Distributed Systems

From the Editor's Bench
Shlomo Engelberg

On Transitions, Transparency, and New Beginnings

The IEEE and its publications are run largely by volunteers, and there are many places where volunteers are needed and used. Many of us take our first steps as volunteers by "volunteering" to write or peer review an article.

Several years ago I wrote an article (with Yona Bendelac) about measuring physical constants using noise. I "volunteered" the article to the magazine, and Kim Fowler, the editor-in-chief, accepted the article. I continued working on measurement related issues, and submitted other articles. When the magazine expanded from four issues each year to a bimonthly publication, Kim asked me if I would be interested in writing a twice-yearly column. I was happy to accept Kim's offer.

Last year, as Kim prepared to move on to other posts within the IEEE Instrumentation and Measurement Society—Kim is now the executive vice president of the society—Kim asked me if I would be interested in moving up to an editorial position. Though it seemed like it might involve quite a bit of work, it also sounded like a real challenge. It was clear that the new position would present me with the opportunity to meet more of my colleagues and with a way that I could make a contribution to the engineering community. After discussing the issue with Kim and my family, I decided to accept Kim's offer. For the past several issues I have been working as the associate editor-in-chief of the magazine. Starting with this issue, I have the opportunity to serve you as the magazine's editor-in-chief.

I invite all of you to consider "volunteering" to do some work for the magazine. If you are doing interesting instrumentation and measurement related work and you are interested in sharing it with our community, drop me a line (at shlomoe@jct.ac.il). If you would like to get a "sneak preview" of what the magazine will be publishing, volunteer to peer review articles. We are always happy to include new volunteers in the magazine's "family."

Since starting to work with the staff at the magazine, I have been very impressed with the transparent way in which the magazine is run and with the way the transition has been managed. Through the hard work of Kim Fowler, the outgoing editor-in-chief, June Sudduth, the assistant

to the editor-in-chief, and Joy Richmond, the managing editor, and because all of them have been willing to tell me and show me just what I need to know and do as editor-in-chief, I have been able to hit the ground running. I have every hope that the transition will be almost "seamless" for our authors, columnists, and for our readers.

Before moving on to a brief description of the articles and tutorial that this month's issue presents, I would like to take this opportunity both to thank Kim Fowler for the help that he has unstintingly provided me with, for his long and dedicated service to the *IEEE Instrumentation and Measurement Magazine* (where he will continue to serve as a regular columnist), and I would like to wish him well as he moves into his new position as the executive vice president of our society. I am sure that we will all benefit from his service as executive vice president, and I hope that he enjoys his new position as well.

The focus of this issue is distributed systems. We have an article concerning a safety critical network for distributed smart traffic signals, a column that deals with distributed measurement systems, and a control theory tutorial that deals with how one treats delays. (Delays are often a problem in distributed systems.) We also have an article on microwave measurements, an addendum to tutorial 12 on outputs and actuators, and a column that deals with advanced learning tools. Enjoy!

Shlomo

President's Perspectives

Alessandro Ferrero

Measurements: a cost or a revenue maker?

I wonder if you share my feelings about industry's view of metrology. Whenever I visit an industrial plant, I frequently find that metrologists in a Test & Measurement (T&M) department are confined to manage incoming inspections and final tests. They seem to be considered annoying people, whose main goal is to find out somebody else's failure to meet a required product specification or a quality standard e.g. the ISO 90000 series of Standards. Not an asset in the production process and as just an undesirable, though necessary cost. These pessimistic thoughts have been verified by my friend Sergio Sartori, the former director of INGC. (INGC is one of the two former Italian National Metrology Institutes that have been recently merged with INRIM). He drew my attention to an article published in a Bulletin of the Collège Français de Métrologie.

This article reported a case study about a mid-sized European industry (with 20 M€ yearly sales), with a production rejection rate of about 4% of the sales (about 800 k€/year). Despite this, the estimated revenue is about 5% of sales (about 1 M€/year). The top management planned to increase the revenues by a further 10% (corresponding to 100 k€/year) by motivating the marketing and sales staff.

However, the T&M department provided an in-depth analysis of the production rejects and found out that the 70% of the total rejects were due to three main causes. The main reason was found to be an inaccurate description of what the customer needed. The acceptance/rejection rules were set incorrectly and more than half the rejects did meet the customers' needs when the rules were set correctly. The second reason was related to the final acceptance test. It was totally based on the operator's subjective experience, instead of on objective data (the measurement of some well defined physical characteristics of the product). After setting-up an acceptance test based on a new, objective measurement procedure, it was discovered that more than the 70% of the previously rejected products passed inspection. The third reason was due to the recommended tolerances that were set by the marketing department. They were mainly based on aesthetics, instead of on specifications of tolerances according to the customers' true needs.

The T&M department submitted recommendations for new inspection rules, the manufacturer followed the recommendations and the net increase in revenues was about the 30% (320 k€/year) without decreasing the customers' satisfaction and without increasing sales! This case study shows that a good T&M department is capable of not only repaying its own cost, but also generating a significant revenue, sometimes higher than the one attainable with a sales increase.

However, as I discussed with Sergio during one of the nice conversations we usually have when we meet, this result can be attained if a number of typical measurement issues are correctly dealt with by the T & M staff: What are the real customers' needs? How have the most critical tolerances been set for the product, and how have they been tailored to the customers' needs? Is the measurement procedure for testing the product specifications adequate to meet the goal, and has the target uncertainty been set adequately?

All these questions relate to measurement problems and have a great economic impact. They can't be disregarded in any good industrial process, because if underestimated it might cause significantly lower incomes, that are nothing else than losses. Finding the correct answer, however, requires competent people, well trained in the I&M field and well motivated by the top management to take part into the top-level decision processes.

The I&M Society has been and is active in advancing knowledge and competence in this area, and its membership represents the most qualified competence in the I&M field. Together with my Season Greetings and my wishes for a Happy New Year, let me also wish that this incoming year brings more and more appreciation for metrology!

Alessandro

In Memoriam: Steve Adam
February 28, 1929 – June 5, 2008

Our friend and colleague, Steve Adam, passed away on June 5, 2008 in Los Altos, California. Many of us had the joy and delight of working with Steve and socializing with Steve and Edie over the past few decades at conferences and in the society's AdCom.

I have known Steve Adam since the beginning of the nineties. Although he was Hungarian electrical engineer, as I am also one, I learned of him only through IEEE. We had our first of longer talks when I got involved in the organization of IMTC/2001 in Budapest, then in the administrative committee of IMS.

We have made the presentation of the venue and organizing for the Board of Directors in 1996, in Brussels. I clearly remember how we were scared to death undertaking something of this scale. Then Steve came to us and offered his help. From this time on, we always counted on him, be it the conference preparation, budgeting, organization of a local IEEE section, or urging colleagues to become active in IEEE. He was friendly, open, and helpful. He was a fixed point in our lives: since he was brought up in Hungary, his gestures, thinking and associations were so familiar to us that he could let us immediately understand what he wanted. Besides, he spoke clean Hungarian, so all this happened in our mother tongue...

We always admired his energy. He had surgeries more complex than any of us would ever have. He accepted everything naturally. When he lost most of his eyesight a few years ago,

we thought: how sad, we are losing him. Then he reappeared, walking a bit uncertainly (he really did not see much), but came and participated in discussions, with more energy we ashamed youngsters ever had ...

   He is an example for us. We will very much miss him. – István Kollar

      Not only was Steve a major pillar of the Society, he was also a remarkable person. I remember him telling Bob and me that his office was right between the offices of Bill Hewlett and Dave Packard. I remember the horror story of Steve smuggling his students out of Hungary during the 1956 revolution -- crawling through the mud in the dark of night? And how they all made it!
      Steve and Edie were the perfect couple -- warm, fuzzy, crazy, funny and
caring. – Leslee C. Myers

      While Steve had a superb technical resume and history, his recounting of the 1956 Hungarian Revolution struck me as a shining example of courage and sacrifice during extremely oppressive conditions. Steve related some of his experiences in the Hungarian Revolution to me during a two-hour layover in the Denver airport in April 2003.
      He was caught up almost by accident in the days of protest and street fighting in 1956 during the futile attempt to oust the Soviets from Hungary. As a young professor Steve was headed to university to teach one day when a massive crowd of protesters swept across a bridge into his path, some of his students in the crowd urged him to join them. He told me how the Hungarian people acted with integrity; when the windows of bakeries were broken, people would take the bread and cakes from display and leave money, which other people did not take.
      Steve quickly rose to a position of leadership in the uprising. He recounted how they learned a weakness of the Soviet tanks and that a Molotov cocktail smashed into a ventilation duct just below the turret would disable the tank. They also determined that the Soviet tank columns traveled in single-file groups of nine vehicles; the Hungarians would count the tanks as they turned a corner and then would attack the last the one in line – the ninth one; this would prevent the first eight tanks from defending the last tank. This method worked until the Soviets added a tenth tank to a column. While attacking the ninth tank machine gun fire from the tenth tank tore through Steve and he was severely wounded. The Hungarians tried to give him medical care while the Soviets pursued him but Steve required hospital care to save his life, which put him into Soviet hands. Many months of negotiations by the United Nations to gain Steve's release followed; Steve experienced repeated cycles of hope of leaving captivity and despair when it did not happen. Eventually Steve did leave Hungary and found a place at Hewlett Packard in California.
      Steve is greatly missed by all of us in the I&M Society; our condolences to Edie, his wife. – Kim Fowler

Article Summaries

A Safety Critical Network for Distributed Smart Traffic Signals
Sanjeev Giri and Dr. Richard W. Wall

For the past two years, researchers at the University of Idaho's National Institute for Advanced Transportation Technology have been developing a method for more efficient traffic control called "Smart Signals". This method employs multiple microprocessors connected by an Ethernet, allowing for more advanced activity and security within an intersection than what is currently offered by central traffic controllers. Among the advantages Smart Signals provides are faster fault-detection, cheaper hardware requirements, greater precision, and smaller space occupancy. Furthermore, Smart Signals caters to overall better safety management by providing drivers and pedestrians with accurate and timely information, and by detecting special needs by intersection occupants. For example, a person may require more time to cross an intersection that typically allotted. This would be picked up by the microprocessors and communicated to the overall network to allow more time for the pedestrian – a feature only Smart Signals can offer!

MICROWAVE MEASUREMENTS – Part III
Advanced Non-Linear Measurements

Valeria Teppati, Andrea Ferrero, Vittorio Camarchia,
Alessandra Neri, Marco Pirola

As the latest publication of a series on microwaves and measurements, Part III offers two approaches aiding in power amplifier design and transistor modeling. "The first technique is the multi-tone/complex modulation load-pull. It is useful especially for wireless applications, where conventional single tone excitations do not give sufficient information for model and design development. The measurement conditions would be too far from the typical working ones. The second measurement technique is the time-domain waveform load-pull. Its applications span from highly accurate and reliable device model extraction to monitoring of actual operating conditions and 'waveform engineering' for high performance design… These techniques provide designers with important insights at the amplifier level and give the necessary device-level information for the development of devices with enhanced performances."

Tutorial 12: An Extension to Outputs and Actuators
Kim Fowler

"This is an addendum to the fine tutorial by de Silva and Wang that published last February [1]. De Silva and Wang's tutorial introduced the basic types of outputs, covering several important cases of mechatronics and displays. This tutorial addendum details some concerns with several of those actuators and outputs, focusing on real-time systems found in instrumentation because they run many different devices, types of equipment, and vehicles." A few key focuses include motor speed control, maximum power transfer, nonlinear resistance, and more.

Tutorial 17: Control Theory, Part III
Control Systems with Delays
A Pictorial Introduction
Shlomo Engelberg

"In this article, Shlomo Engelberg develops and describes five complementary methods of analyzing feedback systems with a single delay, and utilizes the different methods to provide insight into the general characteristics of the systems. These characteristics include the existence of an infinite number of closed-loop poles, the calculations of important quantities that characterize the system, and the response simulation of the system to important classes of inputs. By combining the information given by all of the methods, one is able to develop insight into, and intuition about, such systems. Finally, a simple application of the developed ideas is presented to demonstrate how a measurement strategy can affect the performance of a system."

Column

My Favorite Experiment
John Witzel

Give a Gift of Science for the Holidays this Year

Why buy it when you can build it? When I was a youngster, our first color TV was a kit my dad put together. Although I was too young to do much of anything but watch, I was hooked. My dad even learned enough from building this kit to design a degaussing coil to erase the strange (but really cool) moiré patterns I created on the screen by waving large magnets across it.

As I grew up, my first oscilloscope was a kit, my first digital calculator was a kit, my first digital watch was a kit, my first ham-radio was a kit, my first computer was a kit, well, you get the idea. When was the last time you built a kit with your son or daughter? Granted, it was easier to find kits when I was younger but that doesn't mean they disappeared from the stores, the stores just relocated to the web.

I build kits whenever possible for two reasons; for ownership of the finished product and (most importantly) because when I am finished I know more than when I started. Kits have taught me a lot, although it took me a few years into my first engineering job to realize and appreciate what I had learned outside of textbooks. I had a good advantage as a young engineer because I had unknowingly gained a feeling for manufacturability and assembly issues, PCB layout, repair techniques, cabling, parts research and much more that has helped my career immensely throughout the years. Kits are both educational and fun.

Now, years later when the holidays or birthdays roll around for my grandkids, I don't automatically send them the most popular toy of the moment, I try and send a kit. It's become a tradition. A tradition I'd like to share.

Technology has both been a death-nail and a blessing to kits. Although you don't see science kits advertised on TV, at the local Healthkit store or in magazines any more, a Google of "science kits" returned 1,150,000 hits as of this writing. Some of the better ones I've found I'll share with you this holiday season. Give them a peek before you solidify your gift giving list and you can enjoy some very hard to come by shared time with your kids, most importantly, they may thank you someday.

Whether you decide on model rockets, Ham radios, general science or a home automation kit, all the tools and skills necessary for engineers like us are within easy reach. Give it a try; you might just have some fun too!

Internet Address	Comments
http://www.ramseyelectronics.com/	One of my favorite for electronic kits; they have a free catalog too
http://www.electronickits.com/	Lots of kits - PDF's of the kit manuals are free for the download
http://qkits.com/	Electronics kits
http://xump.com/Science/ScienceKits.cfm	Broad selection of general science kits
http://sciencekits.com/	General science kits
http://www.siliconsolar.com/solar-electronic-kits.php	Kits based on solar cells
http://www.estesrockets.com/	Remember the old Estes rocket kits? Find them here!
http://www.publicmissiles.com/	Rocket kits on steroids! Adult help required
http://www.mastermindtoys.com/	Enter a search for "kits" here; site makes age based recommendations

http://apogeekits.com/	Electronic kits
http://www.abra-electronics.com/	Electronics kits including some test equipment kits
http://www.vellemanusa.com/engine.php	Hundreds of kits including home automation kits
http://www.canakit.net/	Many small electronic kits
http://www.oselectronics.com/	Kits and many cheap parts for the DIY types
http://www.discoverthis.com/	General science kits aimed at the young with age recommendations
http://www.ac6v.com/kits.htm	Here is a list of dozens of links to inexpensive Amateur Radio kits
http://www.elecraft.com/	Professional Amateur Radio kits
http://scientificsonline.com/	Edmund Scientific; a little bit of everything here
http://www.alltronics.com/	Kits and a fantastic source of very cheap parts
http://www.hobbytron.com/	Science kits, electronics kits, robotics kits and a lot of RC toys
http://www.goldmine-elec.com/	Specialty kits and many cheap parts
http://parallax.com/	Robotics and PIC based kits - great stuff here!
http://www.mpja.com/	A great source of cheap parts and surplus items

Table 1, Some of my favorite sites for science kits, projects and inexpensive DIY parts.

John

Instrumentation Notes

(Summary)

Bruno Andò, Alberto Ascia

Advanced Learning Tools: From Real Needs to Useful Student Support

Today's technology is primarily used for advancing communication, whether for signal transmission to orbiting satellites, smart sensor technology, or for improving connection speeds and accuracy. In this article, technology is applied to a new spectrum of advanced communication – helping disabled persons battle their learning disabilities. Here, remote teaching and advanced monitoring tools are introduced which have the ability to adapt to the user's special needs, including aid for the visually impaired. These tools work by monitoring needs, skills, and responses that might otherwise be masked by the user.

Instrumentation Notes

(Summary)

Andrzej Kalicki, Łukasz Makowski,

Andrzej Michalski, Zbigniew Staroszczyk

**Distributed Measurement Systems –
A Web System Approach: Part 2**

Continuing from the April 2008 publication on proprietary software benefits, Distributed Measurement Systems picks up with free and open source software solution. "For both parts.. two approaches [are presented]: a modern style web application and more classical programs. Despite clear differences, they share many common features including: database use, visualization style, and dividing the effort of data processing and visualization between server and client machines. [Part Two demonstrates how]… free and open source software such as the servers, libraries, and the whole platforms… are a great help and provide the opportunity to create a large measurement system in a relatively easy yet standardized way." " [This publication proves] that the same objectives met with proprietary solutions can be achieved with FOSS, if not even better than with proprietary software."

New Products

Robert Goldberg

Agilent's Extended Network Analysis Capabilities up to 20 GHz
Agilent Technologies announces the addition of the 2/4 port, 20 GHz option to its ENA (Extended Network Analysis) network analyzers, as well as the introduction of a new E5092A configurable multiport test set. Agilent describes these new offerings as "best-in-class RF performance" over a wide frequency range with fast measurement speed and multiport measurement capability to the ENA network analyzers.

Agilent's new 20 GHz option extends the 8.5 GHz frequency range of the E5071C ENA Series network analyzer up to 20 GHz. It is used to evaluate a wide range of components, such as the third harmonics of passive components in WLAN, WiMAX™, UWB or any 4G technology that

uses carrier frequency up to 6 GHz. The new 20 GHz option supports both 2-port and 4-port configurations. It is available as an easy upgrade to all existing E5071C port number and frequency range options.

The Agilent E5092A configurable multiport test set, a replacement of the existing E5091A solution, is used to evaluate multiport devices for front-end modules in cellular handsets or WLAN devices, and other multiport devices. It works with the ENA network analyzers to provide frequency coverage up to 20 GHz. The E5092A provides 10-port full crossbar measurements, or up to 22-port measurements, thereby supporting a larger number of ports than other similar solutions.

Agilent's new ENA Series 20 GHz option and E5092A configurable multiport test set feature a user interface and programming commands that are compatible with existing ENA Series solutions, including the multiport test set.

The Agilent ENA network analyzers offer many network analysis solutions, ranging from very low-cost, basic S-parameter measurements to advanced multiport and balanced measurements. The standard ENA analyzers (e.g., E5071C) expand network analysis with advanced features, while the lower cost ENA-L analyzers (e.g., E5061A or E5062A) provide basic S-parameter measurements with an integrated 50 or 75 ohm test set.

 For information about Agilent's new ENA Series measurement options, go to www.agilent.com/find/ena.

New Software Configurable 4 & 8 Port Desktop USB to Serial Adapters
Sealevel Systems announces the SeaLINK+4.SC and SeaLINK+8.SC as two additions to the SeaLINK® USB to serial product line. Offering four or eight serial ports that are software configurable for RS-232, RS-422, or RS-485, the adapters eliminate the need to open the enclosure to change jumper settings or dip-switches. The devices maintain their electrical interface settings locally, allowing the host computer to be repaired or upgraded without reconfiguring the serial ports.
The serial ports on each SeaLINK adapter appear as standard COM ports to the host computer enabling compatibility with legacy software. All Sealevel SeaLINK USB serial adapters use a state-machine architecture that greatly reduces the host computer's overhead when communicating over multiple serial ports simultaneously while supporting data rates to 921.6K bps. Status LEDs on the front of the enclosure indicate serial data activity, electrical interface, and power.

The SeaLINK+4.SC and SeaLINK+8.SC are USB bus powered, so no external power supply is needed. Both models include highly-retentive USB type B connectors to help prevent unintentional disconnection from standard USB cables. When used with the included USB cable with a locking type B connector, the metal thumbscrew provides a secure connection to the device and prevents accidental cable disconnection.

All SeaLINK products ship with the Sealevel Systems SeaCOM™ suite of Windows drivers and diagnostic utilities.

For more information visit www.sealevel.com.

High Accuracy Pressure Transducers
 Omega Engineering introduces the Model PX409 Series of Pressure Transducers. These transducers offer superior performance in a small 0.75" diameter package. The micro-machined silicon sensor has been proven to deliver premium accuracy, elite temperature performance, and long term stability. The silicon sensor is protected by a stainless steel diaphragm which transfers pressure to the sensor by a thin film of silicon oil. The PX409 is ruggedized with a minimum of 4x overpressure protection and secondary containment rated to even higher pressure. Custom specifications for accuracy, temperature performance, units, fittings, and ranges are available. These models are ideal for industrial, automation, test, automotive, and aerospace applications.

Omega piezoresistive pressure transducers have been used in high performance commercial and aerospace applications for over 25 years. The piezoresistive process uses strain gauges molecularly embedded into a highly stable silicon wafer. The silicon wafer is diced into individual die which each contain a full strain gauge bridge. The die is mounted in a sealed chamber protected from the environment by glass to metal seals and a stainless steel diaphragm.

In operation, a small volume of silicone oil transfers the pressure from the diaphragm to the strain bridge. The construction provides a very rugged transducer with exceptional accuracy, stability and thermal effects. A unique design ruggedizes the transducers by providing secondary fluid containment in the event of a diaphragm rupture.

Omega's automated test equipment performs pressure and temperature cycling on 100% of the PX409 transducers. The transducers are then calibrated using extremely high accuracy equipment and a 5-point NIST traceable calibration certificate is included with each transducer. Standard features of the PX409 Series include protective features built into the electronics and the pressure element. Reverse polarity, EMC, and power supply fluctuation protection are standard on all models. Intrinsically Safe and CSA ratings are optional.

For more information please visit www.omega.com/ppt/pptsc.asp?ref=PX409_series.

Time Interval Analyzer

Brilliant Instruments introduces the BI200 Time Interval Analyzer, a PCI-Express based instrument-on-a-card for time and frequency measurement. Based on a new extremely efficient architecture, Brilliant claims the BI200 provides performance levels that far exceed those of the bench-top instruments on the market at a fraction of the cost, size, weight, and power.

The BI200 consumes only 20 W and occupies only a single x1 PCIe slot, yet it delivers 4 million time interval measurements per second with input signal frequency of up to 2 GHz or 4 Gb/s

(without prescaling) and minimum pulsewidth of 150 ps. The time intervals can be the period, or pulsewidth of one signal, or the time difference (skew) between two signals, or one of ten other functions, while each of the measurements has a resolution of 3 ps. The measurements can be streamed continuously to the computer memory over the PCI-Express interface for extremely high throughput. For example, it is possible to set up the instrument to take 100 pulsewidth measurements over a period of 25 microseconds. Then, with a latency of a few microseconds, read the results (including statistics) over the PCIe. This opens up new test and control applications with very fast feedback loops.

The low power and small footprint also allow realistic scaling to large channel count systems with a low cost per channel.

Applications for the BI200 span a multitude of industries – semiconductor test (ATE), serial I/O signals integrity, radar systems and more. Even modern digitally controlled power systems with DC/DC converters can benefit from the ability to continuously measure the pulse width modulation directly on each and every pulse, providing an easy direct measurement of the dynamic response of the power supply controller.

For more information please visit www.b-i.com.

Guide to Wireless and RF Testing

Keithley Instruments announces the availability of Advanced Measurement Techniques for OFDM- and MIMO-based Radio Systems: Demystifying WLAN and WiMAX Testing, a new guide to wireless and RF testing. This CD contains useful and informative RF testing resources, including application notes, articles, white papers, and product demonstrations, to help engineers reduce their cost of test by simplifying and solving the most challenging RF measurement applications.

Advanced Measurement Techniques for OFDM- and MIMO-based Radio Systems provides test engineers with a broad range of information on the fast changing wireless communication and RF testing field for a wide array of applications, including spectrum analyzer power averaging, as well as the most challenging testing of the most complex signals, such as OFDM, MIMO, and WiMAX. In-depth application notes cover topics such as battery testing for mobile phones, RF semiconductor characterization, and RF and microwave signal switching in test setups. The CD also includes an RF glossary and useful tables, such as wireless communication protocol specifications, dBm-Watts-Volts conversion tables, and VSWR loss conversion tables.

To request a free copy of the CD Advanced Measurement Techniques for OFDM- and MIMO-based Radio Systems or for information on any of Keithley's RF test solutions, visit www.ggcomm.com/Keithley/Jun08PR_RFHandbookCD.html.

New Smaller Size Hollow Shaft Potentiometers

Spectrum Sensors and Controls introduces a new line of hollow shaft potentiometers that take up less space, have infinite resolution, long life and excellent output smoothness. These potentiometers feature an anodized aluminum, thermo plastic design with diameters ranging from 0.860" to 2.620" (2.2cm to 6.7cm) and a rotational life of 5 to 50 million cycles minimum, making them ideal for animatronics/robotics, automotive handicap controls and military joysticks.

Spectrum's hollow shaft potentiometers have electrical angles from 26° to 355° ±2°, independent linearity range of ± 0.5% to ± 1.0%, power ratings of 0.5W to 2W @ 70°C and a maximum output smoothness of 0.1%. These potentiometers offer a resistance range of 1KΩ ~ 20KΩ ±10%, 360° continuous rotation, and require no wiper installation/phasing.

Spectrum's potentiometers utilize a co-molded conductive plastic element for a hard smooth surface and greater long-term reliability compared to raised circuit element potentiometers. In Spectrum's process, the termination and resistance materials are simultaneously molded with the base substrate.

For more information please visit www.specsensors.com.

TI Announces New Power-Efficient DSPs and Applications Processors

Texas Instruments introduces its low-power processor roadmap with more than 15 new devices across four product lines. For the first time, designers will be able to easily bring portability to applications requiring high-precision floating-point processor capabilities, as TI claims their new roadmap includes the industry's lowest power floating-point digital signal processor (DSPs). TI's new devices also enable significantly longer battery life with the industry's lowest power fixed-point DSP. Additionally, customers will have the option to design portability and feature rich GUIs into their products using TI's new ARM9™ and ARM9-plus-DSP applications processors.

TI low power solutions include:

- **Low power and high precision with new TMS320C674x DSPs:** For the first time, developers will have the ability to bring portability to audio, medical, industrial and other applications requiring the precision, wide dynamic range and time-to-market benefits of floating-point DSPs. See the product bulletin at www.ti.com/c674xpb.

- **High performance at half the power with TMS320C640x DSPs.** The C640x DSPs use half the power of existing high-performance devices in TI's TMS320C6000™ DSP platform, giving system designers the ability to add portability to processing-intensive applications including software defined radio, industrial instrumentation and emerging markets. See the product bulletin at www.ti.com/c640xpb.

- **Multimedia performance and low power with OMAP-L1x applications processors.** Enabling developers to integrate feature-rich GUIs as well as networking and touch screen capabilities into their portable designs, the new OMAP-L1x product line includes

ARM9 and ARM9-plus-DSP architectures. See the product bulletin at www.ti.com/omapl1xpb.

- **Maximize battery life with TMS320C550x.** For developers requiring the longest battery life, TI will be extending the low-power leadership of its TMS320C5000™ DSP platform with new C550x devices. The new DSPs include large on-chip memory as well as an optimized FFT coprocessor for faster analysis and still cut core power consumption levels to 6.8 µW in deep-sleep mode and 46 mW total power in active mode – half the power of existing C5000 devices. See the product bulletin at www.ti.com/c550xpb.

For more information, including product bulletins, visit www.ti.com/lowpowerprocessors.

Water Sensors Solve Challenging Liquid Detection in Clear, Frosted or Colored Containers

Banner Engineering WORLD-BEAM® QS30H2O Opposed Mode Water Sensors provide an innovative solution for efficiently detecting water-based liquids in clear, frosted, colored or even partially opaque bottles or containers. QS30 Water Sensors use a specially designed 1450 nm sensing beam, which is inherently absorbed by water, to make the previously challenging clear bottle/clear water combination detection a high-contrast application, enabling reliable detection. In addition, QS30 Water Sensors have high excess gain to "burn through" colored glass, labeled/decorated bottles and translucent milk jugs to detect the liquid contents.

QS30 Water Sensors consist of an emitter and a choice of either a low-power receiver, ideal for detecting water in clear bottles, or a high-power receiver, designed to effectively receive the emitted beam through partially opaque containers. In addition, the 13 mm diameter beam can be shaped using one of the three apertures that come standard with each emitter/receiver pair. The aperture reduces excess gain and narrows the sensing beam, facilitating accurate detection of water in vials, test tubes or other small vessels and containers.

For further information please visit www.bannerengineering.com.

USB Programmable Smart Vibration Switch

The IMI Sensors division of PCB Piezotronics (PCB®) has released the Series 686B USB Programmable Smart Vibration Switch, designed for 24/7 continuous vibration monitoring and protection of critical machinery.

Series 686B offers a smart alternative to unreliable mechanical switch technology. This electronic switch has much better accuracy and reliability than traditional mechanical switches, and is easily installed in place of existing mechanical switches, since it only requires two wires – and can replace legacy switches without the need for additional cable runs. Series 686B also offers a remote reset capability and USB programmable delays to avoid false trips. This

universally powered unit is hermetically sealed for use in the harshest of environments, mounts with a single stud like a sensor, and is available for use in hazardous areas.

For additional information, visit www.pcb.com.

Geotest Introduces GP1612H Function Generator

As part of its line of legacy instrumentation replacement products, Geotest has introduced the GP1612H, a 100% form-fit-function replacement solution for the obsolete HP 8112A pulse generator. The GP1612H is 100% drop-in replacement for the Hewlett Packard 8112A, requiring no code modification and offering full compatibility with the HP 8112A's features and functions.

Besides full GPIB programming compatibility with the obsolete HP 8112A, the GP1612H's features include a straightforward front panel display that shows individual parameters and their values; selectable complementary pulse and double pulse – in continuous, triggered, gated and counted burst modes; and selectable predefined amplitude and offset for critical stimulus signal generation for testing of major semiconductor technologies including TTL, CMOS and ECL.

For more information please visit www.geotest.com.

Show-n-Tell™ CAD/CAM Tool Provides Learning and Communication

VX Corporation announces the release of its new Show-n-Tell™ communication tool. "Show-n-Tell" is built into VX CAD/CAM for on screen step-by-step lessons and to automate design review and markup as a 3D Markup tool.

The debate over the most effective CAD/CAM training method has been going on for over two decades. Users get frustrated by out-of-date printed documentation that CAD/CAM companies struggle to keep current. Videos are easier to keep current, but most users do not like flipping back and forth from the video tutorial to their CAD system with every step. Nearly every professional CAD system offers the option to take instructor-led training (ILT) in a real or virtual classroom, but this can be costly. This style can either give you the best personal attention or "leave you in the dust."

With the "Show-n-Tell" tutorials, there are no video drivers or codecs to install or reams of paper to print. The "Show-n-Tell" tutorial is launched by loading a VX file. Users can step back and forth with a click of a button and all instructions are on screen eliminating the need to flip back to a video or hold a book open. No more grey-scaled images from a tutorial book. 3D models, showing the expected result, can be rotated and zoomed, giving the user better feedback and understanding. Users work at their own pace, not that of an instructor, so no one gets left behind. VX allows the user to save the "Show-n-Tell" tutorial session and reload it at a later date. Along with the new tutorials, users will also be able to launch the new QuickTips™ instructions from the help menu.

QuickTips™ covers common questions and provides productivity tips using videos, stills and text instructions. VX will initially include four "Show-n-Tell" tutorials with the release of this new enhancement, and plans are already in the works to make more available for download in the future.

Show-n-Tell™ authoring is simple enough that a user can use it for both design review and markup.

Find more information at www.vx.com.

RF Conducted Immunity System Tests to All Automotive Specifications

AR RF Microwave Instrumentation has introduced the Model CI00401 RF Conducted Immunity system (100 watts nominal / 10 kHz – 400 MHz), a complete, self-contained system for automotive testing.

The system contains a signal generator, 3-channel power meter, 100-watts nominal AR amplifier (10 kHz – 400 MHz), directional coupler, and control software. Everything is contained in a single housing, eliminating setup issues. The CI00401 has the versatility required for every test laboratory and equipment manufacturer.

Model CI00401 Provides Complete Testing Solutions to the Following Standards:
- ISO 11452-4
- GMW 3097
- ES-XW7T-1A278-AC
- DC-H224
- BMW GS95002
- Other automotive standards

The system's RF amplifier and signal generator can be used independently. If special needs arise or when standards change, a larger amplifier can be connected to the system. Spectrum analyzers and monitoring equipment can also be controlled by the system software.

Find more information at www.ar-worldwide.com.
Optical Spectrum Analyzer

Yokogawa Electric Corporation releases the new AQ6370B Optical Spectrum Analyzer, a greatly enhanced replacement for the AQ6370 Optical Spectrum Analyzer. By reengineering the AQ6370B, Littrow light reflections have been removed, measurement time improved by 50 percent compared with the AQ6370 for example, and command processing speeds increased, thereby improving measurement quality, efficiency and reducing cost on the production line.

The rapid growth of high-speed optical networks, triggered by the dramatic increase in network traffic including image data, has caused the 10-Gbit/s high-speed transmission to move beyond its traditional role in backbone networks. These high-speed rates are being extensively used in

metro networks (intra-city networks) and access networks. As a result, the production of communication equipment and optical components for 10-Gbit/s transmission has increased.

The design of the AQ6370B traces back to 1998 with the release of the AQ6317 series followed by the AQ6370 in early 2006 which enhanced measurement efficiency.

Product Features include:

- A 50 percent improvement in throughput over the AQ6370 model and a measurement speed 10 times faster than the AQ6317 series. Thus the AQ6370B will dramatically improve the measurement time in an automatic measurement system at a production site.

- The monochromator, which resolves a beam of light by wavelength, reduces noise caused by the measurement of light near the optical signal thus producing greater accuracy.

- Close-in dynamic range: The ability to suppress the optical noise near the optical signal in resolving light by wavelength.

- Weight has been reduced to 19 kg, some 30% lighter than the previous model.

For more information about Yokogawa, please visit their web site at www.yokogawa.com.

2008 IEEE Joseph F. Keithley Award in

Instrumentation and Measurement

Sponsored by Keithley Instruments, Incorporated

The IEEE Joseph F. Keithley Award in Instrumentation & Measurement award is presented for outstanding contributions in electrical measurements. It was established in 2001 and was presented for the first time in 2004. It is awarded by the IEEE.

The 2008 Joseph F. Keithley Award is presented to

Robert G. Fulks

"For pioneering developments in automated measurements"

Robert G. Fulks developed the first fully automatic bridge for measuring capacitance at General Radio Company (GenRad) and the first commercial test system for printed circuit board assemblies containing complex digital logic circuits. His career accomplishments are of lasting significance to the field of electronic test measurements, improving the efficiency, and significantly reducing the cost of system and component manufacturing. His systems have been used by major computer companies as well as the U.S. Navy to test and repair circuit boards at field repair sites, on ships and in submarines. Mr. Fulks is former chairman of the IEEE committee that developed the IEEE-488 (GPIB/HPIB) instrumentation interface standard and a former chairman of the Boston section of the IEEE group on instrumentation and measurement that later became an IEEE Society. He is past chairman of the Advanced Automatic Test Equipment Concepts committee for the U.S. Navy. He holds 10 patents and has published numerous papers in the area of electronic measurement. Mr. Fulks holds a bachelor's and master's degrees in electrical engineering from the Massachusetts Institute of Technology, Cambridge.