

The IEEE Instrumentation & Measurement Magazine
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AUTOTESTCON 2009 Technical Highlights

From the Editor's Bench

Shlomo Engelberg

Expose Yourself to Automated Test Equipment

At this time each year, we publish the AUTOTESTCON issue. In this issue, we cover the 45th edition of AUTOTESTCON which was held in Anaheim, California from September 14 – 17, 2009. The conference was sponsored by the IEEE Instrumentation and Measurement Society and the Aerospace and Electronics Systems Society. If, like me, you do not spend too much time dealing with the world of automated test equipment (ATE), this issue should be a real eye opener. In preparing this issue, every article that appeared in the AUTOTESTCON Proceedings is reviewed, and we at the magazine try to present you with a selection of the most generally oriented, interesting, and best written of the articles that appear in the proceedings. By reading the articles, you will get a feel for the concerns of the ATE engineer. With this issue and the conference proceedings, you will begin to understand how truly large systems work and how such systems are designed and maintained.

As a college professor, I have seen how exams are dealt with by colleges and universities. Preparing exams is not simple, and tracking exams across multiple campuses is far from trivial. Much work goes into preparing and tracking exams, but for all the care that is taken with exams, we do not come close to the care that is taken with some of the systems described in this issue. It is fascinating to see how the government and the military deal with the technical and logistical problems they face. In this issue, we present six articles from the proceedings. We have articles that describe implementing serial bus interfaces, instrument design that meets the challenges of legacy and emerging requirements, TPS data collection and data mining, testing and prognostics of ball grid array components, a Common S²ENCE Maintenance system, and efficient techniques for reducing error latency in on-line periodic BIST. Thanks to our columnists, we also have a selection of columns for you. Enjoy!

Shlomo

I&M Society President's Greetings

Kim Fowler

AUTOTESTCON is a premier conference for military, aerospace, and industrial instrumentation. Its primary and perennial theme is automated test systems for military equipment. The Instrumentation and Measurement Society, IMS, is very pleased to co-sponsor AUTOTESTCON with the IEEE Aerospace and Electronic Systems Society, AESS.

AUTOTESTCON and I2MTC are the largest conferences that IMS sponsors. Both conferences address concerns and issues related to instrumentation and measurement and have complementary markets. AUTOTESTCON tends to be more applications-focused within the military and industrial markets, while I2MTC tends to have a more academic focus. Both conferences are extremely important venues for presenting and exchanging ideas and advances in instrumentation and measurement.

Over the years, AUTOTESTCON has been very successful, drawing 200 to 300 exhibitor booths and upwards of a thousand attendees. This year should be no exception. AUTOTESTCON's Board of Directors and Conference Committee have been diligent in preparing a remarkably successful conference. I commend them on their ongoing efforts and thank them, as well as the General Chairs and the Technical Program Chairs, for hosting AUTOTESTCON.

This issue of the I&M Magazine contains selected paper reprints from AUTOTESTCON 2009. I trust you will find them interesting, and that you will consider attending a future AUTOTESTCON.

Kim

Message from the IEEE Aerospace & Electronic Systems Society

Marina Ruggieri, President, 2010-2011

The focus of the Aerospace and Electronic Systems Society (AESS) is the organization, systems engineering, design, development and operation of space, air, ocean and ground complex systems through the effective interaction among the three pillars of the aerospace, electronic and defence sector: industry, institutions and research centers.

AUTOTESTCON is very well framed within the field of interest of AESS. It is a successful conference for the military, aerospace and industrial instrumentation communities. AUTOTESTCON provides an excellent example of enhancement and dissemination of the culture of complex systems through the international community, bringing a large and beneficial exchange of experience and achievements among our members.

AESS is extremely proud to be a primary sponsor of AUTOTESTCON - since its founding in 1964 - and partner with IEEE in one of its most successful application focused conferences. AESS is also pleased to share the sponsorship with the Instrumentation and Measurement Society (IMS). It is a good opportunity to thank the IMS for its support and for this special AUTOTESTCON issue of the I&M Magazine. A special thank-you goes to the AUTOTESTCON Conference Committee and the AUTOTESTCON Board for their extraordinary effort to make AUTOTESTCON 2010 a great event for the whole engineering community!

Marina

Article Summaries

Implementing Serial Bus Interfaces Using General Purpose Digital Instrumentation

(Summary)

Dale Johnson

As the electronics industry has evolved, so too has the number of methods for transferring information between electronic components. Today there are many protocols for communicating between components, circuit boards, subassemblies, least replaceable units (LRUs), and systems. A common choice facing test engineers responsible for testing components using one or more of these serial protocols is whether to purchase test instruments dedicated to a specific bus or to purchase general-purpose test equipment and program the instrument to provide the required functionality. The use of generic digital test instruments for emulating common serial bus protocols can often provide benefits over dedicated bus test products. This paper explores three serial bus protocols: the Serial Peripheral Interface (SPI) bus, the Inter-Integrated Circuit bus (I²C) bus, and a Joint Test Action Group (JTAG) bus, and discusses how one might use a general purpose digital instrument to emulate these busses and the benefits of doing so. Following are brief descriptions of these common serial busses.

This summary includes text from the article.

Common S²ENCE Maintenance

(Summary)

Simon M. Jessop, Johan Reimann, and Patrick W. Kalgren

The Common Smart Support Enhancements for Net Centric Enabled Maintenance (Common S²ENCE Maintenance) System is a set of data transfer services and self-evolving reasoning technologies designed to automatically shorten test times and increase diagnostic accuracy. A major focus in the development of the Common S²ENCE program is the reduction of cost required to develop the system using standard interfaces and automated development techniques. As reasoning technologies mature, design efforts must move beyond functional engineering to include the additional lifecycle considerations including low support costs, maximum reusability, and upgradeability. In this article, the authors discuss the related work, the design decisions made during the development of this technology that support both the functional and lifecycle considerations, the system architecture, and the relevant standards.

This summary includes text from the article.

Instrument Design that Solves the Challenges of Both Legacy and Emerging Test Requirements

(Summary)

Carl Heide and David Kaushansky

In designing an automatic test system (ATS) that meets a customer's current and emerging test requirements, many system integrators must also meet the challenge of creating a system that maintains a customer's investment in existing test program sets (TPSs). Test instrument manufacturers can help system integrators overcome this challenge by designing instruments that meet the challenges of both legacy and emerging test requirements. While new technology such as FPGAs and advanced DSP can go a long way toward helping the designer meet both challenges, creating an instrument that successfully matches both sets of requirements requires great care in applying the technology to achieve a high degree of flexibility. In this article, the

authors discuss the reasons a design-for-flexibility approach is so important to the instrument vendor, the ATS integrator, and the end customer, and provide design guidance and examples that illustrate the success of this approach.

This summary includes text from the article.

Efficient Techniques for Reducing Error Latency in On-line Periodic Built-in Self-Test

(Summary)

Hussain Al-Asaad

On-line periodic BIST is a testing method for the detection of operational faults in digital systems. The method applies a near-minimal deterministic test sequence periodically to the circuit under test and checks the circuit responses to detect the existence of operational faults. On-line periodic BIST is characterized by full error coverage, bounded error latency, and moderate space and time redundancy. In this paper, we present various techniques to minimize the error latency without sacrificing the full error coverage. These techniques are primarily based on reordering the test vectors or the selective repetition of test vectors. On-line testing for digital systems is discussed, and we review the most common BIST method, which is typically used to test for manufacturing faults. Methods that reduce the error latency in on-line periodic BIST are presented as well as directions for future research in on-line testing.

This summary includes text from the article.

Test Program Set Data Collection and Data Mining

(Summary)

Ian Willams and Susan Moran

One part of Test Program Set (TPS) development that is often ignored is data collection and processing. Using current software technologies, data storage and retrieval has become a significantly easier task than in years past. Test engineers can easily and efficiently add data collection methods to all phases of TPS development and execution. To help improve test quality and reduce test and manufacturing costs, data mining algorithms and statistical decisions are applied to the test process to define and specifically target parameters and defects that are likely causing unit under test failures. This paper discusses tools and techniques for TPS data collection and near real-time data processing and visualization using commercial, off-the-shelf products (COTS) such as Microsoft® SQL Server® database software and Visual Studio® development system. Authors show examples of how to add simple data collection and processing methods to the UUT test process using .NET programming languages.

This summary includes text from the article.

Advanced Testing and Prognostics of Ball Grid Array Components with a Stand-Alone Monitor IC

(Summary)

Anuj Bhatia, James Hofmeister, Justin Judkins and Doug Goodman

Modern FPGAs can have ball grid array (BGA) packages of over a thousand solder balls affixed to a printed circuit board. The BGA packages provide high interconnect densities using closely spaced solder balls, but they are subject to cracking, oxidation and eventual failure. As each of these solder balls is prone to becoming damaged, intermittent faults occur in fielded equipment. In this paper, the authors present a novel, stand-alone, low power Integrated Circuit, the Solder Joint (SJ) Monitor. It can reside on an FPGA board, monitor I/O pins continuously for solder-joint faults using battery power of less than 5.0 mW, detect all solder joint faults of at least 100 Ω (sensitivity) that last a minimum of 15 ns (resolution) with no false alarms faults, and isolate them before the FPGA begins to exhibit an intermittent failure. SJ built-in self-test can be used to monitor the pins of powered-off FPGAs.

This summary includes text from the article.

Departments

New Products

Robert Goldberg

Logic Protocol Analyzer Test Solution for PCI Express 3.0

Tektronix announces a comprehensive test solution for PCI Express 3.0, the next generation PCIe specification, spanning protocol to physical analysis in a single tool. The new Tektronix TLA7SA16 and TLA7SA08 Logic Protocol Analyzer modules, bus support software, and probes combine to give PCIe 3.0 developers an exclusive, time-correlated view of system behavior, starting with protocol analysis and working down to the physical layer to debug the root cause of elusive problems.

The Tektronix PCIe 3.0 test solution builds on Tektronix' previous generation PCIe protocol and logic analysis offerings. It also expands on previously announced offerings for PCIe 3.0 electrical test and validation including Serial Data Link Analysis (SDLA) Software for the DPO/DSA/MSO70000 Series oscilloscopes.

The Tektronix Logic Protocol Analyzer delivers the best of both a protocol analyzer and a logic analyzer for PCIe design, test and debug. Protocol analyzer capabilities include flexible, integrated data views for analyzing and displaying protocol traffic flow correlated with physical layer events. Logic analyzer capabilities include a wide range of probing options, sophisticated triggering and time-correlated waveform and disassembled listing data displays of raw symbols and lane data. The new PCIe solution expands the TLA7000 Series high-performance logic analyzer family and works with TLA7000 mainframes including TLA7012 portable and TLA7016 bench top models.

Using real-time and HW-accelerated, post-processed statistics displayed in the new Summary Profile Window, the Logic Protocol Analyzer lets users quickly assess system health, identifying artifacts and patterns of interest (errors, specific transaction types, ordered sets, etc.).

The new TLA7SA16 and TLA7SA08 Logic Protocol Analyzer modules provide x8 and x4 lane support respectively with support for 8.0 GTs acquisition rates and support for PCI Express link widths from x1 through x16. The modules are fully compatible with previous generation PCI Express specifications.

Up to 16 GB deep memory (for x16 link) increases chances of capturing both an error and the fault that caused that error. To make maximum use of memory, users can store everything on the bus or use powerful, real-time hardware filtering and conditional storage to store selected transactions over an 11 day period.

Find more information at www.tektronix.com.

Piezoelectric Accelerometer for Flight Vehicles

Meggitt Sensing Systems has introduced the Endevco® model 7257AT, a compact, hermetically sealed piezoelectric accelerometer with integral electronics, designed for vibration measurements on flight test vehicles, particularly ones that incorporate telemetry as their chosen data acquisition system. The distinguishing feature of this accelerometer is that it offers the functions of both flight test accelerometer and airborne amplifier in one small package. Meggitt claims this to be the only sensor of its kind on the market today.

Available in six model variations, with choice of 10 mV/g or 100 mV/g sensitivity and upper corner frequency ranges from 500 to 5000 Hz, the Endevco® model 7257AT offers a $\pm 2.5V$ full scale output, biased at +2.5Vdc, which can be directly interfaced with many different types of telemetry systems. The sensor's unique three-wire configuration offers fixed voltage input, with a built-in four-pole Butterworth low-pass filter that provides necessary out-of-band signal suppression, typically required for telemetry-based applications. In addition, the sensors can be powered by any flight vehicle standard +15 to +32 Vdc supply and are electrically case isolated from the mounting surface.

A recommended accessory for use with the model 7257AT is the Endevco® model 6917M2-XXX, a directly compatible cable terminating with pigtailed. For detailed technical specifications, drawings or additional information about model 7257AT or other Endevco® products available from Meggitt Sensing Systems, visit www.endevco.com.

Triaxial Accelerometer with Low Mass Design

Kistler Instrument Corporation has announced the debut of Type 8688A, a globally patented series of low-cost high-sensitivity IEPE triaxial accelerometers, with optional TEDS, designed to simultaneously measure vibration in three orthogonal axes.

Available in ranges of $\pm 5g$, $\pm 10g$ and $\pm 50g$, with choice of 100, 500 or 1000 mV/g sensitivities, the Type 8688A IEPE triaxial range incorporates Kistler PiezoBeam® technology, with an integral ceramic cantilevered beam, enclosed within a lightweight (less than 6.7 grams for 1000 mV/g), robust, welded titanium housing. Sensing elements are designed to provide outstanding amplitude and phase response over a wide frequency range and are temperature compensated using Kistler's own patented methods.

Type 8688A triaxial accelerometers offer an integral 4-pin connector, facilitating easy mounting and installation into space confined areas. Sensors may be mounted on any of three faces. The accelerometer operates directly from the internal power source found in most FFT analyzers, Kistler Piezotron® power supply couplers or any industry-compatible power source.

With its industry-exclusive low mass design, high sensitivity, high dynamic range and low noise operation, this precision triaxial accelerometer series is ideal for any application where mass loading may be a concern.

For additional details, drawings and specifications, please visit www.kistler.com.

Portable RF Radio Altimeter Test Set for Aircraft Flightline Test

Aeroflex introduces the ALT-8000, RF-based portable radio altimeter flightline test set. The ALT-8000 is a lightweight universal test set for 4.3 GHz FMCW (frequency modulated continuous carrier wave) radio altimeters and pulse radio altimeters with a large 12-inch color touch screen for ease of use.

Aeroflex claims the ALT-8000 to be the first flightline test system of its kind. The ALT-8000 is an inexpensive, portable simulator for testing radio altimeters installed in aircraft and UAV (unmanned aerial vehicles). Until now, flightline test sets have not been RF-based and have only tested the analog or digital back-end of the receiver via test port signal injection. Existing RF based test systems have been confined to bench test applications and rely upon heavy, bulky and expensive delay lines to check altitude indications at one or two fixed points.

By contrast, the ALT-8000 is easy to use and can be carried to the flightline. The ALT-8000 may be directly coupled to the radio altimeter transmitter/receiver (TX/RX) ports or may be connected via supplied TX/RX antenna couplers, which accommodate most aircraft antenna variants. As a result, faulty radio altimeter system elements can be identified faster.

The ALT-8000 radio altimeter flightline test set provides RF simulation of radio altitude from -100 feet to +50,000 feet (+/- 1.5 foot accuracy) and altitude rate may be set to provide a smooth ramping altitude simulation to verify decision heights and altitude trips, for auto-land systems and altitude data feed to EGPWS (enhanced ground proximity warning systems). Up to three ALT-8000 test sets may be linked via an altitude sync line for executing 2- or 3-channel coordinated altitude simulation for dual or triple installation auto-land system testing. The supplied antenna couplers allow the radio altitude system to be quickly verified, without access being required to test ports on the UUT (unit under test). The RF looped test verifies TX frequency, power and sweep rate; the RF level control provides the means to test the UUT sensitivity.

For more information, please visit www.aeroflex.com.

High-Resolution Arbitrary Waveform Generator

Agilent Technologies Inc. has announced the 81180A arbitrary waveform generator, a new generation of instrument that bridges the trade-off between bandwidth and bits. The 8118A is a new class of instrument, an arbitrary waveform generator that provides greater bandwidth and higher resolution.

Until now, engineers had to decide between the optimal bandwidth and optimal signal quality for their application. But many of today's applications require high bandwidth and high-signal quality.

Transferring high-volume data requires digital modulation capabilities with a high dynamic range. With Agilent's new 81180A arbitrary waveform generator, test engineers can achieve both: up to 1.5 GHz bandwidth and 12-bit vertical resolution.

The advanced sequencing in the 81180A supports complex arbitrary waveform. Three levels of sequencing, combined with 64M point's memory, allow engineers to set up complex real-world signals. The dynamic control connector lets real-time applications control the waveform and allows external select sequences.

Different applications require different signal characteristics. The 81180A arbitrary waveform generator is optimized for three different use cases:

- working in conjunction with Agilent's Vector Performance Signal Generator for Inphase/Quadrature applications;
- maximum bandwidth and flatness for direct RF applications up to 1.5 GHz; and
- applications in the time domain with low overshoot and jitter with transition times of 600 ps.

Benefits of the Agilent 81180A include versatile signal generation, high-bandwidth signal generation with very low harmonic distortion and unique flatness.

Additional information about the Agilent 81180A arbitrary waveform generator is available at www.agilent.com/find/81180.

High Power Limiter Protects to 7 GHz

Mini-Circuits new VLM-73+ extends a popular line of SMA connectorized, high power, limiter protection circuits to 7 GHz. Ideally suited for protecting low noise receivers from exposure to unwanted high level signals, the VLM-73+ has only 0.3 dB typical insertion loss in the linear region, yet reacts almost instantaneously (2 nsec typical response time and 10 nsec recovery time) to signals up to 1 Watt input power by limiting the output power to less than +15 dBm across the frequency band. Housed in Mini-Circuits patented Uni-Body construction, the VLM series is a tough unit for the most rugged receiver applications.

For more information, please visit www.minicircuits.com.

Temperature Measurement Handbook

Volume MMXIV Omega Temperature Measurement Handbook® 7th Edition is now available. It offers detailed information and specifications on over 40,000 products for process measurement and control featured on over 2,000 Full Color pages. The New 7th Edition contains the latest technology and new products in sanitary temperature sensors and devices, wireless connectors and instruments, profile temperature labels, thermal imagers and infrared temperature products, automation products, new technical books related to measurement and control, as well as updated technical references and data.

Also included are Omega's most popular temperature measurement and control products including thermocouples, RTD probes and elements, thermistors, calibration equipment, handheld instruments, meters, controllers, timers, transmitters, process controllers and power switching devices, data acquisition, recorders, cryogenics temperature measurement, and heaters.

For more information, please go to www.omega.com/literature.

Clamp Meter Transmits Readings to FLIR IR Cameras

Extech Instruments introduces the new EX845, a 1000A AC/DC CAT IV clamp meter with new METERLiNK™ technology and a built-in infrared thermometer.

METERLiNK™ is an exclusive new technology that wirelessly connects FLIR infrared cameras to Extech meters via Bluetooth™ to accelerate and simplify inspections. During infrared inspections of electrical components, users can transmit key electrical readings such as current or voltage from an Extech EX845 clamp meter directly to a FLIR infrared camera. METERLiNK™ instantly imprints the electrical readings onto a related infrared image not only adding time-savings, but also ensuring accurate, coordinated documentation for PDM inspection reports.

The rugged new Extech EX845 1000A clamp meter is designed to deliver safety and versatility without compromising performance or innovation. The EX845's advanced True RMS meter functions include AC/DC current, voltage, resistance, capacitance, frequency, infrared and contact temperature, diode-test, and continuity check. The fast-responding EX845's peak hold function captures inrush currents and transients.

The bright 4-digit, 4,000 count backlit display is complemented by several one-button functions including data hold, min/max, and selectable auto- or manual-ranging. The large 1.7" (43mm) jaw opening handles conductors up to 750MCM or multiple conductors such as two 500MCM. For quick, point and shoot temperature readings, the patented, non-contact IR thermometer with laser pointer is useful for fast hot-spot detection.

The EX845 has a CAT IV-600V, CAT III-1000V overvoltage safety rating and is CE and ETL approved. The meter comes complete with an 8-piece professional test lead set, a 9V battery, Type K temperature probe, and a belt holster. NIST certification is available for this product.

To learn more about the new EX845, please visit www.extech.com/instruments.

Upgraded 12-Ghz Sampling Oscilloscope

The new PicoScope 9201A PC Sampling Oscilloscope is an essential tool for analyzing electrical communications standards and characterizing connectors, cables, IC packages and printed circuit boards. Unlike a real-time oscilloscope, the PicoScope 9201A builds up a picture of a repetitive signal by combining samples from a large number of cycles of the waveform. This enables it to achieve very high effective sampling rates (up to 5 TS/s) and fast time bases (10 ps/div to 50 ms/div) at a much lower cost than a real-time scope of comparable bandwidth.

The PicoScope 9201A has two 12-GHz input channels, enabling it to analyze a wide range of communication standards up to 6.6 Gb including Ethernet, SONET/SDH, Fibre Channel, InfiniBand, XAUI, G.703 up to 155 Mb, and ANSI T1 up to STS3. Mask limit tests for all these standards, and many more, are included. The powerful analysis functions include high-resolution cursors, automatic eye-pattern measurements with statistics, and FFT. The PicoScope 9201A also has two trigger inputs: a 1 GHz direct trigger and a 10 GHz prescaled trigger.

The PicoScope 9201A has 20% lower noise and 5 dB better inter-channel isolation than its predecessor, the PicoScope 9201, plus many other improved specifications. The PC software has also been upgraded with over 70 new standard masks such as RapidIO up to 3.125 Gb/s, PCI Express up to 5 Gb/s and Serial ATA up to 3 Gb/s. The scope connects to any Windows XP or Vista computer with a USB 2.0 port.

Unlike traditional, bulky bench-top instruments that contain a PC and a display, the PicoScope 9201A is housed in a compact enclosure that takes up very little space on your workbench.

Find more information at www.picotech.com.

Ultra-Rugged Hand Held Computer Features Optional RFID

Two Technologies, Inc.[®] introduces the Hydrus[®] Luna RFID, an ultra-rugged and powerful hand held computer designed for long-term daily operation in the harshest working conditions. With a battery capacity of 37 WATT-hours, the Hydrus Luna functions for over 40 hours.

It is IP67/IP68 rated for protection against dust and water, The Hydrus Luna RFID is ideal for outdoor use in extreme environments. Double wall case construction of GE Xenoy[®] provides impervious sealing against environmental conditions, with drop and shock protection covering internal components.

A 5MP (4MP processed) True-Camera-System captures color images and bar codes with real auto focus, LEDs and a True-Flash-System. Users can capture then relay images or data and transmit them back to a main office or centralized location.

A 55-key alpha numeric keypad with application-specific graphics plus an eight-position joystick allows for individual or combined operations. Customized keypads allow for intuitive, user-friendly operations and finger tip control.

Hydrus Luna RFID offers wireless communications and networking capabilities via Bluetooth[®], WLAN and 802.11b/g. RS-232 and USB ports are available for adding peripherals and accessories that extend the product's utility. Integrated precision GPS is optional. Hydrus Luna RFID is PACK Ready, allowing expansion space for the addition of your custom electronics, such as LF RFID, HID[®] RF/IR, proprietary radios and other data collection modules.

A powerful computer with 256MB SDRAM and up to 32GB of data storage, Hydrus Luna RFID uses Microsoft[®] Windows[®] CE .NET 5.0 operating system and a Marvell[®] PXA270 processor operating at 624MHz.

For more information on Hydrus Luna RFID, go to the company website at <http://www.2t.com>.

Component Tracker System

Manufacturers seeking cost-effective ways to collect and archive test data for product lifecycle management systems and quality assurance can now use the InterTech Development Component Tracker System, which integrates bar coding, scan and software tracking of each part and batch, including all leak test, functional test and lifecycle test data related to each component.

The InterTech Development Component System not only provides full traceability in the event of product recalls, but also provides data for process optimization to streamline production, and storage of all test data at each production stage for SPC (Statistical Process Control) data that underlies most quality assurance systems and full ISO 9001 compliance.

For more information on the InterTech Component Tracking System or other test technology used in InterTech's turnkey test solutions, please visit www.intertechdevelopment.com/instrumentation_detail.cgi?id_num=144.

TURCK Single Axis MEMS Inclinometer Sensor Detects Angular Tilt Over Full 360 Degree Range

TURCK introduces a new single axis inclinometer sensor for detecting angular tilt with an adjustable measuring range of 360 degrees. Inclinometer sensors solve unique feedback requirements for applications such as leveling platforms or controlling tilt angle in a diverse array of applications.

TURCK's single axis inclinometer sensor measures angular tilt in reference to gravity. To deliver precise measurements, the inclinometer utilizes a MEMS (micro-electro-mechanical system) device that incorporates a micro-electro-mechanical capacitive element into the sensor. The device consists of two parallel plate electrodes, one stationary and one attached to a spring-mass system. As the inclinometer tilts with the attached equipment, its acceleration produces deflection in the non-stationary electrode. The result is a measurable change in the capacitance between the two plates that is proportional to the angle of deflection. These signals have been conditioned to produce a single analog voltage output (0.1 to 4.9 VDC) or current output (4 to 20 mA).

The inclinometer's MEMS technology utilizes a microboard design that ensures high accuracy within a compact, industrialized package. To withstand challenging environments, this robust inclinometer is IP68-rated and offers a wide temperature range of -30 to 70° C.

For TURCK product or technical information, please visit www.turck.com.

Laboratory Instrument Control Software

METTLER TOLEDO has released the latest version of its unique laboratory software – LabX 2010. LabX software is recognized for its unique approach to aiding the performance of laboratory weighing applications and managing the associated data generated. The all new LabX 2010 release supports XP and XS Balances as well as the new line of density meters and refractometers from METTLER TOLEDO. The software's variety of included One Click™ application solutions help users perform their routine tasks with a single touch of the instrument dynamic display for fast, easy, and secure workflows. This and more are all part of Laboratory Solutions Powered by LabX 2010.

LabX 2010 securely manages the entire application, including automatically performing all calculations, and guiding users through the workflow and report generation. It also has the capacity for secure data storage and data export/import—with full regulatory compliance if required.

The new built-in OneClick™ application solutions include all necessary steps for fast and easy performance of common lab tasks. For example, new OneClick™ Standards Solution Preparation in LabX 2010 swiftly guides the user through error-free preparation of reference standard solutions including accurate weighing of the reference compound, solvent addition, labeling, automatic calculation of all concentrations, and comprehensive reporting.

LabX 2010 can be tailored to fit individual process requirements: The user can easily add options to meet the needs of regulated environments, product handling, or automated import and export, or create virtually any application to be accomplished.

Additional information can be found at www.mt.com.

Membership Notes

Our Society has 3,897 members, including affiliates, according to information available at the end of March 2010. This is a 5.7% decrease when compared to March 2009. Over the same time period, the IEEE community increased to 10,738 members mainly due to development reported by nineteen Societies. The Membership Committee has received a number of communications from non-renewing members that indicated employment changes. We plan to keep in touch with them and look for ways to be of assistance to them, to existing members, to the students, and to those who are at the beginning of a career change. Student activities have had large turnouts. Alexandru Nechifo, an IMS student ambassador, has written two reports about presentations that he made at two conferences at the Politehnica University of Bucharest about the IEEE and the International Measurement University. The events were attended by more than 70 undergraduate and graduate students in December 2009 and March 2010. Equally rewarding are the activities of our Chapters. The new members of our Society are already seeking to become active, and their affiliation with the existing chapters or involvement in the technical committees are ways to get involved immediately with the best activities that promote our Society goals.

Good news came in April from New Zealand – the inauguration of the **IEEE IMS New Zealand Chapter**. That was an excellent opportunity to organize a Workshop on Sensors and Instrumentation Research in New Zealand at Massey University, Palmerston, north campus. It was a successful event.

The newly created **IEEE IMS Nanjing/Shanghai/ Wuhan Jt. Sections Chapter** was approved at the end of February 2010.

The existing I&M Chapter in the **Germany Section** is actively seeking collaboration on a regional basis to increase synergies and commitment to the professional success of workshops on specialized topics in the measurement area. The I&M family welcomes the new members, and also encourages the existing members to look for their best place to be involved. Do not forget that you can be nominated by the I&M Society for a society office also! We are all proud to see this intense activity!

Congratulations to the 25 I&M Members elevated to Senior Members from January to April 2010: Alessandra Flammini, Gabriele D'Antona and Sergio Rapuano (Italy Section); Ashley M. Hulme (U.K. & Rep Of Ireland Section); Ce Liu (Houston Section); Gaozhi Xiao and Miodrag Bolic (Ottawa Section); Giovanni D. Rovera and Marc Lethiecq (France Section); Halit Eren

(Western Australia Section); Huaxiang Wang (Beijing Section); Jeffrey C. Andle (New Hampshire Section); Jorge Pontt (Chile Section); Joyanta Kumar Roy and Sethumadhava R. Ananthesh (Calcutta Section); K. Saba Mylvaganam (Norway Section); Mark Vivino (Susquehanna Section); Mark H. Weatherspoon (Tallahassee Area Section); Masahiro Aoyagi (Tokyo Section); Pak K. Chan (Singapore Section); Robert Rickenbach (Buenaventura Section); Sam D. Broyles (Dallas Section); Thomas E. Linnenbrink (Pikes Peak Section); Venkata Chandrasekhar Sarma Tummalapalli (Hyderabad Section); and Wanli Jiang (Twin Cities Section).

Kristen Donnell is a dedicated, efficient, and available Chapter Chairs liaison and has submitted the following report.

Announcing the 2009 Outstanding Chapter Award

Cheers to Our Chapters – Congratulations on a Successful 2009!

The I&M Society is proud to say that we had 30 active Chapters in 2009 that represent regions all over the world. The I&M Chapters are the most direct and influential way the Society is able to interact with its members. Every Chapter should be proud of its 2009 Chapter activities and meetings. Out of our 30 Chapters, there were 6 who held over 10 events last year.

The Uruguay Chapter featured two events that were held in collaboration with local student branches. Students and student members are the future of our Society, and engaging students in Chapter activities is an important accomplishment. As such, the I&M Society is pleased to announce that the Uruguay Chapter has been named the I&M Society 2009 Outstanding Chapter.

The Delhi Chapter, a joint Chapter with the Engineering in Medicine and Biology Society, featured a large guest attendance at many of their 2009 events. Congratulations for an outstanding effort in spreading the word about the I&M Society!

The United Kingdom and Republic of Ireland (UKRI), Long Island, Malaysia, and Taipei Chapters all showed strong member attendance at their respective events throughout 2009.

Without our Chapters giving our members the opportunity to interact with one another on a local level, our Society would not be as strong overall. Many thanks to all of you for supporting our members so well! Congratulations to Uruguay and all of our Chapters for an active, successful 2009!

Alexandru Nechifor is an IEEE IMS undergraduate student representative from Bucharest and he submitted the following two reports.

Promoting IEEE, IMS and the 3rd Annual International Measurement University

When the the Politehnica University of Bucharest sponsored a conference on December 9, 2009, I made a presentation promoting IEEE, the IMS and my experience in going to IMU 2009. The conference was called “A World at Your Feet! Study scholarships, private scholarships and other opportunities!” The conference was organized by the Center for Counseling and Orientation in Career (CCO[http:// ccoc.pub.ro/](http://ccoc.pub.ro/)) at the University. With more than 70 student attendees, the conference had almost equal numbers of undergraduate and graduate students. The student attendees were eager to find out about conferences, scholarships, summer schools and other activities that could help them in their development. I talked to the students about the importance of performing research work, about the need to specialize in a certain domain of interest and to

be aware of the latest technological developments in that particular field. I talked about the opportunity to meet active professionals and acquire international recognition. I gave my IEEE experience as an example and how IEEE helped me to achieve so much. I talked about the awards and student activities that IEEE organizes for students, like the IEEEXtreme Contest or the IEEE Presidents' Change the World Competition. I continued the examples with my IMS involvement and activity as an undergraduate student representative. In the conclusion, I focused on my participation in IMU 2009 and encouraged the students to apply for IMU 2010.

“Aim for your future! Career experience starts from college”

The Center for Counseling and Career Orientation (<http://www.ccoc.pub.ro/>) organized a conference that was held on March 24, 2010 at the University Politehnica of Bucharest. The conference, “Aim for your future! Career experience starts from college,” had more than 70 attendees, both undergraduate and graduate students. I presented the topic “Internship and Research” and encouraged the students to get internships in the field of research. I started by talking about the 38 research centers at the University Politehnica of Bucharest and how to apply for internships there. These opportunities are currently not widely known, especially among first year students who attended the conference. I also gave tips on how to choose the right internships in research and stressed how important it is to publish one's results in a prestigious publication like the IEEE I&M Transactions. Presenting the role of IEEE, its high-impact publications, its developed standards, and the need for a future engineer to take part in this technical association was an important emphasis to make. I also gave examples of student activities like the international competition IEEEXtreme Contest and stressed the importance of volunteer work locally and in IEEE. I have learned this as an active volunteer in the Center for Counseling and Career Orientation at the University. I also explained to the participants that publishing a paper in IEEE Transactions or a Conference Proceedings is a distinctive addition in one's application for a masters or PhD program at prestigious universities.

2009 IEEE I&M Society Awards

Each year the IEEE Instrumentation and Measurement Society accepts nominations for its awards. The AdCom Awards Committee manages the nominations process, reviews the candidates, and recommends a slate. The slate of candidates is then submitted to the Society AdCom for approval, and the awards are presented at our annual Awards Banquet held as part of the I2MTC conference. The Awards Committee is pleased to announce the 2009 winners.

IEEE I&M Society Outstanding Young Engineer Award

The I&M Outstanding Young Engineer Award recognizes an outstanding young I&M member who has distinguished him or herself through achievements which are technical, of exemplary service to the I&M Society or a combination of both, early in his or her career. The nominee must not have reached his or her 39th birthday and must be an I&M Society member at the time of nomination.

The 2009 Outstanding Young Engineer Award recipient is **Jenny Wirandi** of the Oskarshamn Nuclear Power Plant in Sweden, *For outstanding contributions in applying uncertainty concepts to complex measurement processes that involve significant human factors.*

Jenny Wirandi received the B.Sc. degree in electrical engineering from the University of Kalmar, Kalmar, Sweden, in 1997 and the Ph.D. degree in electrical measurement from the Lund

University, Lund, Sweden, in 2007. In 2007, she joined the Blekinge Institute of Technology, Karlskrona, Sweden as a post-doc. Since 2008 she has been a System Engineer at Oskarshamn Nuclear Power Plant, Oskarshamn, Sweden. Her research interests are modern measurement concepts and their applications to industry, including traceable calibration, measurement uncertainty, and the role of the operator in the measurement system.

IEEE I&M Society Technical Award

The I&M Society Technical Award is given to an individual or group of individuals for outstanding contribution or leadership in advancing instrumentation design or measurement technique. The 2009 Technical Award recipient is **Jacques L. Willems** of Ghent University in Belgium, *For outstanding contributions to the analysis of electric power systems under nonsinusoidal conditions.*

Jacques L. Willems (SM'1979, F'1990, LF'2010) graduated in electromechanical engineering from Ghent University, Belgium, received the S.M. degree from M.I.T. and a doctoral degree from Ghent University. Since 1964 he has been with the Engineering Faculty of Ghent University, Belgium, teaching and doing research in the areas of power systems and dynamic systems. He was a Visiting Postdoctoral Research Fellow at Harvard University in 1970, and a Professeur Visiteur at the Université du Rwanda in 1982. He was Dean of the Engineering Faculty of Ghent University from 1988 to 1992, and Rector of Ghent University from 1993 to 2001. He has also been active in evaluation and accreditation of study programs. He became Emeritus Professor in October 2004.

The I&M Society Distinguished Service Award

The I&M Society Distinguished Service Award is presented each year to an individual who has given outstanding service to the Society and to the profession. The 2009 Distinguished Service Award recipient is **Emil M. Petriu** of the University of Ottawa, Ontario, Canada, *For outstanding leadership during more than ten years of AdCom membership, including service as General Chair or Program Chair of five IMTC conferences, and as Cochair of TC-15, TC-28, and TC-30.*

Emil M. Petriu, P.Eng. (F'IEEE, F'CAE, F'EIC) is a Professor and University Research Chair in the School of Information Technology (SITE), University of Ottawa, Ottawa, Ontario, Canada. He received his Dr. Eng. Degree in Electrical Engineering from the Polytechnic Institute of Timisoara, Romania, in 1978. In 1979, he held a UNESCO postdoctoral scholarship in the Department of Applied Physics at the Technical University of Delft, The Netherlands. He is a Registered Professional Engineer in the Province of Ontario, Canada.

Dr. Petriu served as a member of the Administrative Committee (1996-2005) and Vice-President (2000-2002) of the IEEE Instrumentation and Measurement Society. He served as Chair of the IEEE Joseph F. Keithley Award Committee (2007-present) and member of the IEEE Technical Field Awards Council (2007-present). He is serving as Chair of the TC-15 on Virtual Systems in Measurements, Co-Chair of the TC-30 Security and Contraband Detection of the IEEE Instrumentation and Measurement Society, and Chair of the Virtual Reality Task Force of the Intelligent Systems Applications Technical Committee of the IEEE Computational Intelligence Society.

The I&M Society Career Excellence Award

The I&M Society Career Excellence Award is awarded to recognize a lifetime career of meritorious achievement and outstanding technical contribution by an individual in the field of instrumentation and measurement. The 2009 Career Excellence Award recipient is **Stephen A. Dyer** of Kansas State University, Manhattan, Kansas, USA, *For a career dedicated to education in science and engineering; for research contributions in instrumentation and Hadamard-transform spectrometry; and for outstanding contributions to the I&M Society, including service as Editor-in-Chief of the Transactions, as founding Editor-in-Chief of the IEEE Instrumentation & Measurement Magazine, and as President of the Society.*

Stephen A. Dyer holds the B.S. in physics, the M.S. in electrical engineering, and the Ph.D. in engineering, all from Kansas State University, Manhattan. He has spent most of his career in academics, receiving his first faculty appointment at the age of 23, and has held faculty positions in physics, mathematics, and electrical and computer engineering. In addition, he has taught courses in entrepreneurship, as well as segments of courses in physical chemistry, flight dynamics, anatomy and physiology, and creative problem-solving. Having had appointments at five different institutions, Steve currently serves at Kansas State, where he was promoted to full professor in 1989.

His research has spanned a number of areas, notably instrumentation and measurement, spectrometry, digital signal processing, and communication theory. His contributions to stationary-mask Hadamard-transform multiplex spectrometry—in particular, the design and development of spectrum-recovery methods and fast algorithms to improve performance at low signal-to-noise ratios—were cited in his elevation, in 1997, to IEEE Fellow. He has more than 125 technical publications, including his edited book, *Survey of Instrumentation and Measurement* (Wiley, 2001).

Dr. Dyer has had connection, as well, with industry and the public. Before he started in academics, he worked in engineering positions, writing software and designing semiautomatic test equipment. For the past 30 years, he has acted as a consultant for about 40 companies and institutions, doing analysis, product-design, or forensic work in various areas, including instrument design, signal processing, electromagnetics, and optics.

Steve has also helped make students aware of IEEE through his on-campus service, having served as IEEE Student Branch Counselor at the University of Kentucky and at K-State. He was also the co-founding faculty advisor for the IEEE EMBS Chapter at K-State. Dyer has been active in the I&M Society since the 1980s, and has been on the AdCom continuously since the beginning of 1992, serving the Society in various capacities.

Society Honors: I&MS Fellows in 2010

The IEEE Fellows Program was established to recognize and honor outstanding members for their significant accomplishments in the advancement or application of engineering, science, and technology and for their contributions to the mission of the IEEE: to advance global prosperity by fostering technological innovation, enabling members' career growth and promoting community worldwide. The IEEE Fellows are an elite group from around the globe. The IEEE looks to the Fellows for guidance and leadership as the world of electrical and electronic technology continues to evolve. The Instrumentation and Measurement Society (IMS) Fellows Identification and Evaluation Committees identify candidates, gather references from their peers, and submit detailed applications to the IEEE Fellow Committee in a confidential process typically extending over several years. After a further rigorous evaluation and selection process by the IEEE Fellow Committee, each year a slate of candidates for elevation to Fellow is

proposed to the IEEE Board of Directors for approval. Per IEEE rules, the number of successful candidates in any year must not exceed onetenth percent of the IEEE voting membership on record as of December 31 of the preceding year. This year 309 Fellows were elevated from approximately 309,000 members.

Five I&M Society members were elevated this year from 4,455 members. IEEE Fellows receive a certificate and pin. The Instrumentation and Measurement Society members elevated to Fellow in 2010 are:

Georg Brasseur

Graz University of Technology
Austria

For developments in electronic diesel engine control

Georg Brasseur received the Dipl.-Eng. degree in electrical engineering and the doctoral degree in technical science from Vienna University of Technology, Vienna, Austria, in 1979 and 1985, respectively. He was an Associate Professor at Vienna University of Technology, heading the research group Automotive Electronics from 1979 to 1998. At that time, he received the “venia docendi” on industrial electronics. Since 1999, he has been a Full Professor heading the Institute of Electrical Measurement and Measurement Signal Processing at the same university. From 2001 till 2008, he chaired the Christian Doppler Laboratory for Automotive Measurement Research, and for the years 2004 and 2005 he was the Dean of the Faculty of Electrical and Information Engineering, Graz University of Technology, Graz, Austria. He is author or co-author of over 100 technical papers and patents. His research interests focus on automotive sensors, capacitive sensing devices, analog circuit design, automotive electronics, and actuators.

He is co-chair of the IEEE I&M Technical Committee TC-20, founder of the IEEE I&M TC-9 Subcommittee on Capacitive Sensing, a member of IEEE (M’94-SM’97-F’10), the Austrian Academy of Sciences ÖAW, the Austrian (ÖVE) and German (VDI) Association of Professional Electrical Engineers. He has received four research awards: the “Dr. Ernst Fehrer Preis” in 1982, the “Plansee-Preis” in 1985, in 2001 the “Wilhelm Exner-Medallion” of the Austrian Association for Small and Middle-Sized Enterprises, and in 2007 the “Erwin Schrödinger-Preis” of the Austrian Academy of Science.

George C. Giakos

The University of Akron
USA

For contributions to efficient imaging devices, systems and techniques

Professor Giakos is a faculty member of the Department of Electrical and Computer Engineering, and Biomedical Engineering, at the University of Akron, OH, USA. Prior to joining the University of Akron, he was an Associate Director of the Imaging Research Laboratory at the University of Tennessee, in the Department of Biomedical Engineering. In 1978, he received the Laurea Degree in Physics from the University of Turin, Italy (1978), a graduate Degree in Nuclear Instrumentation from the University of Edinburgh, UK, (1979), a MS Degree in Nuclear Space Physics from Ohio University, US, (1985), and a Ph.D. Degree in Electrical and Computer Engineering from Marquette University, US, (1991).

Dr. Giakos’ research is in the design of imaging systems, ladars and surveillance sensor platforms, multispectral polarimetry, nuclear instrumentation, design of cargo and airport security inspection systems for the Department of Defense and Homeland Security, as well as in the design of innovative molecular nanophotonics devices. His research group was among the

first in the US to pioneer the characterization of the detection and imaging characteristics of Cadmium Zinc Telluride semiconductor substrates for flat-panel digital radiography applications.

Dr. Giakos holds fifteen US and international patents and has authored more than 150 peer-review articles and journal publications. Dr. Giakos is an IEEE Fellow, the Editor in Chief of the International Journal of Signal and Imaging Systems Engineering (IJSISE), and the Chairman of the TC-19 IEEE I&M Technical Committee on "Imaging Measurements." He is the founder, organizer and general chairman of the IEEE I&M International Workshops and Conferences on Imaging Systems and Techniques.

George E. Zentai, Ph.D.

Ginzton Technology Center of Varian Medical Systems
USA

For contributions to the advancement of digital X-ray imagers

Dr. George Zentai is a senior scientist and R&D manager at Varian Medical Systems in Palo Alto, CA with over 30 years of experience encompassing project and product management, research, design, development, testing and manufacturing for a variety of products. His experience includes digital X-ray detectors, amorphous semiconductors, photo-electronic elements for high speed data transmission, industrial and medical lasers and laser projection systems for entertainment. He also has expertise in developing product proposals, managing feasibility studies, and overseeing sales/marketing and distribution products. Dr. Zentai holds a PhD in electronic engineering from the Technical University of Budapest, Hungary.

Prior to his position at Varian, Dr. Zentai has held senior technical and management positions at OIS Imaging Systems, Argonne National Laboratory in the United States. He was president and partner at Eurolaser Ltd., and technical manager at Group-4 Securitas, Ltd., in Hungary. He has held several positions at the Hungarian Academy of Sciences where he researched various technologies related to amorphous silicon.

Dr. Zentai was the invited keynote speaker at the IEEE IST 2007, IST 2008 and IST 2009 and IWSSIP 2009 conferences; won first prize at the Hungarian Academy of Sciences for laser material interaction in 1982. He has published over 50 papers and been awarded over 10 patents.

James Baker-Jarvis

National Institute of Standards and Technology
USA

For contributions to dielectric measurement and analysis of microwave measurement structures

Dr. Baker-Jarvis has been active in the area of dielectrics and electromagnetics since 1981. In his early career he concentrated on information theory applied to maximum entropy methods, hydrodynamics, and developed a combined electromagnetic-heating model to describe *insitu* volumetric heating of oilshales. Since 1989, Dr. Baker-Jarvis has been in the field of dielectrics. He has been project leader of the NIST electromagnetic Properties of Materials Project for 6 years. He is recognized as an international expert in dielectric measurements and theory. He received 2 NIST Bronze Medals (1990 and 2006), and is often asked to help organize or give invited talks, papers, and standard methods developed.

Dr. Baker-Jarvis has developed and published fundamental models for the coaxial probe, the reentrant cavity, open-circuit holder, transmission lines, and split cylinder resonator. He has been instrumental in the setup of the project's liquids, phantom-tissue, radar-absorbing materials, and substrates measurement programs. In response to industry needs in 1989, Dr. Baker-Jarvis developed a novel algorithm for determining the permittivity in transmission lines. For this he was awarded the Commerce Bronze medal.

Over the last eighteen years at NIST, Dr. Baker-Jarvis has developed and published over 100 papers which include six papers on mode-match solutions for dielectric measurement techniques. These mode-match solutions form the basis of a number of the important measurement methods in the project.

Nicholas G. Paulter, Jr.

National Institute of Standards and Technology
USA

For contributions to ultra-high speed waveform measurements

Nicholas G. Paulter, Jr. received the M.S. degree in chemistry from the University of New Mexico, Albuquerque, in 1988 and the M.S. degree in electrical engineering from the University of Colorado, Boulder, in 1990. He was with Los Alamos National Laboratory, Los Alamos, NM, from 1980 to 1989, where he was involved in the study of fast electrical phenomena and in the development of high-speed photoconductors for use as ultrafast light detectors and sampling gates. In 1989, he joined the National Institute of Standards and Technology (NIST), Boulder, to develop transient-pulse measurement techniques and analysis. He is currently with the Office of Law Enforcement Standards, NIST, Gaithersburg, MD. His present research interests include millimeter-wave/terahertz-wave imaging, imaging metrology, and through-wall sensing and imaging.
