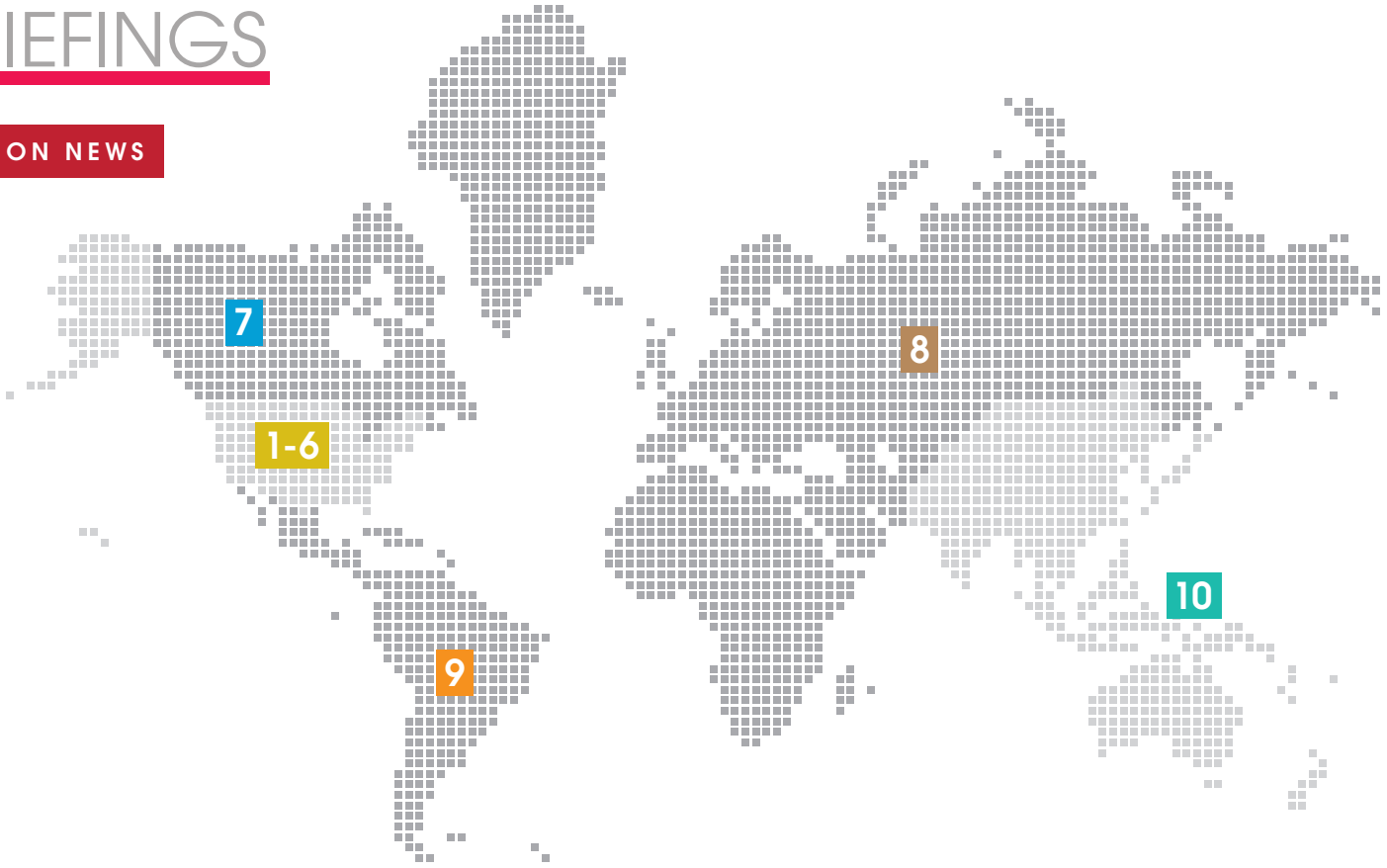
rebooting computing

MOVING BEYOND PRESENT LIMITATIONS

IEEE

REGION NEWS



REGION 1 NORTHEASTERN UNITED STATES

■ **New York Section** forms IEEE Engineering in Medicine and Biology Society chapter.

REGION 3 SOUTHEASTERN UNITED STATES

■ Student branch at **Florida International University, Miami,** forms IEEE Industry Applications Society chapter.

■ Student branch at **University of South Florida, Tampa,** forms IEEE Microwave Theory and Techniques Society chapter.

REGION 4 CENTRAL UNITED STATES

■ Student branch formed at **Indiana State University, Terre Haute.**

■ **Central Iowa Section** forms IEEE Magnetics Society chapter.

REGION 5 SOUTHWESTERN UNITED STATES

■ **St. Louis Section** forms joint chapter of IEEE Engineering in Medicine and Biology, Microwave Theory and Techniques, and Photonics societies.

REGION 6 WESTERN UNITED STATES

■ **Boise (Idaho) Section** forms IEEE Life Members (LM) affinity group.

■ **Orange County (Calif.) Section** forms IEEE Graduates of the Last Decade (GOLD) affinity group and IEEE LM affinity group.

■ Student branch at **California Polytechnic State University, San Luis Obispo,** forms IEEE Consumer Electronics Society chapter.

■ **Seattle Section** forms joint chapter of IEEE Communications and Vehicular Technology societies.

REGION 8 EUROPE, MIDDLE EAST, AND AFRICA

■ Student branch formed at **University of Klagenfurt, Austria.**

■ Student branch at **KU Leuven, Belgium,** forms joint chapter of IEEE Industry Applications and Industrial Electronics societies.

■ **Lithuania Section** forms IEEE GOLD affinity group.

■ **Slovenia Section** forms IEEE Women in Engineering (WIE) affinity group.

■ Student branch at **Universitat Politècnica de Catalunya, Barcelona,** forms IEEE Power & Energy Society chapter.

■ Student branch formed at **Blekinge Institute of Technology, Karlskrona, Sweden.**

■ Student branch formed at **Meliksah University, Kayseri, Turkey.**

■ **United Arab Emirates Section** forms IEEE Robotics and Automation Society chapter and joint chapter of the IEEE Computer and Power Electronics societies.

REGION 9 LATIN AMERICA

■ Student branches formed in Bolivia at **Escuela Militar de Ingeniería, La Paz,** and **Universidad Autónoma Tomás Frías, Potosí.**

■ Student branch at **Universidade Católica de Petrópolis, Brazil,** forms WIE affinity group.

■ Student branch formed at **Universidade Federal do Pará, Tucurui, Brazil.**

■ Student branch at **Universidad Autónoma de Colombia, Bogotá,** forms IEEE Robotics and Automation Society chapter.

■ Student branch at **Universidad de Los Andes, Bogotá,** forms IEEE Industry Applications Society chapter.

■ Student branch at **Universidad El Bosque, Bogotá,** forms IEEE Control Systems Society chapter.

■ Student branch at **Universidad de San Buenaventura, Medellín, Colombia,** forms IEEE Computer and IEEE Engineering in Medicine and Biology society chapters.

■ Student branches formed in México at **Instituto Tecnológico de Estudios Superiores de Zamora** and **Centro Universitario, Universidad Autónoma del Estado de México, Zumpango.**

REGION 10 ASIA AND PACIFIC

■ Student branch at **Macquarie University, New South Wales, Australia,** forms IEEE Microwave Theory and Techniques Society chapter.

■ **Western Australia Section** forms IEEE Systems, Man, and Cybernetics Society chapter.

■ Student branch formed at **New York Institute of Technology, Nanjing, China.**

■ **Shanghai Section** forms IEEE Engineering in Medicine and Biology Society chapter.

■ Student branch at **Audisankara College of Engineering and Technology, Gudur, India,** forms IEEE Computer Society chapter.

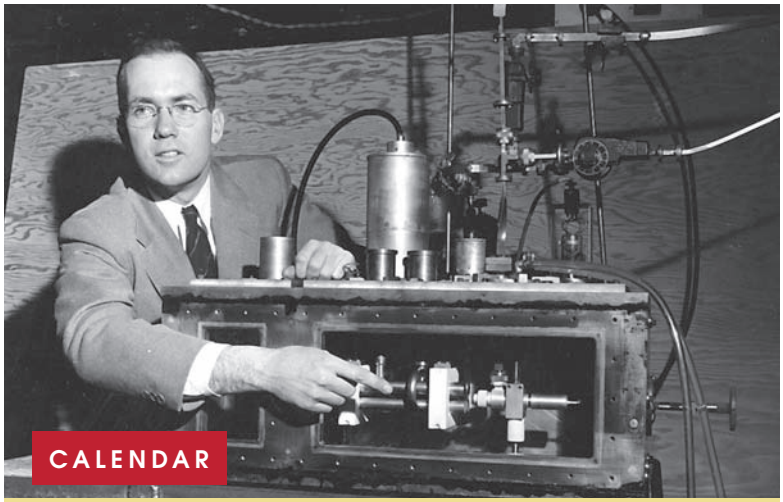
■ Student branch at **Vignan Institute of Technology and Science, Hyderabad, India,** forms IEEE Power Electronics Society chapter.

■ Student branch at **Islamia University of Bahawalpur, Pakistan,** forms IEEE WIE affinity group.

■ Student branch at **Mehran University of Engineering and Technology, Karachi, Pakistan,** forms IEEE Computer Society chapter.

■ **Singapore Section** forms IEEE Broadcast Technology Society chapter.

SEND US YOUR NEWS The Institute *publishes announcements of new groups once they've been approved by IEEE Member and Geographic Activities. To send us local news, like student branch events and competitions, WIE or preuniversity outreach efforts, or other IEEE group activities, use our form on the Region News page at http://theinstitute.ieee.org/region-news.*



CALENDAR

March

1 1960: The Haloid Xerox Co. (now Xerox Corp.) ships its Model 914, the **first commercial photocopy machine**.

2–3
Region 10 meeting in Chiang Mai, Thailand.

7 1926: The **first transatlantic telephone call** is placed, between London and New York City.

16 1789: Birthdate of **Georg Simon Ohm**, the physicist who discovered a direct proportion between the voltage applied across a conductor and the resultant electric current—a relationship known as Ohm's Law.

24 1959: Nobel Laureate and physicist Charles H. Townes [top] receives a patent for the **maser, a precursor to the laser.**

April

1 1972: Intel introduces the 8008, the **first 8-bit microprocessor.**

6–7
Region 5 meeting in Denver.

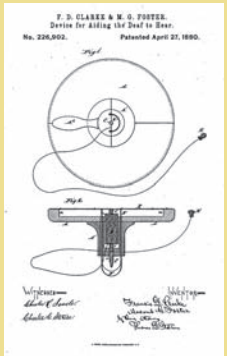
5–7
Region 3 meeting in Jacksonville, Fla.

19–21
Region 8 meeting in Madrid.

20–21
Region 2 meeting in Morgantown, W.Va.

26–28
Region 7 meeting in Toronto.

27 1880: Francis D. Clarke and M.G. Foster receive a patent for the **first electric hearing aid.**



May

10 1958: Birthdate of **Ellen L. Ochoa**, an electrical engineer who in 1991 became the first Hispanic female astronaut.

16 1960: Theodore Harold "Ted" Maiman demonstrates the **first functioning laser** at Hughes Research Laboratories, in Culver City, Calif.

18 1845: The **first electromagnetic telegraph line** in France, between Paris and Rouen, goes into service.

23 1922: Birthdate of physicist **Esther M. Conwell**, the first woman to receive the IEEE Edison Medal, in 1997.

Historical events provided by the IEEE History Center. IEEE events indicated in red.

TOP (TOWNES): AP PHOTO; LEFT (XEROX): XEROX CORP.; MIDDLE (PATENT): U.S. PATENT AND TRADEMARK OFFICE; RIGHT (MAIMAN): HUGHES RESEARCH LABORATORIES

NEWS

De Marca

De Marca Is 2013 President-Elect

IEEE FELLOW J. Roberto Boisson de Marca has been elected IEEE's 2013 president-elect. He begins serving as IEEE president on 1 January 2014.

De Marca received 23 229 votes. The runner-up, Fellow Tariq S. Durrani, garnered 22 194. The results were made official when the Teller's Committee report was accepted by the IEEE Board of Directors at the Board Series, held in New Brunswick, N.J., on 11 and 12 November.

De Marca has been a faculty member at the Catholic University of Rio de Janeiro since 1978. His leadership positions there include associate academic vice president. He served twice as a scientific consultant to AT&T Bell Laboratories.

De Marca was scientific director of the Brazilian National Research Council and served on the advisory committee of Finep, the largest Brazilian funding agency for R&D. De Marca was founding president of the Brazilian Telecommunications Society and is a member of the Brazilian Academy of Sciences and National Academy of Engineering. He has received the IEEE Communications Society's Donald W. McLellan Award, its Harold Sobol Award, and the IEEE Communications Society/Korea Information and Communications Society Globalization Award.

He has served IEEE in several capacities, including vice president, Technical Activities, in 2008; president of the Communications Society in 2000 and 2001; Division III director in 2004 and 2005; IEEE secretary in 2006; and chair of the Humanitarian Technology Challenge Committee from 2008 to 2010. He was also chair of the Future Directions Committee in 2010 and 2012.

Two Vie for 2014 President-Elect

THE IEEE Board of Directors has nominated IEEE Fellow Tariq S. Durrani and Senior Member Howard E. Michel as candidates for 2014 IEEE president-elect. The two men are set to face off in the annual election later this year. The winner will serve as 2015 IEEE president. Durrani ran for 2013 IEEE president-elect and lost to Fellow J. Roberto Boisson de Marca.

Durrani is a research professor in the electronic and electrical engineering department at the University of Strathclyde, in Glasgow. He joined the university as a lecturer in 1976 and headed its electronic and electrical engineering department from 1990 to 1994. He was deputy principal of the university from 2000 to 2006.

He is a Fellow of the United Kingdom's Royal Academy of Engineering, the Royal Society of Edinburgh, and the Institution of Engineering and Technology. In 2003 he was awarded the Order of the British Empire by Queen Elizabeth II "for services to electronics research and higher education."

In 2010 and 2011 Durrani was vice president, IEEE Educational Activities, and in 2003 and 2004 he was vice chair of technical activities for Region 8. He served as president of the IEEE Engineering Management Society in 2006 and 2007 and president of the IEEE Signal Processing Society in 1994 and 1995. He was also Region 8 direc-

Durrani

Michel

CLOCKWISE FROM LEFT: RON NEWKIRK; TARIQ DURRANI; D. CONFAIR/UNIVERSITY OF MASSACHUSETTS DARTMOUTH

Online

Available 8 March at theinstitute.ieee.org

SOCIETY SPOTLIGHTS
Four societies and a technical council that deal with rebooting computing

BOOKS OF INTEREST
Free e-books cover computing-related topics

tor of the IEEE Communications Society from 2009 to 2011.

Michel is an associate professor of electrical and computer engineering at the University of Massachusetts, in North Dartmouth. His research interests include artificial neural networks and distributed-intelligence sensor networks. Michel is an embedded-instrumentation and system-architecture consultant to the U.S. Navy.

He retired from the U.S. Air Force in 1994 as an engineering manager. During his 18-year Air Force career, he was a pilot and a research engineer, helping to launch seven satellites and directing launch-base tests involving booster, satellite, and range hardware. He also helped develop engineering processes for mission-critical Defense Department computer systems.

Michel was also vice president, IEEE Member and Geographic Activities, in 2011 and 2012, and Region 1 director in 2008 and 2009. He was the 2010 chair of the IEEE Public Visibility Committee. He was also on the IEEE-USA Board of Directors in 2008 and 2009.

Election ballots for president-elect and other IEEE positions are scheduled to be mailed out on 15 August.

IEEE Assembly Elects Five Board Members

THE IEEE ASSEMBLY in November elected five officers to the IEEE Board of Directors. Four of the new members, who began their one-year terms on 1 January, are Marko Delimar, secretary; John T. Barr, treasurer; Ralph M. Ford, vice president, Member and Geographic Activities; and Gianluca Setti, vice president, Publication Services and Products. The fifth, Michael R. Lightner, was elected to serve a second year as vice president, Educational Activities.

IEEE Medal of Honor Goes to Jacobs

IEEE LIFE FELLOW Irwin M. Jacobs, cofounder in 1985 of Qualcomm, is the recipient of this year's IEEE Medal of Honor. He was recognized for "leadership and fundamental contributions to digital communications and wireless technology."

A semiconductor company in San Diego, Qualcomm designs, manufactures, and markets digital wireless telecommunications products and services globally. As CEO in the 1990s he oversaw the development of Qualcomm's code division multiple access for cellphones, wireless base stations, and chips. The company's CDMA technology was adopted as one of the standards for 3G wireless networks.


Jacobs

THE JACOBS FAMILY

Jacobs retired from Qualcomm in 2009. He is currently chair of the Salk Institute for Biological Studies, a nonprofit scientific research organization in La Jolla, Calif.

He is scheduled to receive the Medal of Honor, which is sponsored by the IEEE Foundation, on 29 June in San Diego at the annual IEEE Honors Ceremony.

—Amanda Davis

TECH TOPIC

The Future of Computing

New Rebooting Computing Working Group will tackle technological challenges

BY KATHY PRETZ

ALEJANDRO MENDOZA/ISTOCKPHOTO

THE USE OF HIGH-PERFORMANCE computers has exploded. The complex systems play a role in all sorts of tasks these days, including trading stocks, forecasting the weather, and breaking codes.

But people who work with the powerful machines are encountering roadblocks. In addition to the physical limitation of how much information you can store on each chip, IC developers are hampered by power-dissipation concerns. The data centers that run the computers require a tremendous amount of energy—enough sometimes to power a small city. Where to situate the centers and how to power them are sticky issues. And, as always, there is the challenge of improving computers' performance while making them more energy-efficient.

Figuring it all out is more than just a single computer manufacturer acting alone can handle. That's why IEEE's newest working group, Rebooting Computing, has set its sights on improving all aspects of high-performance computing—a "soup-to-nuts approach," according to IEEE Senior Member Elie Track, cochair of the group along with IEEE Fellow Tom Conte, vice president of the IEEE Computer Society. Created last year, the group is sponsored by the IEEE Future Directions Committee, the organization's R&D arm.

As Bichlien Hoang, senior program director for IEEE Future Directions, puts it, the working group will "start with a small number of activities, such as developing a Web portal and organizing workshops to engage participants, as well as creating a community for them and finding ways for the community to grow." The group plans to launch a website to provide data, list upcoming workshops and conferences, and provide a forum for discussion, comments, and other input from IEEE members.

Once those first steps are taken the group will apply for funding from the IEEE New Initiatives Committee, Hoang says.

"Revamping computing is not something that any organization or company can undertake by itself," Track says. "IEEE has societies and councils engaged in almost every

aspect of computing, so our organization is the natural place to take on these tasks." Track is also president of the IEEE Council on Superconductivity and a senior partner with Hypres, a superconducting electronics firm. (For a profile of Track, see p. 14).

"The goal is to completely rethink computing, from devices to circuits to architecture and software," he declares. "IEEE will be the catalyst to spawn new thinking."

WHAT'S IN A NAME?

First, a name—and function—had to be chosen. The group started off calling itself the High-Efficiency Computing Working Group, and limited itself to addressing how to reduce large computers' power consumption. It changed its name after learning of IEEE Life Fellow Peter Denning's Rebooting Computing project, sponsored by the U.S. National Science Foundation.

Denning, who heads the computer science department at the Naval Postgraduate School, in Monterey, Calif., is tackling issues stemming from the decline of computer science education in the United States. His effort is based on his Great Principles of Computing project, which identified the scientific theories of computing and applied them in an innovative curriculum.

Progress in computing has closely tracked IC improvements that follow Moore's Law, in which the number of transistors on a chip doubles roughly every 18 months so that performance increases exponentially. The axiom held for roughly 50 years, but because of limitations in just how small components can be made, that kind of improvement is now leveling off, at least as far as computer clock frequency is concerned, Track says.

"There was a time when you could go from 500 megahertz to 1 gigahertz readily enough, but nowadays clocks are leveling off at around 2 or 3 GHz," he says. Individual transistors can be pushed to run faster, but doing so for the millions found on a typical microprocessor would generate unsustainable amounts of heat.

"It's become clear that all kinds of computers, including supercomputers, are not going to advance at nearly the rates they have in the past," Track says. "But more computing power is needed, and we need to find ways to go beyond the existing limitations."

POWER IN THE CLOUD

Some say the answer is in cloud computing, but the servers running those services are going to have to perform faster. To do so, they will need a tremendous amount of power.

Companies with large computing centers, like Google, are finding that because their cloud-computer servers consume so much power, they need to locate them where they can have water-cooling systems, Track says. "So far they have been able to manage this but at a great cost." So computer companies are looking at both making the servers more energy-efficient and improving their cooling systems.

The goal, to be reached in stages, is to achieve exascale computers that perform as many operations per second as 50 million laptops. To this end, enhancements being investigated include significantly increasing parallel processors in multicore architectures, as well as making fundamental advances in processor and memory technology, interconnects, system architecture, and software upgrades.

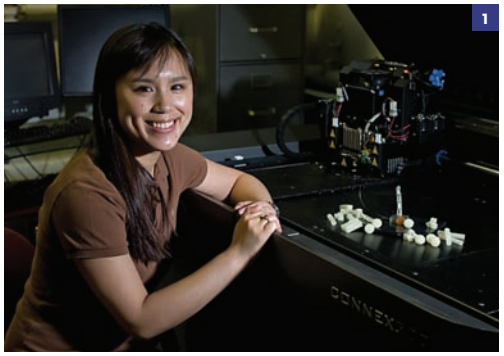
There's no dearth of ideas for improvements, but each tends to be limited to only one aspect of computing. Coming to an agreement on what to focus on is the role the Rebooting Computing Working Group has accepted.

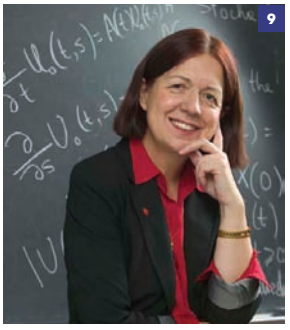
"It's time to rethink the entire approach to computation," says Conte. "We have been using the same models for computation since the inception of computing. We've tweaked and optimized every level of the stack, but to meet today's challenges, everything has to be on the table. This will require a serious, cross-discipline conversation among domain experts."

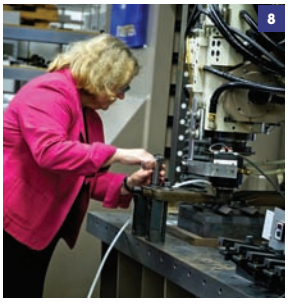
AT YEAR'S END

The working group is organizing a workshop to be held from 11 to 13 December in Washington, D.C. Leaders have been invited from Google, IBM, Intel, and others in industry, as well as representatives from government research agencies and academic labs. Their task: to help define the challenges and make recommendations for meeting them.

"We all have the same goals but different ways of achieving them," Track says. "The fundamental idea is that it cannot be a narrow improvement in just one aspect; it has to be improvement across the board. The total can be more than the sum of its parts."







IEEE GROUPS

Shining a Spotlight on Female Engineers

IEEE Women in Engineering aims to raise awareness, close gender gap BY ANIA MONACO

DID YOU KNOW that the person widely recognized as the first computer programmer was a woman?

Ada Lovelace was known for her work on Charles Babbage's early mechanical general-purpose computer, the Analytical Engine. Her notes on it include what is now recognized as the first computer algorithm.

And another woman, Grace Hopper, developed the concept of a compiler in the late 1940s and early 1950s while working at Remington Rand, which became part of Sperry Rand Corp. in 1955.

Despite their technical achievements through the years, however, women represent only about 10 percent of engineers in the workplace—a figure that has held steady for years.

IEEE Women in Engineering is working hard to increase that percentage and bring greater public awareness of women's contributions. It now has 1400 members, one third of them men.

Gearing up to celebrate its 20th anniversary in 2014, WIE has been especially active. Last year it established a scholarship, launched a public visibility campaign, developed an app for tablets that spotlights the work of female engineers who are IEEE members, posted videos of its activities on IEEE.tv, and partnered with Google to hold an outreach event. Be on the lookout for more WIE activities this year.

"These efforts support WIE's core mission of recognizing outstanding achievements and providing a vibrant, engaged community for women in IEEE," says Nita Patel, chair of the 2013 IEEE WIE Committee. "WIE has taken a leap in the past year to help promote the achievements of women across IEEE."

GREATER VISIBILITY

To spotlight the work of female engineers, WIE in September rolled out a visibility campaign, with the catchphrase "I Change the World. I Am an Engineer." The campaign features online chats with prominent WIE members as well as posters highlighting successful female engineers who are IEEE members. The posters were hung at engineering schools as well as in preuniversity classrooms.

In September and October, the group held weekly online chats with viewers of the live video streaming website UStream, many of whom were students. IEEE Fellow Karen Panetta and Senior Member Ramalatha Marimuthu spoke about what it's like to be an engineer and answered viewers' questions in real time.

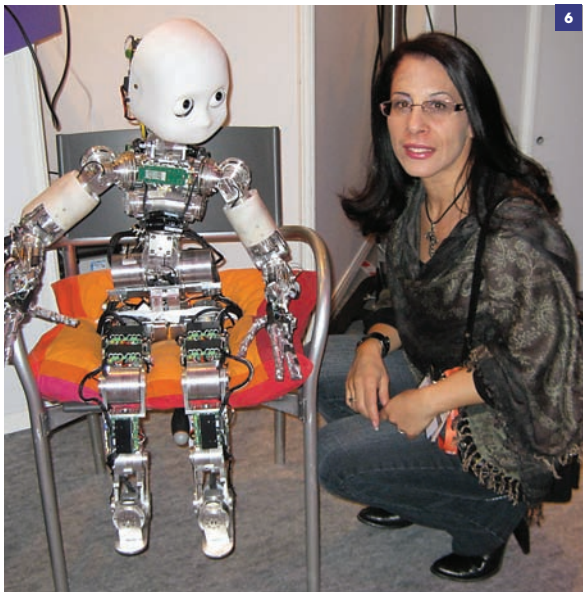
Other speakers included IEEE Senior Member Maria Cristina Dias Tavares, professor of electrical and computer engineering at the University of Campinas, in Brazil, and IEEE Member Teresa Schofield, an electronics engineer and chair of the IEEE United Kingdom and Republic of Ireland Section WIE affinity group.

Each chat drew almost 100 participants and added 29 000 new "likes" to WIE's Facebook page, which promoted the online chats and included links to the videos.

And WIE has been spreading the word about female engineers' accomplishments through the "I Change the World. I Am an Engineer" app, launched in January. Available for Android and Apple

IEEE (10)

1. *Nadia Cheng* **MECHANICAL ENGINEERING**
2. *Niebert Blair* **ELECTRICAL ENGINEERING**
3. *Carolyn McGregor* **COMPUTER SCIENCE**
4. *Mariana Fraga* **ELECTRICAL ENGINEERING**
5. *Suaad Alshamsi* **AEROSPACE ENGINEERING**
6. *Despo Ktoridou* **COMPUTER ENGINEERING**
7. *Caitlin Slezycki* **ELECTRICAL ENGINEERING**
8. *Alexandra Joshi-Imre* **ELECTRICAL ENGINEERING**
9. *Bozenna Pasik-Duncan* **PHYSICS AND MATHEMATICS**
10. *Xiaorui Zhu* **MECHANICAL ENGINEERING**



tablets, the app features profiles of more than 80 women (some are pictured above). Each profile includes a biography, information about the engineer's career, and a photo. An e-book version, featuring interactive PDFs, is also available.

PARTNERING WITH GOOGLE

To build support for women in science, technology, engineering, and mathematics (STEM) fields, WIE partnered with Google to hold an event on 23 and 24 January at the company's headquarters in Mountain View, Calif. "Enhancing the Sustainability of Women in Technology" drew about 200 attendees, many of them women working in the field. Speakers included several female Google employees, who covered a variety of technical topics such as fault-tolerant computing, data analysis, and Google's cloud computing applications.

Panetta, the event's program cochair, is the mastermind behind Nerd Girls, a program at Tufts University, in Medford, Mass., that seeks to dispel the stereotype of geeky engineers. Panetta is a professor of electrical engineering at the university and former chair of the IEEE WIE Committee, which functions as the organization's board of directors.

Marimuthu, the event's cochair and 2011 and 2012 chair of the WIE Committee, discussed the importance of applying innovative research to solve real-world problems. Marimuthu is no stranger to such work. When she's not busy heading the department of information technology at Kumaraguru College of Technology, in Coimbatore, India, she works on developing early screening systems to detect autism and other disorders in children.

Miche Baker-Harvey, a software engineer at Google, laid out the secrets to landing a dream job. She covered interviewing skills, résumé writing, and leadership traits.

Other presentations focused on being a role model, the difficulties of balancing personal life with work, and how IEEE student branches can organize Student Professional Awareness Conferences. These conferences address a technical topic and bring in IEEE members and other experts to provide career advice and discuss the benefits of IEEE membership.

SCHOLARSHIP

WIE has teamed up with TechSearch International, a licensing and consulting firm in Austin, Texas, to offer an annual US $2500 scholarship to a female college engineering student. Established in November, the IEEE Frances B. Hugle Engineering Scholarship was developed with TechSearch's founder Jan Vardaman. Hugle, a pioneer in the invention of tape-automated bonding, used in the manufacture of ICs, held 16 electronics patents.

WIE plans to award the scholarship this year to a female IEEE student member in her third year of undergraduate study at an accredited university or college in the United States. If you're interested in donating to the scholarship fund, visit http://www.ieee.org/donate and select the Frances B. Hugle Memorial Fund.

As WIE prepares for its 20th anniversary, upcoming activities include launching a WIE channel on IEEE.tv, organizing webinars with IEEE Educational Activities, holding more live chats on UStream, and redesigning the WIE website to make it more user-friendly. The IEEE.tv channel will show videos of WIE members and events. The webinars, to be available in the IEEE eLearning Library, will feature WIE members discussing their areas of expertise.

"I look forward to continuing to engage our members in industry, provide resources for our members in academia, and inspire students to go into engineering," Patel says. "I am so happy to be a part of this world-changing organization of men and women focused on technology for the benefit of humanity."

For more information, contact women@ieee.org. To join IEEE WIE, visit http://www.ieee.org/membership_services/membership/women/women_join.html

QUESTION OF THE MONTH

What Are Computing's Biggest Problems?

IEEE has launched the Rebooting Computing initiative to explore challenges facing high-performance computers (see "The Future of Computing," p. 6). In turn, the Rebooting Computing Working Group is examining efforts under way to cram ever more performance on smaller chips, improve computers' performance while making them more energy-efficient, and tackle the problems with data centers that must run on enormous amounts of electricity.

What do you believe is the greatest challenge facing high-performance computers, and what can be done to overcome it?

Respond to this question by commenting online at http://theinstitute.ieee.org/opinions/question. A selection of responses will appear in the June issue of The Institute *and may be edited for space. Suggestions for questions can be sent to institute@ieee.org.*

RESPONSES TO DECEMBER'S QUESTION

Will Robots Replace Surgeons?

More robots are popping up in operating rooms around the world. The da Vinci Surgical System robot is now used in four out of five prostatectomies in the United States, with more than 1800 of the machines installed at some 1400 hospitals worldwide. In August, the U.S. Food and Drug Administration cleared a robot-assisted system for minimally invasive treatment of coronary artery disease.

Although today's robots are still controlled by surgeons, some researchers say that might not be so in the future. Bioengineers at Duke University, in Durham, N.C., have an autonomous robot that can perform simple surgery, such as taking a sample of a cyst, on its own. Other researchers have wondered whether fully autonomous robots can perform more complicated tasks.

Do you think robots will one day replace surgeons for certain procedures? Would you trust a robot over a surgeon?

The following responses were selected from comments that appear at http://theinstitute.ieee.org/opinions/question/will-robots-replace-surgeons.

NONTECHNICAL ISSUES

If robots ever replace surgeons, it will probably be very far in the future. It's not just a matter of robots performing surgical procedures autonomously. Nontechnical issues are also of concern, such as whether surgeons will accept being replaced by robots, and figuring out who is responsible if an autonomous surgical robot fails during a procedure or does a poor job.

—lorisfichera

HELPING HANDS

Robots are not intended to replace surgeons—they will assist as tools. It will still be the surgeon's responsibility for any robot failure. Surgeons will never be replaced, though their hands might be.

—andyJ

ROBOT NIGHTMARE

Technology for autonomous robotic surgery may be available in the near future, but public acceptance is another story.

Other than the robotic surgeon that attached Luke Skywalker's prosthetic hand in the movie *Star Wars: The Empire Strikes Back*, many science fiction and horror movies, such as *The Terminator*, have cast robots in a very bad light. This image is now embedded in the public psyche. I would not like a robot with its tool rack of saws, knives, and drills alone with me in an operating room.

—Russ

KEEP HUMANS IN THE LOOP

Robot surgeons will operate only under a surgeon's supervision for a very long time to come, even when they're able to perform surgery autonomously. Complications can arise beyond the robot's ability to cope, and people feel more confident with a human in the loop. Commercial aircraft have been capable of autonomous flight for many years now, but no airlines fly without pilots.

A more likely scenario is that one surgeon will monitor multiple robots operating simultaneously, ready to step in if complications arise, with physicians on call in case multiple problems occur.

—Peter Thomson

ACCEPT NO SUBSTITUTE

Robot surgeons are a possibility, but they will take time to develop. However, I don't think machines will completely replace surgeons even if they do perform better. Legal issues will keep the surgeon in the room to take responsibility if anything goes wrong.

—Sudaraka Mallawaarachchi

CORRECTION

"Conferences: January–July 2013" [December, p. 13] incorrectly placed the IEEE International Conference on Micro Electro Mechanical Systems in Tokyo. The January conference was to take place in Taipei, Taiwan.

GETTY IMAGES

the institute

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PRESIDENT'S COLUMN

Humanitarian Technology… and Moore

MOORE'S LAW IS as ubiquitous to members of our professional community as the right-hand rule. Starting as an observation of the exponential growth of the number of transistors on ICs, it has been applied to many other aspects of our electrotechnical art, and today is a guiding principle and metric for the digital IC industry. Thus, futurists have used Moore's Law as a basic argument for the coming of the singularity, the smarter-than-human intelligence made possible by technology, and with good reason.

Our community is no longer defined by the physical borders of our homes or work spaces. Family, friends, colleagues, and mentors can be reached at a moment's notice through modes of communication largely in their infancy just a generation ago. What further improvements can we expect in the next 10 to 15 years?

Despite the fact that technology can unite the farthest reaches of our world, some 2 billion people, approximately a quarter of the world's population, have no access to any of it. Education, health care, reliable power, and clean water are but a few items on a regrettably long list of needs still largely unmet.

As a global leader within our professional community, IEEE is uniquely positioned to facilitate fulfillment of those needs. At any given moment, thousands of you—my fellow IEEE members—are working on projects to benefit families, communities, and ultimately, humanity. Sometimes your efforts spread across IEEE sections; often, they reach other nations and continents. Technology, and a desire to help improve the lives of others, brings us together.

Likewise, we have thousands of IEEE members working tirelessly within government, academia, and the global business community to build engineering capacity within regions and nations. Their efforts in the classroom, the boardroom, and the civic arena are helping to nurture and shape the next generation of engineering professionals and leaders.

Which brings us to an apparent quandary: how to choose among the many ways to enrich the lives of others while confronting the reality of finite resources. What is the proper allocation of money, time, and expertise to efforts that will improve the lives of a community of thousands or to efforts that will improve the availability and quality of engineering education for students throughout a nation?

You can argue—with equal passion and reason—that either endeavor is the "right" place to dedicate personnel, funding, and focus. Or we can engage in both endeavors.

Right now, IEEE's members are busy doing both—and more. We have the capacity to attack problems from many perspectives and are doing so. The "right" allocation of time, funding, and knowledge is a choice I leave to each of you.

Your desire to help others may lead you to work on a telemedicine project that brings a remote village in Peru into closer contact with a large hospital in a Peruvian city. It may lead you to meet with decision makers in a nation's legislative body. It may lead you to foster interest in engineering among tomorrow's possible technologists in a local classroom. Or it may lead you to develop a simple but elegant method of purifying contaminated groundwater. All of these paths are equally noble, equally impactful, equally important—and equally yours to choose.

In recent years, I have been fortunate to meet many of you who have already chosen a path and are actively advancing technology to benefit humanity. I commend you for your actions. Your work on grassroots technology projects in Africa, Haiti, India, Peru, Thailand, and other places has made a tremendous difference. Likewise, the initiatives you have implemented to maximize engineering education in your region or nation have fostered countless opportunities for future technologists.

I ask the following of my fellow IEEE members not currently involved in such activities: Consider helping your community with projects that are within your professional endeavors. Consider the papers you have authored, the conferences you have attended, and the advances you have made in your chosen field, and see if the knowledge you gained from any of them can help your community.

Finally, consider the increases in connectivity of our modern world and ask yourself if you can do even more. I believe it is possible to do more, and I urge you to do so.

If you are uncertain how to take part in initiatives that benefit our profession and the community, reach out to a fellow IEEE member or volunteer already engaged in such activities. You will be pleased you did; those whom your efforts assist will be even more pleased.

I welcome your thoughts and questions. E-mail me at president@ieee.org.

Peter Staecker
2013 IEEE President and CEO

PRODUCTS AND SERVICES

IEEE Portal Aims to Inspire Future Computer Engineers

Trycomputing.org offers career profiles, lesson plans, and more

BY AMANDA DAVIS

IN A WORLD where computers have become ubiquitous, the need for computer engineers is growing. The Association for Computing Machinery forecasts that about 150 000 computing jobs in the United States alone will be opening up each year through 2020. The number of students graduating with computer science degrees, however, is declining, which raises the question: Who will take the reins?

To spark students' interest in the rapidly growing field, IEEE has launched TryComputing.org—a website aimed at preuniversity students, parents, and teachers.

Developed by IEEE Educational Activities and the IEEE Computer Society, the site encourages students to check out such areas as video games, social media, software development, and network engineering. TryComputing follows in the footsteps of the successful TryEngineering.org—an IEEE website that explores the vast array of career possibilities within the broader field of engineering.

Since its launch in September, TryComputing has had more than 13 000 visitors from around the world, including Australia, Canada, China, Costa Rica, Ecuador, England, India, South Korea, and the United States.

EXPLORING OPTIONS

The new site's Discover page is a good place to start. There, students can select keywords that best describe what they like to do—perhaps analyzing, communicating, or fixing technical problems.

Based on those tags, TryComputing matches students with a career track that fits their interests.

They can also click on the Work tab and then the "Visit a list of computing careers" link to see job titles within computer engineering as well as a brief overview of responsibilities associated with each role.

What is a day like in the life of a computer engineer, and where can a degree in computer engineering take you? So far, 14 computer engineers—including software engineers, game developers, and entrepreneurs—have answered those questions on the site, and more are expected to add their stories. Students can browse these profiles, which include the engineers' job descriptions, what it took to get them where they are now, and what makes their careers enjoyable.

Among the engineers featured is IEEE Senior Member Susan K. "Kathy" Land, deputy program manager of the Missile Defense Agency, part of the U.S. Department of Defense. She helps manage the development of command, control, and battle communications systems.

Land, a former IEEE Computer Society president, says, "Active participation in a professional association, like IEEE, is critical for individuals who wish to get the most from their professional careers."

TryComputing also offers a number of ways for students to get involved in computer science outside the classroom. Students can click on the Inspire tab and then "Computing student opportunities" to find a list of events, including the Intel International Science and Engineering Fair, the world's largest preuniversity science competition.

For students who have decided to pursue a computer science degree, or for school counselors helping students choose a university, the site provides a directory of more than 1700 schools from around the world that offer accredited programs in the field.

Students click the Study tab and enter their field of interest and country, and the directory presents nearby schools. Included in the results are links to each school's website.

Undergraduate and graduate students looking for money to help pay for their education can review TryComputing's list of scholarships and fellowships. Among them is the IEEE Computer Society's Richard E. Merwin Scholarship, which awards US $1000 or more to IEEE student members who are active in their student branches and who show promise in their academic and professional efforts.

FOR TEACHERS, TOO

TryComputing also offers resources for preuniversity teachers. They can download free lesson plans that teach basic computing concepts, including algorithms and product design.

The plans, which are meant for students between the ages of 10 and 18, include activities such as solving mazes, programming binary clocks, and building graphical models of a city. To add to the mix, teachers just need to click on "Submit your lesson plan ideas."

A version of this article appeared on The Institute's *website in November in the Career and Education channel.*

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OLIVER MALMS/ISTOCKPHOTO

CONFERENCES: JUNE–DECEMBER 2013

Upcoming IEEE conferences cover topics related to computing

Rebooting Computing Workshop

WASHINGTON, D.C.; 11–12 DECEMBER

TOPICS: Rethinking all aspects of computing, including design, function, performance, and energy efficiency. The workshop is being held in conjunction with the International Electron Devices Meeting, taking place from 9 to 11 December.

SPONSOR: IEEE Future Directions Committee
VISIT: http://www.his.com/~iedm/general/future.html

International Conference on Supercomputing

EUGENE, ORE.; 10–14 JUNE

TOPICS: Computer architecture and hardware, including multicore and multiprocessor systems, accelerators, memory, interconnection networks, and storage; high-performance computational and programming models; high-performance system software; and hardware for big data scenarios, with a focus on high-performance data analytics.
SPONSOR: IEEE Computer Society
VISIT: http://www.ics-conference.org

International Symposium on Computer Architecture

TEL AVIV; 23–27 JUNE

TOPICS: Processor memory storage systems architecture; parallel and multicore systems; instruction, thread, and data-level parallelism; architectures for security and virtualization; network processors and router architectures; architecture modeling and simulation methodology; and data-center scale computing.
SPONSOR: IEEE Computer Society
VISIT: http://isca2013.eew.technion.ac.il

International Superconductive Electronics Conference

CAMBRIDGE, MASS.; 7–11 JULY

TOPICS: Digital superconducting circuits and systems, mixed-signal circuits and systems, quantum information technology, RF and microwave applications, passive devices and components, metrology and active analog devices, and superconducting spintronics.
SPONSOR: IEEE Council on Superconductivity
VISIT: http://www.isec-2013.org

International Conference for High-Performance Computing, Networking, Storage, and Analysis

DENVER; 17–22 NOVEMBER

TOPICS: Algorithms, networks, bioinformatics and computational biology, inverse problems, processor architecture, chip multiprocessors, graphics processing units (GPUs), memory subsystems, security and identity management for cloud computing, data management, and storage networks.
SPONSOR: IEEE Computer Society
VISIT: http://sc13.supercomputing.org

International Conference on High-Performance Computing

HYDERABAD, INDIA; 18–21 DECEMBER

TOPICS: High-performance computing, parallel and distributed algorithms and systems, parallel languages and programming environments, hybrid parallel programming with GPUs and accelerators, fault-tolerant algorithms and systems, cloud and grid computing, interconnection networks and architectures, and power-efficient and reconfigurable architectures.
SPONSORS: IEEE Computer Society, Association for Computing Machinery
VISIT: http://www.hipc.org

PROFILE

Elie Track: Rethinking the Computer

A superconductivity expert tackles the challenge BY SUSAN KARLIN

TODAY'S BOTTOMLESS pit of information creates an endless need for computers with greater storage, higher performance, and more energy-efficient systems. Computing can generate so much heat that servers must be positioned near water for cooling. And the power they require is beginning to exceed the capabilities of local power plants. So, is it time to rethink the computer?

IEEE Senior Member Elie Track thinks so. He is president of the IEEE Council on Superconductivity and cochair of the IEEE Rebooting Computing Working Group [see "The Future of Computing," p. 6]. A senior partner at Hypres, a superconducting electronics company in Elmsford, N.Y., Track chairs the group with IEEE Fellow Tom Conte, a professor of computer systems and software at Georgia Tech.

IEEE began its Rebooting Computing initiative last year to rethink the design and function of computers, hoping to attain greater performance on less energy. The working group members have a broad range of expertise, including computer architecture, multicore approaches, and high speed devices.

They will meet once a month by phone and through a website. The group plans to hold a meeting with thought leaders in December following the IEEE International Electron Devices Meeting in Washington, D.C., to finalize the redesign recommendations they will share with the community.

The idea is for the experts to weigh in on the pros and cons—and dispel concerns— about their particular arenas. "We're envisioning an interdisciplinary exchange across the board, so experts who usually work in their own silos can now work together," Track says.

His expertise is in superconductivity. Superconductive ICs utilize the intrinsic properties of superconductors, which include zero electrical resistance. That means "lightning fast speed" can be achieved, according to Track.

So far, superconductor ICs have been able to reach 10 times the speed of semiconductors, with potential for 100 times the speed, Track estimates. The technology has been applied in wideband satellite communications and other wireless transceiver applications.

"The need for cooling the superconducting ICs to cryogenic temperatures is greeted with fear and hesitation," he says. "The Rebooting Computing group is the first step toward changing these attitudes. The reality is that cryocoolers are very reliable today, and failures often result from electronic rather than mechanical components."

Superconductivity is a necessary component to realize the initiative's goals, because computing at lower temperatures will save more energy than it takes to cool the systems, Track says.

SUPERCONDUCTING FOCUS

With the exception of a two-year teaching sabbatical, Track has spent his 25-year career at Hypres, focusing on the R&D of superconducting microelectronics in communication applications. In the 1990s he applied the technology to help develop a self-contained primary voltage standard, to calibrate devices such as voltmeters, as well as secondary standards.

Superconductivity is indispensable to realizing a primary voltage standard—essentially defining the volt by international agreement—whereby the unit of voltage is derived from the fundamental units of frequency, the electron charge, and Planck's constant. The relationship among these units is realized physically by a superconducting integrated circuit. Track is now applying superconductivity to improve the speed and capacity of transceivers for wireless communications and to improve the image quality at lower fields in magnetic resonance imaging.

Currently, wireless signals travel the airways as modulated analog signals. Communications systems reduce the signal to a lower frequency for digitization, which causes a data loss. Track is working on a method for near-instantaneous digitization that produces superior signal fidelity. The key to realizing the digitization at wide bandwidth is a superconducting analog-to-digital converter uniquely capable of producing very high linearity and dynamic range at high frequencies.

Superconductivity has experienced ebbs and flows of interest over the years. Now, Track says, high-performance and energy-efficiency needs are driving a revival. But the high amount of energy that it takes to bring circuits to super-cooled, superconducting levels makes computers built entirely of superconductors impractical. "It's not a solution in itself but must work in tandem with other solutions such as multicore processing," he says. "We must take a holistic look at the whole computing system."

REAL-WORLD PHYSICS

Track, born in Lebanon, graduated from the American University of Beirut in 1979 with a bachelor's degree in physics. He was drawn to applied physics after taking a liking to the electronics used in physics experiments. He went on to earn a master's degree and a Ph.D. in physics from Yale University in 1982 and 1988, with a focus on applied physics.

He joined Hypres as a staff scientist and eventually worked his way up to CEO, a position he held until 2000. When the company, with his blessing, brought in a new CEO to take the firm in a more commercial direction, he became a consultant and partner, exploring new applications for Hypres's technology.

Throughout his professional life, he has kept in touch with student communities, which has honed his ability to explain his work in layman's terms, an invaluable skill in describing his research to technical and nontechnical audiences.

Since 1999, Track has been a member of the Yale Science and Engineering Association (including a stint from 2007 to 2010 as president), raising awareness of Yale's engineering program and raising funds for academic engineering scholarships.

From 2003 to 2005, he indulged a desire to teach by becoming a visiting physics professor at Fairfield University, in Connecticut, where he developed a course in wireless communications for non-science majors. And he helped mentor mechanical engineering students at the University of North Carolina at Charlotte, where he served as an adjunct professor of physics from 2008 to 2011.

A GENERATION AWAY

For now, the working group plans to apply its redesign recommendations to enhance the performance and energy efficiency of large systems. "The temperatures required by superconducting electronics make them more suited to large systems, such as servers and data centers, than for handheld or small consumer products," Track says. "The performance of large systems would then enable ordinary gadgets to be more powerful and efficient by their connectivity through the cloud, as in cloud computing."

After that, fundamental innovations in compact, portable, efficient cryocoolers are needed to create portable products using superconductors—a challenge for the next generation of engineers.

GLUEKIT

PART-TIME PASSIONS

Jessica du Maine

Buzzing Buddies

IEEE SENIOR MEMBER

Jessica du Maine is in awe of her buzzing partners. "Bees are just amazing," she says. "They live in a matriarchal society, they're engineers, the workers are female, and the only purpose of the male drones is to mate with the queen."

How does someone get into beekeeping? For du Maine, it was a need to occupy herself after her youngest child left for college last year. "The year before that, I thought, what am I going to do with myself when I'm not raising kids?" she recalls. She considered raising goats but learned they needed milking twice a day. Bees, on the other hand, "produce food, and you don't have to babysit them," she says.

PASSION
Beekeeping

OCCUPATION
Patent examiner

HOMETOWN
Alexandria, Va.

Du Maine, who lived in Missouri at the time, started attending meetings and taking classes at the Eastern Missouri Beekeepers Association. "Turned out there was a whole urban beekeeping thing going on in St. Louis," she says.

She bought a starter kit that included hives [a snow-covered hive is pictured above], a smoker to calm the bees, a suit to protect herself, and a honey extractor. She got her first bees soon after, when an association member brought her some starter hives (including 10 000 bees and one queen) from a bee farm in Louisiana.

During the colder months in Missouri, du Maine fed her bees a syrup of boiled-down sugar water—a weekly 2-hour task. When honey production started, she checked on her bees monthly. "It's like taking the roof off a house," she says. "You don't want to bother the bees too much. The best time is in the morning, after the forager bees [with stingers] leave to gather nectar. The only time I got stung was when I went into the beehive late in the day without wearing proper equipment."

Harvesting, extracting, and filtering the honey took a few hours, she says. "Working with the bees was scary at first," she adds, "but it felt like a partnership. I kept them fed, and they returned the favor."

In August, she became a patent examiner with the U.S. Patent and Trademark Office in Alexandria. Before leaving Missouri, she donated her hives—which she couldn't take with her—to a St. Louis beekeeping program for teens.

Now she's looking into teaching beekeeping courses.

"Patent examining is a high-stress job. It's all about production," she says. "It's very calming in the bee yard. Bees respond to pheromones. They know when you're excited, so you have to center yourself. They're such hard workers, they make you feel like you should be doing more." —*Susan Karlin*

Sudeendra Koushik

Crafting Cartoons

BY DAY, IEEE Member Sudeendra Koushik creates products and services as the director of innovation for HCL Technologies in Bangalore, India. By night, his creations take a more visceral form.

Koushik spends most evenings perfecting his cartooning skills so that his drawings can be exhibited at the Indian Institute of Cartoonists gallery, in Bangalore. A member of the IIC, he specializes in cartoons about technology, management, engineering, and Indian current affairs. He posts his work at KoushikCartoons.blogspot.com.

PASSION
Cartooning

OCCUPATION
Innovation director

HOMETOWN
Bangalore, India

"Cartooning helps me innovate because both sides of my brain are engaged," he says. "A cartoonist sees various aspects of a situation. That ability helps me see different solutions to an engineering problem. It increases the left-right brain connection, because you're writing a joke with one part of your brain and drawing it with another."

Koushik began drawing when he was 7 years old, at a time when a career as a professional artist was less culturally acceptable. He had an affinity for science and math, so he decided to study electrical engineering at the University of Mysore. There, he drew cartoons for the university newspaper and designed posters for campus events. After graduating, he worked full time as an electrical engineer and part time as an advertising illustrator. "I was drawn to the efficiency of advertising cartoons," he says. "Messages had to be short but convey a lot without much dialogue."

As Koushik's engineering duties increased, he abandoned his advertising gig and, later, his cartooning. But he never stopped thinking about it. When his work took him to Singapore and the Netherlands, he noted the local cartooning styles.

"I returned to India with a more global sense of humor," he says. He resumed his hobby, frequently adding European touches to the backgrounds of his cartoons.

Today Koushik draws about four times a week. About six months ago, he began drawing on a tablet computer, using Paint.net, Corel, and Photoshop. It takes about four hours for him to craft a cartoon, and a solo show at the IIC gallery requires 50 professional-quality cartoons.

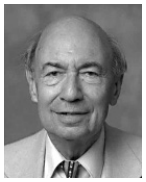
"I hope having a show will give me the momentum to approach newspapers and magazines with my work," he says. —*S.K.*

CLOCKWISE FROM LEFT: NICOLE DU MAINE; SUDEENDRA KOUSHIK; KRUTHIKA KOUSHIK; ISTOCKPHOTO

IN MEMORIAM

Fritz J. Friedlaender

IEEE MAGNETICS SOCIETY PRESIDENT
Member Grade: **LIFE FELLOW**
Age: **87**; *Died:* **3 OCTOBER**



Fritz Josef Friedlaender was a founding member of the IEEE Magnetics Society, serving as its president in 1977 and 1978.

For 45 years, Friedlaender was a professor of electrical and computer engineering at Purdue University, in West Lafayette, Ind. A renowned expert in the field of magnetism, his research focused on the engineering applications of magnetic domains, and he made significant contributions to high-speed data storage. He retired in 2000 as professor emeritus.

In addition to the Magnetics Society, Friedlaender was also a member of the IEEE Computer, Education, and Power & Energy societies.

He earned bachelor's and doctoral degrees from the Carnegie Institute of Technology (now Carnegie Mellon University) in 1951 and 1955.

Irving S. Reed

COMMUNICATIONS PIONEER
Member Grade: **LIFE FELLOW**
Age: **88**; *Died:* **1 SEPTEMBER**

Irving S. Reed, a mathematician and engineer, was best known for inventing along with Gustave Solomon a class of algebraic error-correcting and error-detecting codes, known as Reed-Solomon codes. And he and David E. Muller developed the Reed-Muller codes, a family of linear error-correcting codes used in communications.

From 1951 to 1960, Reed worked at MIT's Lincoln Laboratories, in Lexington, Mass., where his research focused on computer programming languages and the theory and analysis of radar systems.

In 1960, he left Lincoln Laboratories to join Rand Corp., a nonprofit research facility in Santa Monica, Calif., partly funded by the U.S. government. Three years later he became a professor of computer science and electrical engineering at the University of Southern California, in Los Angeles. Reed was a founding member of the university's Communication Sciences Institute and its Signal and Image Processing Institute. He retired in 1993.

Reed received several IEEE awards for his technical contributions, including the 1989 Richard S. Hamming Medal and the IEEE Information Theory Society's 1998 Golden Jubilee Award for Technological Innovation. He shared with Solomon the 1995 IEEE Masaru Ibuka Consumer Electronics Award for "contributions to basic error-correcting codes, specifically the Reed-Solomon codes, which have led to the compaction of data and made possible a generation of consumer compact optical disk products."

Reed earned his bachelor's, master's, and doctoral degrees, all in mathematics, from Caltech.

Erwin Tomash

COMPUTER INDUSTRY PIONEER
Member Grade: **LIFE SENIOR MEMBER**
Age: **91**; *Died:* **17 DECEMBER**

Erwin Tomash was cofounder of Dataproducts Corp., which became one of the world's largest manufacturers of high-speed printers.

After serving as a radar specialist in the U.S. Army Signal Corps during World War II, Tomash became a junior electrical engineer at Engineering Research Associates, a computing firm, in Arlington, Va.

In 1962 he cofounded and became CEO of Dataproducts, in Los Angeles. Through the next two decades, the company developed dot-matrix and more advanced digital printers. Tomash stepped down as CEO in 1971 and retired in 1980 as chairman of the board.

In 1979, he cofounded the Charles Babbage Institute in Minneapolis at the University of Minnesota. The research center specializes in the history of information technology, digital computing, computer programming, software, and networking.

Tomash received the IEEE Computer Society's 1987 Computer Entrepreneur Award in recognition of his early pioneering work. He was a member of the Computer Society and the IEEE Society on Social Implications of Technology.

He received a bachelor's degree in electrical engineering in 1943 from the University of Minnesota, then earned a master's degree in engineering in 1950 from the University of Maryland, in College Park.

FRITZ J. FRIEDLAENDER: IEEE; IRVING S. REED: UNIVERSITY OF SOUTHERN CALIFORNIA; ERWIN TOMASH: STAR TRIBUNE

ELECTION

2013 Election Countdown

A look at the open positions and deadlines

ON 1 MAY, the IEEE Board of Directors is scheduled to announce the names of all candidates to be placed on this year's ballot. The ballot will include candidates for IEEE president-elect, who are nominated by the board, as well as nominees for delegate-elect/director-elect openings, submitted by their respective division and region nominating committees. The candidates for 2013 IEEE president-elect have already been announced [see p. 4].

The ballot also includes nominees for president-elect and members-at-large of the IEEE Standards Association board of governors; vice president–elect, IEEE Technical Activities; and president-elect and member-at-large, IEEE-USA. The IEEE Board of Directors is also responsible for placing proposed constitutional amendments on the ballot.

IEEE members who have not been nominated but want to run for office must submit their intention to petition to the IEEE Board of Directors. It must be received at the IEEE Operations Center, in Piscataway, N.J., by 15 April. Petitions must be accompanied by the necessary number of valid voting members' signatures, and the petitioner must meet other requirements as well.

For more information about the petition process or the annual election, visit http://www.ieee.org/elections or contact corp-election@ieee.org.

UP FOR ELECTION IN 2013

Chosen by all voting members
- IEEE president-elect

Chosen by members of all technical divisions
- IEEE Technical Activities vice president–elect

Chosen by members of the respective technical divisions
- IEEE Division II delegate-elect/director-elect
- IEEE Division IV delegate-elect/director-elect
- IEEE Division VI delegate-elect/director-elect
- IEEE Division VIII delegate-elect/director-elect
- IEEE Division X delegate-elect/director-elect

Chosen by members of the respective regions
- IEEE Region 1 delegate-elect/director-elect
- IEEE Region 3 delegate-elect/director-elect
- IEEE Region 5 delegate-elect/director-elect
- IEEE Region 7 delegate-elect/director-elect
- IEEE Region 9 delegate-elect/director-elect

Chosen by members in Regions 1–6
- IEEE-USA president-elect
- IEEE-USA member-at-large

Chosen by members of the IEEE Standards Association
- IEEE Standards Association president-elect
- IEEE Standards Association board of governors members-at-large

DEADLINES AT A GLANCE

15 March
Deadline for organizational units to submit slates of candidates to the IEEE Board of Directors for inclusion on the annual election ballot

15 April
Deadline for submitting intention to petition for an office on the annual election ballot

1 May
IEEE Board of Directors submits to the voting membership a list of nominees for IEEE president-elect; delegate-elect/director-elect, as applicable; and other positions to be elected by voting members for the coming term. The board also announces whether it intends to put forward any constitutional amendments.

14 June
Petition signatures nominating an individual for placement on the annual election ballot must be received by noon EDT USA/16:00 UTC.

15 August
IEEE annual election ballots are sent to all voting members on record as of 30 June. Voters can also begin accessing their ballots electronically.

1 October
Ballots must be received by noon CDT USA/17:00 UTC.

JUAN DARIEN/ISTOCKPHOTO

The Annual Election Results Are In

HERE IS THE IEEE Tellers Committee's tally of votes from valid ballots counted in the 2012 annual election and approved in November by the IEEE Board of Directors:

IEEE President-Elect, 2013

J. Roberto B. de Marca	23 229
Tariq S. Durrani	22 194

IEEE Division Delegate-Elect/ Director-Elect, 2013

Division I

Ellen J. Yoffa	1508
Alfred E. Dunlop	1009
Rakesh Kumar	842

Division III

Harvey A. Freeman	3305
Byeong Gi Lee	3176

Division V

Susan K. (Kathy) Land	3456
James D. Isaak	2861

Division VII

Wanda K. Reder	2848
Noel N. Shulz	1657

Division IX

Marina Ruggieri	2347
Jae Hong Lee	1189
Jerry C. Carroll	917

IEEE Region Delegate-Elect/ Director-Elect, 2013–2014

Region 2

Timothy P. Kurzweg	1568
Gerard J. Christman	1293
Emilio M. Salgueiro	624

Region 4

Robert C. Parro	1013
Bernard T. Sander Jr.	1007
Hamid Vakilzadian	561

Region 6

Thomas M. Coughlin	3408
Paul J. Kostek	2096

Region 8

Costas M. Stasopoulos	5543
Saurabh Sinha	4846

Region 10

Ramakrishna Kappagantu	4064
Kukjin Chun	3121
Nim K. Cheung	2634

IEEE Standards Association Board of Governors Member-at-Large, 2013–2014

Philip C. Wennblom	779
Wael William Diab	679

IEEE Standards Association Board of Governors Member-at-Large, 2013–2014

Paul J. Hearty	727
Robert S. Oshana	690

IEEE Technical Activities Vice President–Elect, 2013

Jacek M. Zurada	14 942
Vincenzo Piuri	12 995

IEEE-USA President-Elect, 2013

Gary L. Blank	13 454
Clarence L. (Lee) Stogner	8424

IEEE-USA Member-at-Large, 2013–2014

Kristi J. Brooks	16 506
Ron T. Ogan	5427

ACHIEVEMENTS

Introducing the 2013 Fellows

The Institute *congratulates these 297 IEEE senior members from around the world who were named IEEE Fellows for 2013. They join an elite group of nearly 6900 IEEE Fellows, who have contributed to the advancement or application of engineering, science, and technology.*

Ramachandra Achar
Scott T. Acton
Robert C. Aitken
Stephen B. Alexander
Jeffrey Andrews
Hiroyuki Arai
Carter M. Armstrong
Rolf Aschenbrenner
Gaetano Assanto
Farrokh Ayazi
Ralph H. Baer
Salvo Baglio
R. Jacob Baker
Alexander A. Balandin
Peter M. Balma
Andrew R. Barron
John E. Barth
Sanjoy K. Baruah
Khosrow Behbehani
Amine Bermak
Robert E. Berry
Jacek Blazewicz
Vincent Blondel
Enrico Luigi Bocchieri
Wolfgang M. Boesch
Maurice Borgeaud
Rodney Brooks
Martin Buehler
David R. Bull
Ramón Cáceres
Vince D. Calhoun
Om-Prakash N. Calla
Jan Camenisch
Charles Forrest Campbell
Gail A. Carpenter
Robert Henry Caverly
Kwok Kee Chan
Mansun Chan
Yao-Wen Chang
Raja Chatila
Kwok Tong Chau
François Chaumette
Kuo-Ning Chiang
Jeffrey R. Childress
Tzi-Dar Chiueh
Peter Sienpin Chow
Andrzej Cichocki
David S. Cochran
Gérard Denis Cohen
Jonathan H. Connell
Marco Corsi
Max H.M. Costa
Paul W. Coteus
David R.S. Cumming
Mihai Datcu
Suman Datta
Antonio De Maio
Louis A. Dessaint
Suhas N. Diggavi
Yujie J. Ding
Branislav V. Djokić
Matthew B. Dwyer
Ahmed Mostafa Elantably
Ayman M. El-Refaie
Yonina C. Eldar
Ali Emadi
Takatomo Enoki
Johan H.R. Enslin
David Esseni
Rene-Jean Essiambre
B. Fardanesh
Aaron Fenster
Elena Ferrari
Jeffrey Foerster
Giles M. Foody
Paolo E. Gamba
Erwin C. Gangl
David Garlan
Alan D. George
Saeed S. Ghassemzadeh
Gerard Ghibaudo
Georgios Ginis
Dimitris Gizopoulos
Fred Glover
Lalit Goel
Kenneth Goodson
Clément Gosselin
Leonid Grcev
Marshall Greenspan
Marco Guglielmi
Christine Guillemot
Ruyan Guo
Hani Hagras
Alexander M. Haimovich
Jung Han
Kenneth A. Hansen
Yang Hao
Jayant R. Haritsa
James Hayward Harlow
Sailing He
Akira Hirose
Håkan Hjalmarsson
James C. Hoe
Donald G. Holmes
Anders Host-Madsen
Michael S. Hsiao
Dan M. Ionel
Sushil Jajodia
Ulrich Jakobus
Xiaohua Jia
Karl H. Johansson
Rolf Johansson
Leo Joskowicz
Tadeusz Kaczorek
Swarn Singh Kalsi
Lina J. Karam
Joel S. Karp
Nei Kato
André Kaup
Tetsuya Kawanishi
Jeffrey O. Kephart
Yann H. Kerr
Peter B. Key
Kazuro Kikuchi
Nicholas G. Kingsbury
Masaru Kitsuregawa
Geoffrey Stephen Klempner
Gerhard Klimeck
Kevin W. Kobayashi
Wei-Hu Koh
Joseph A. Konstan
Yoram Koren
Kenneth Kreutz-Delgado
Gerhard Krieger
Kannan M. Krishnan
Kadaba R. Lakshmikumar
Riccardo Lanari
Carl E. Landwehr
David C. Larbalestier
Sung-Ju Lee
Luke F. Lester
Juerg Leuthold
Paul Leonard Lewin
Guifang Li
Li Erran Li
Yanda Li
Shunlin Liang
Mark Liao
Daniel Liberzon
James P. Libous
Ying-Dar Lin
Tamas Linder
Mikko H. Lipasti
Michal Lipson
Marco Liserre
Eugene Litvinov
Chih-Wen Liu
Yan-Fei Liu
Jinhu Lu
Kai-Kuang Ma
Yi Ma
Gerald Q. Maguire
Ravi V. Mahajan
Jean Mahseredjian
Danilo Mandic
Madhav V. Marathe
Radu Marculescu
Igor L. Markov
Paul W. Marshall
Seán Cian Ó Mathúna
Carlos Mazure
William Robert McCown
Alexander McEachern
Gaudenzio Meneghesso
Helen Mei-Ling Meng
Dean Mensa
Subhasish Mitra
Mauro Mongiardo
Kip Morison
Arthur S. Morris
Paul Muralt
Sreenivasa S. Murthy
Matt W. Mutka
Brad A. Myers
Christopher J. Myers
Michael R. Neuman
Zaiping Nie
Ali M. Niknejad
Cun-Zheng Ning
Masaaki Niwa
Masaya Notomi
Chikaodinaka Nwankpa
Eiji Oki
Bikash C. Pal
John W. Palmour
Daniel Palomar
Constantinos B. Papadias
Antonia Papandreou
Frank Chongwoo Park
Jong-Keun Park
Steven D. Pekarek
Marcello Pelillo
Serge Pelissou
David J. Perreault
Beatrice Pesquet-Popescu
Christian Y. Pichot
John W. Pierre
Kameshwar Poolla
Peter J. Pupalaikis
Sanjay Raman
Steven K. Reinhardt
Kate A. Remley
Michel Renovell
John Robertson
Jon Rokne
Alton D. Romig
Richard C. Rose
Caroline Anne Ross
Lucio Rossi
Mark E. Russell
Matthew N.O. Sadiku
Corsi Sandro
Sudeep Sarkar
Takuro Sato
Ton van der Steen
Randhir Thakur
Thomas N. Theis
Zhi Tian
Leon M. Tolbert
Michail K. Tsatsanis
Haruhiko Tsuchiya
Gene Tsudik
Antonia Maria Tulino
Matthew A. Turk
Jerzy Tyszer
Kenji Uchino
Ramasamy Uthurusamy
Guy A.E. Vandenbosch
Ingrid Verbauwhede
John P. Verboncoeur
Pramod Viswanath
Harish Viswanathan
Wei-Yen "Wayne" Wang
Wen-Hann Wang
Xi-Zhao Wang
Yuan Wang
Karl F. Warnick
James L. Wayman
Tsachy Weissman
David James Wetherall
Philip Charles Woodland
Dapeng Oliver Wu
Feng Wu
Tzong-Lin Wu
Jing Xiao
Dehong Xu
Jie Yang
Peide Ye
Eric M. Yeatman
B. Yegnanarayana
Wen-Yan Yin
Chen-Hua D. Yu
Tak Shing Peter Yum
Ramin Zabih
Ephraim Zehavi
Qing Zhao
Zhi-Hua Zhou
Glenn Zorpette
Geoffrey G. Zweig

ISTOCKPHOTO

CALL FOR NOMINATIONS

Nominations Sought for IEEE Leaders

Volunteers needed to serve as corporate officers and committee members and chairs

IEEE IS GOVERNED by volunteer members and depends on them for many things, including editing IEEE publications, organizing conferences, coordinating regional and local activities, writing and authorizing publication of standards, leading educational activities, and identifying individuals for IEEE recognitions and awards.

The Nominations and Appointments (N&A) Committee is responsible for developing recommendations to be sent to the Board of Directors and the IEEE Assembly on staffing many volunteer positions, including candidates for president-elect and corporate officers. Accordingly, the N&A Committee is seeking nominees for the following positions.

2015 IEEE President-Elect
(who will serve as president in 2016)

2014 IEEE Corporate Officers
- Vice president, Educational Activities
- Vice president, Publication Services and Products
- Secretary
- Treasurer

2014 IEEE Standing Committees
(members and chairs)
- Awards Board
- Employee Benefits and Compensation
- Ethics and Member Conduct
- Fellow
- Governance
- History
- Nominations and Appointments
- Public Visibility
- Tellers

DEADLINE FOR NOMINATIONS

15 March 2013

WHO CAN NOMINATE?

Anyone may submit a nomination; nominators need not be IEEE members, but nominees must meet certain qualifications. Self-nominations are encouraged. An IEEE organizational unit may submit recommendations endorsed by its governing body or the body's designee.

A person may be nominated for more than one position. Nominators need not contact their nominees before submitting the form. The N&A Committee will contact nominees to ascertain their eligibility and their willingness to serve.

HOW TO NOMINATE

For information about the positions, including qualifications and estimates of the time required by each position during the term of office, check the Guidelines for Nominating Candidates at http://www.ieee.org/about/corporate/nominations/nominations_guidelines.html. To nominate a person for a position, complete the online form.

NOMINATING TIPS

Each year many ineligible candidates are nominated. Before submitting a nomination, make sure to check eligibility requirements on the N&A Committee website at http://www.ieee.org/about/corporate/nominations.

The positions for which the N&A Committee makes recommendations represent the uppermost governance levels in IEEE. Volunteers with relevant prior experience in lower-level IEEE committees and units are recommended by the committee more often than volunteers without such experience. For example, candidates for the Awards Board have a greater likelihood of being recommended if they have already served on an awards committee of a society, section, or region or on another IEEE board.

Individuals recommended for president-elect and corporate officer positions are more likely to be recommended if they possess a strong track record of leadership and relevant accomplishments within and outside IEEE. Recommended candidates often have significant prior experience as members of IEEE boards and standing committees.

—Moshe Kam, Chair
2013 IEEE Nominations and Appointments Committee

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