

The IEEE Instrumentation & Measurement Magazine
August 2017 Issue

Highlighting Select Papers from
AUTOTESTCON 2016 and Beyond

President's Message

Welcome to IEEE AUTOTESTCON 2017

Ruth A. Dyer, IEEE Instrumentation and Measurement Society President

On behalf of the IEEE Instrumentation and Measurement Society (IMS), I want to welcome you to IEEE AUTOTESTCON 2017 at the Renaissance Schaumburg Convention Center Hotel in Schaumburg, Illinois! This conference provides outstanding opportunities to learn about the newest automated testing technologies being developed and implemented, as well as to meet with colleagues and make new acquaintances. We know you will enjoy your experience as one of the many attendees at this conference.

The long-lasting, collaborative sponsorship of AUTOTESTCON by the IMS and the IEEE Aerospace and Electronic Systems Society (AESS) has been highly successful, and it has facilitated the exchange of innovative ideas and information among our two engineering professional societies, government entities, and industry for more than 50 years. The student-travel awards and best-paper awards provided by the IMS assist our student members financially in being able to attend and recognize their valuable contributions to emerging technologies.

Attending this conference is also a great way for students to meet, and establish important relationships early in their careers with professionals in the military and the aerospace industry. Another one of the highlights of AUTOTESTCON is the large number of exhibitors who attend, showcase their products and services, and demonstrate state-of-the-art instruments and the impressive measurements of which these instruments are capable. Seeing the pioneering ideas developed by researchers come to life in the form of these novel instruments is truly exciting!

As has been our custom over the last few years, we highlight papers presented at the 2016 AUTOTESTCON in the August 2017 issue of *IEEE Instrumentation and Measurement Magazine*. We hope you will find the information presented in the papers included in this issue to be useful to you, and we hope you will enjoy IEEE AUTOTESTCON 2017! Ruth

Teresa Pace, IEEE Aerospace and Electronic Systems Society President

As President of IEEE Aerospace and Electronic System Society, I am pleased to be able to once again join the IEEE Instrumentation and Measurement Society in welcoming you to this year's IEEE AUTOTESTCON in Schaumburg, Illinois. This is an incredibly exciting conference that brings together students, researchers, academics, government, and industry participants from all over the world in a beautiful setting to discuss the most advanced automated test technologies available. Covering Performance Based Logistics, Health Monitoring and Diagnostics, embedded Instrumentation, Support Economics, and Test & Support Management, the conference provides an excellent venue for dialogue and information exchange on topics that are of significant interest to the Aerospace and Electronic Systems community. System readiness and automatic test are critical components in providing government and military users with equipment that is reliable, dependable, and effective. In our rapidly evolving and challenging world climate, this is more important now than ever. This conference is precisely the place to be able to discover, share, and discuss ideas, needs, and recent developments to stay up to date and be ready to rapidly respond as soon as the need may arise.

The IEEE AES Society is proud to be a co-sponsor of this conference along with the IEEE I&M Society, with whom we have had the honor of collaborating for many years.

Very best regards,
Teresa

Article Summaries

A Fourth Category of Software-Defined Instrumentation for Wireless Test

(Summary)

Tarek Helaly and Nikhil Adnani

The test and measurement of emerging wireless systems requires wideband equipment with stringent specifications. Shrinking test equipment budgets are necessitating newer cost-effective approaches to testing devices. This paper presented a brief overview of the existing categories of test equipment, highlighted the advantages and limitations associated with each and introduced the R5500 as a new, fourth category of instrument for test and measurement. The R5500 is a novel, cost-effective and portable platform for fulfilling the test and measurement requirements of modern, complex wireless signals. It can be used in a number of deployment scenarios and its small form-factor allows it to be embedded within larger systems. The host-side software architecture that interfaces with the R5500 includes control and communication protocols that conform to widely adopted standards. In addition, the RTSA application allows users to perform different types of analyses. Finally, the R5500 is characterized by having a rich set of APIs to process the digitized data. These APIs are available in different programming languages to accommodate a wide range of development requirements.

Noncontact Electrical System Monitoring on a U.S. Coast Guard Cutter

(Summary)

Peter Lindahl, Greg Bredariol, John Donnal, and Steven Leeb

Modernization in the U.S. Navy and U.S. Coast Guard (USCG) includes an emphasis on automation systems to help replace manual tasks and reduce crew sizes. This places a high reliance on monitoring systems to ensure proper operation of equipment and to maintain safety at sea. Recently developed noncontact current and voltage sensors, [1] combined with nonintrusive load monitoring (NILM) methods [2], provide a nonintrusive, low-cost, and easily installed package for machinery monitoring. This paper presents an application case study using these NILM-enabled sensors installed on the main electrical feeders of the USCG Famous Class Cutter SPENCER. The system records the power demand on the ship and disaggregates this demand by identifying transients corresponding to loads changing states, e.g., a pump turning on. Results of this study showcase these novel sensors' ability to monitor both generation and loadside equipment while at sea or in port and provide information useful for tracking operation schedules, energy usage, and maintenance needs.

This text is from the introduction of the article.

Run-Time Reconfigurable Instruments for Advanced Board-Level Testing

(Summary)

Igor Aleksejev, Artur Jutman, and Sergei Devadze

In this paper, the authors proposed to classify already known embedded instruments based on the format in which they are provided to an end customer. Conforming to the introduced classification, only soft core and hard macro-based instruments were proposed before. They present embedded run-time reconfigurable instruments provided as a pre-compiled FPGA bitstreams specifically designed for board-level test tasks. This missing class of instruments is a great alternative to the already known ones. The fundamental advantage of the presented run-time reconfiguration (RTR) approach is that the readymade instrument can be immediately used for every system under test and does not need to be recompiled for a new product or after a product change. The feasibility of the proposed methodology was proven by the implementation of the RTR instruments' targeted board-level T&M tasks. The obtained real-life experimental results proved the efficiency of developed instruments over state-of-the-art test technologies.

This text is the conclusion of the article.

Image Processing Algorithms for Crack Detection in Welded Structures via Pulsed Eddy Current Thermal Imaging

(Summary)

Zhiping Liu, Ge Lu, Xingle Liu, Xiaoli Jiang, and Gabriel Lodewijks

In this paper, the influences of the physical features of the weld are investigated using analytical and COMSOL Multiphysics ® finite element method simulations. A method for surface crack detection based on a novel image fusion method using mathematical morphology and an automatic region growing algorithm is investigated. First, the effect of emissivity variation is reduced by thermal response difference. Then the temperature anomalies of the area are found by an automatic region growing algorithm while the welding seams can be detected using mathematical morphology transform. Finally, the object region is extracted by image fusion. In this way, the disturbance of the weld edge is eliminated and the crack is detected effectively by its geometric features and the infrared image. Experimental results show that this method can extract the position and length of the crack accurately considering the weld surface conditions and provides guidance for the quantitative analysis of weld cracks.

This text is the conclusion of the article.

Measuring and Characterizing Nonlinear RF Systems: Faculty Course Development Award 2013

(Summary)

Niclas Björsell and Wendy Van Moer

The main goal of the Measuring and Characterizing Nonlinear RF Systems course is to provide students a backpack full of easy to use and accurate measurement and modelling techniques for radio frequency (RF) systems. The course is taught at both the University of Gävle, Sweden (HIG) and the Vrije Universiteit Brussel, Belgium (VUB). At both universities the course was available on the master level as well as Ph.D. level, where it is important that students gain insight in the working principles and special requirements of RF measurement instrumentation designed to measure nonlinear behavior. Since students only become masters in a topic by doing it, the instructors teach them to perform correct measurements of the nonlinear behavior of RF systems, since measuring is knowing. When students understand and master the correct measurement techniques, they can fully understand the working principles of RF components. This is a mandatory step towards the correct modelling of the nonlinear behavior. During the course, students encounter state-of-the art nonlinear modelling techniques, discover their advantages and disadvantages, and then are able to make the correct choice between the models.

Wireless Power Transfer for Contactless Instrumentation and Measurement

(Summary)

Rodrigo Wolff Porto, Valner J. Brusamarello, Ivan Müller, Fabian Leonardo Cabrera Riaño, and Fernando Rangel de Sousa

Wireless power transfer is a hot global research topic with potential to be applied in a broad range of applications. Research groups in Brazil have been working on the subject and applied it to sensor networks and medical instrumentation and made contributions to the dynamic tuning of the WPT system, to the optimization of the energy transfer, to the link miniaturization and to the development of methods for contactless characterization. In this article, the authors review the modeling of a typical IPT link and discuss the criteria for maximizing the power transferred to the load as well as the power transfer efficiency.

This text is from the introduction and conclusion of the article.

Columns

Basic Metrology

(Summary)

Reinventing the Wheel

Richard Davis

The engineering of stability into a wide variety of commonly-used devices and systems is a well-known necessity. Inherently unstable mechanical systems are often stabilized by the addition of servocontrol, a well-known historical example being the addition by James Watt of a “governor” to his steam engine. The steam engine led to the steam locomotive. Designing the cars that rolled along on rails introduced novel stability problems, ingeniously solved by the redesign of the wheels used by the railroads. A recent publication, “Why Trains Stay on Tracks,” shows that the full explanation for the stability of rolling railroad cars is still an interesting topic for consideration.

This summary was written by the author.

Future Trends in I&M

(Summary)

A Young Perspective of Power Systems Measurement and Protection

George Cornea

In this month's column, the author discusses how "the role of measurements in any technological process is extremely important in the proper functioning of a power system, so the degree of stability of a system, whether it comes to voltage or frequency, is greatly influenced by how the system's information is interpreted through measurement and protection devices." In his field, "to ensure a proper functioning of numerical protection relays, it is necessary that the measured voltage and current in the primary circuit are done with high accuracy and efficiency. Given that in the transmission network of a power system the voltage is typically 220-400 kV, numerical protection relays cannot be installed directly in the primary circuit, so for optimum operation there are a number of required quantities of primary conversion. Ideal channel instrumentation will generate an output waveform that will be an exact replica of the one in high voltage but scaled by a constant factor." The author discusses significant challenges to power system protection circuits currently in use and how, in the future, he hopes "the use of magneto-optical and electro-magnetic instrumentation transformers will increase, and the amount of data processed through them will be more optimal for monitoring and protection applications."

This summary includes text from the article and first person text from its conclusion.

Society News

NASA Space Technology Research Fellowship Award

Katelyn Brinker

NSTRF Award Summary

The NASA Space Technology Research Fellowship (NSTRF) is an award provided to graduate students who show potential to contribute greatly to space technology research and create innovative solutions that will allow America to remain competitive in terms of space exploration. While pursuing research and a graduate degree, this fellowship provides the recipient with tuition support, a student stipend, a NASA research collaborator, and the opportunity to conduct research at a NASA facility, all allowing the student to partake in broader space technology research opportunities and advance their academic and career goals.

DiscoverE New Faces of Engineering Award

The DiscoverE New Faces of Engineering Award aims to recognize students who have made an impact in their professional societies and have the potential to make a large impact on the engineering field. I was the IEEE-USA winner for my work on the Missouri Science and Technology Mars Rover Design team (Rolla, MO), my involvement with the Instrumentation and Measurement Society and my IEEE student branch, and my internship experience at Southwest Research Institute and LafargeHolcim.

Research

Applied Microwave Nondestructive Testing Laboratory (amntl)

As an undergraduate research assistant at *amntl* I have had the opportunity to work on a lot of different projects, advance my skills, and gain valuable experience that will help me for the rest of my career. Some of my projects have included investigating the dielectric properties of clay pots that are used for water filtration in Guatemala to see if they could be reproduced to help people with water filtration needs in other areas of the world, performing microwave measurements on a variety of samples for the purpose of material characterization, and exploring the use of a new differential microwave probe (on which there is a paper that was accepted for I2MTC 2017).

For my Master's degree, I am going to work on developing passively-coded miniaturized sensors to be embedded for material characterization and structural health monitoring. The hope is that these could be used to inspect and monitor everyday structures like bridges and pillars, but that they could also be used for monitoring habitats on other planets and spacecraft structures. Below is the submitted proposal summary for the research I will be performing under the NSTRF.

NSTRF Submitted Proposal Summary

“Materials and structures are constantly subject to fatigue and degradation, and monitoring and maintaining civil, space, and aerospace infrastructure is an ongoing critical issue facing our society today. As new materials, such as complex multilayer composites, come into wider use, the need to monitor them is also rapidly growing. Space exploration adds to this need by offering extreme conditions and increased risk associated with material failure. The proposed research seeks to tackle this problem by developing passively-coded miniature embedded wideband microwave sensors, exploring their applicability, and investigating the utility of a novel and unique methodology for inspecting materials and complex structures. Each sensor will consist of a miniaturized wideband antenna specifically designed to have a number of resonances in its reflection property. By using the reflection properties of the antenna, regions in frequency of resonance and reflection can be associated with 0s and 1s to create a specific “code” for that antenna. This code shifts (in frequency) or alters based on the properties and degradation of the material in which the antenna is embedded. These sensors could be embedded in materials and structures such as concrete, a composite fuselage, or an astronaut's planetary habitat, and by being passive, the sensors will not need to be energized (i.e., wired in or provided with a power source). In the case of a planetary habitat, an astronaut could easily inspect their home for damage using a simple transceiver, and perform repairs or preventative maintenance if necessary. This practice would increase the astronaut's safety and minimize the risk of structure failure while they explore and are faced with the unforgiving environment of space. Because this technology is of such a low TRL nature, its full application range cannot be conceptualized at this point. However, with their low cost nature and versatility, these sensors have the potential to be integrated into many space structures and materials as well as everyday civil and aerospace structures like bridges, parking garages, and planes. Additionally, the sensor data could be used to refine manufacturing processes. This research will be pursued as part of an electrical engineering master's degree at Missouri S&T under the guidance of Dr. Reza Zoughi and the tools needed to engage in this research will be primarily provided through the Applied Microwave and Nondestructive Testing Laboratory (amntl) on campus.”

Congratulations to the 2017 University Rover Challenge Winners

Congratulations to Katelyn Brinker, IEEE I&M Society Undergraduate Student Representative, and the whole Missouri S&T Mars Rover Design Team, on winning the 2017 University Rover Challenge! The University Rover Challenge (URC) is an international design competition where teams showcase potential next-generation Mars rovers. The 2017 competition hosted 35 collegiate teams from around the world at the Mars Desert Research Station in Hanksville, Utah. The URC event, sponsored by the Mars Society, is designed to demonstrate the fundamentals of remote robotic travel and task completion.

Missouri S&T's Mars Rover, named Gryphon, was designed and built by the students. The team developed custom circuitry for the rover, machined the aluminum and carbon-fiber support structure, developed durable wheels for terrain mobility, and 3-D printed gears used in the rover. Read more about the Missouri S&T Mars Rover Design Team's victory by visiting: <http://bit.ly/2sAPgeY>.

A photo accompanies this announcement in the print magazine.

Departments

New Products

Robert Goldberg

Please send all "New Products" information to:

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Lock-in Amplifier/AWG with Pulse Counter

Zurich Instruments has expanded their UHFLI, a 600 MHz Lock-in Amplifier and Arbitrary Wave Generator (AWG), with a Pulse Counter option for recording random pulses.

Pulses of a minimal time of 4.44 ns can be counted on up to four channels at a bandwidth of 225 MHz.

The Pulse Counter can be used in four different modes. In free-running mode, the counter is activated by a configurable timer, and after the acquisition, it is reset and restarted. The total number of counts recorded in each sequence is transferred after the acquisition. In gated-mode, the counter is activated on a rising edge and deactivated on a falling edge. On the falling edge, the number of pulses is transferred. The gated-free-running mode is a combination of the

previous two modes. Time-tagging mode records each event with a timestamp and transfers to the PC.

For fast data transfer to the host PC, USB 2.0 and Ethernet 1GbE connections are included.

The LabOne user interface enables swift and straightforward data handling. This toolset is further strengthened with a Histogram, Oscilloscope with a sampling rate of 1.8 GSa/s, FFT Spectrum Analyzer and a Threshold Unit. The available APIs for LabView, MATLAB, Python, C/C++ and .NET allow simple interfacing with other programs.

The Pulse Counter option has applications in fluorescence lifetime and ion-trap experiments, for example. In the area of quantum information processing, the Pulse Counter data can be used to quickly modify the output-sequence of the AWG as often required in quantum-error-correction protocols and quantum teleportation experiments.

Find more information at www.zhinst.com/products/uhfli/uhf-cnt.

Test Solution Capable of Measuring WLAN DUT Performance in Operation

Anritsu has announced a Network Mode for its Wireless Connectivity Test Set MT8862A, which is an instrument capable of supporting various WLAN protocol standards, such as IEEE802.11ac/n/a/g/b. The MT8862A is capable of measuring the performance of an 802.11ac-capable WLAN device under test (DUT) in the actual operating state. With the Network Mode configuration, the MT8862A serves as a more efficient manufacturing test solution to verify WLAN chipsets designed into smartphones, smart home electronics, connected cars, and IoT systems, which eventually entails into faster time to market and lower testing cost.

RF performance characteristics, such as Tx power and Rx sensitivity (PER), as well as waveform coverage range can be measured over-the-air (OTA) using the Network Mode, which eliminates the need for dedicated vendor provided test modes typically required for WLAN device verification. Removal of a physical connection establishes a more accurate representation of the actual DUT performance in a real-world environment, as the measurements take into consideration the effect of the internal wireless antennas.

The Wireless Connectivity Test Set MT8862A can be operated remotely via web browser from a control PC connected by Ethernet. This configuration simplifies conducting measurements by eliminating more complex setups for more efficient testing.

Engineers can realize numerous advantages when using the MT8862A Wireless Connectivity Test Set compared to conventional WLAN test equipment. It can be easily and quickly integrated into a production line and is simple to maintain and calibrate. The MT8862A reduces test system costs, increases production throughput, and delivers the most flexible WLAN testing available.

To learn more about this product, visit www.anritsu.com.

1 GHz Oscilloscope Platforms Now Feature 10x Oversampling

Teledyne LeCroy has introduced the HDO4000A, HDO6000A, HDO8000A, and MDA800A analog and mixed-signal oscilloscopes. These four, high-definition, oscilloscope product lines range from 200 MHz – 1 GHz bandwidth and utilize 12-bit HD4096 technology.

These products have now achieved new levels of measurement capability. HDO-A oscilloscopes feature Enhanced Sample Rate technology that automatically ensures optimal display of acquired waveforms to the instruments' full rated bandwidth. Additionally, the next-generation MAUIR (Most Advanced User Interface) with OneTouch user interface makes measurement setup easy and provides users dramatically faster time to insight when debugging complex signal abnormalities. Lastly, the updated PC systems with faster processors, more CPU memory, and solid-state drives add even more value. With the HDO-A introduction, the world's highest definition oscilloscopes become even more powerful and productive with 10x oversampling, the most efficient and intuitive user interface, and a supercharged PC system.

All HDOs are ideal for debugging and troubleshooting power electronics, automotive electronics, and embedded/mechatronic designs with high-resolution sensor signals. HDOs owe their high performance to bandwidths up to 1 GHz, acquisition memory of up to 250 Mpt/ch, and 12-bit vertical resolution. There are also mixed-signal oscilloscope (MSO) options/models. All HDOs offer an extensive array of serial trigger, decode, measure/graph, and eye diagram (TDME) options. All of the above, coupled with many other general-purpose and application-specific probes and software options, have made the HDOs an industry favorite.

HD4096 High Definition Technology finds its roots in high sample rate 12-bit ADCs, high signal-to-noise ratio amplifiers, and low-noise system architecture. This technology enables HDO-A oscilloscopes to capture and display signals of up to 1 GHz at 16 times more resolution than other oscilloscopes.

All HDO-A oscilloscopes feature MAUI with OneTouch, which extends Teledyne LeCroy's capability of user-interface innovation. MAUI with OneTouch optimizes convenience and efficiency by enabling all common operations with a single touch of the display. This user interface has revolutionary drag-and-drop actions to copy and set up channels, math functions, and measurement parameters without lifting a finger.

Common gestures such as drag, drop, pinch, and flick facilitate instinctive interaction with the oscilloscope. The “Add New” button quickly enables a new channel, math, or measurement while traces and parameters turn off with a flick of a finger.

For further information, visit www.teledynelecroy.com.

Touch Monitor User Interface for AC & DC Power Source Family

Pacific Power Source has announced a unique touch-screen monitor user interface mode for its new AFX Series of programmable ac and dc power sources. This new capability extends the front-panel LCD touch and keypad controls onto a large, high-resolution monitor with touch capability.

Both the instrument screen information and touch-screen version of the front panel keyboard can be displayed on a large monitor connected via the HDMI connector on the front of the AFX power source. The result is a large, easy-to-read visual display with a large, touch-operated keyboard directly below it. All function and menu keys carry over to the monitor display as well.

Typical applications for this enhanced and larger user interface are operator training and seminar presentations. The large display also allows a test engineer to monitor equipment under test operation from across a lab or control room without having to be directly in front of the actual instrument. Switching between external monitor and front-panel controls can be accomplished easily by plugging the HDMI cable in or out. A wide range of monitor sizes and resolutions is supported, enabling the operator to use existing available monitors for this feature.

The AFX series is available in output power levels ranging from 6 kVA to 60 kVA. Capabilities include a 15 Hz to 1200 Hz frequency range, single 300 VRMS constant power mode voltage range, programmable RMS or DC and peak current limit functions, and included Pacific Power PPSC Studio Windows control software.

For more information on the new AFX Series, visit the Pacific Power Source website at www.pacificpower.com.

New Compatibility with CyberOptics for Data Collection and Quality

Aegis Software has announced compatibility with CyberOptics' complete suite of award-winning SPI (Solder Paste Inspection) and AOI (Automated Optical Inspection) systems, and Aegis' FactoryLogix software. This new interface will provide CyberOptics customers with improved quality control and an enhanced, automated method for identifying and collecting manufacturing defect data during inspections.

When used in conjunction with the rich CAD environment enabled by FactoryLogix, the robust output data from CyberOptics' AOI and SPI machines allows for a digital view of the collected defect data that extends down to the pin level.

Traditional methods of identifying defects, such as manual, paper-based reports, are no longer necessary. Data collected from CyberOptics is recorded directly into the FactoryLogix database and allows for a single source device history of the product for quick reporting without the need to export the raw data to an external source. Based on the collected pass and fail data, FactoryLogix can intelligently reroute the product to the appropriate reroute path. This increased efficiency in production saves both time and money for customers.

Learn more by visiting www.aiscorp.com.

New Ultra-Portable Laser Tracker System

Hexagon Manufacturing Intelligence has launched the latest addition to its range of laser tracker systems. The Leica Absolute Tracker AT403 has been designed to offer excellent portable metrology performance and presents significant improvements in terms of speed and ease of measurement.

With full IP54 certification, an operating temperature range of $-15\text{ }^{\circ}\text{C}$ to $45\text{ }^{\circ}\text{C}$ and the introduction of the RapidSight aim alignment tool, the Leica Absolute Tracker AT403 is able to provide CMM capabilities in a wide range of challenging measurement environments. Portable usage is further enhanced by WiFi connectivity, providing true access point functionality.

The system's updated distance meter technology is able to make improved use of the Leica B-Probe in terms of measurement speed and usability. It also delivers measurement process speed improvements for reflector measurements and supports the newly introduced continuous measurement functionality, which allows for the measurement of moving points for the first time within this level of the Leica Absolute Tracker range.

The Leica Absolute Tracker AT403 retains key features from its predecessors, such as the PowerLock function, full battery operation and an ultra-large measurement volume of 320 meters (\emptyset).

For more information, visit www.HexagonMI.com.

PXIe Precision Programmable Resistor Ladder

With the introduction of the EMX-70XX Series of Precision Programmable Resistor Ladders, AMETEK continues to expand their core ATE PXI Express (PXIe) card lineup. The EMX-70XX series can be used to simulate sensors, potentiometers, thermocouples, pressure sensors, strain gauges, and more. It easily integrates into functional test applications in automotive, aerospace, and medical settings and can even be used for fault insertion or as a low-power load simulator. Connect channels in series or parallel to increase range or to simulate potentiometers as needed.

The full feature set of the EMX-7004 includes:

- 4 independent channels,
- 4 decades per channel
- Accurate steps from $1\ \Omega$ to $16,383\ \Omega$ in $1\ \Omega$ increments (EMX-7004)
- Precision sensor simulation
- Low thermal offset ($\leq \pm 25\ \mu\text{V}$)
- Independent sense feedback
- Operates in parallel or series
- Dynamic soft front panel interface IVI-COM, IVI-C, and LabVIEW™ drivers available

Visit www.vtiinstruments.com for more information.

Adaptive FPGA-Based Video Processing Platform

UK MOD's Defence Science and Technology Laboratory (DSTL) has contracted a team, led by Plextek Services Limited and including RFEL Limited and 4Sight Imaging Limited, to tackle the problem of performing rapid evaluations of real-time image processing functions and to simultaneously demonstrate the latest adaptive capabilities that modern FPGA-based system-on-chip architectures can deliver to defense and security surveillance applications, all within a minimized size, weight and power footprint.

DSTL can use this platform to solve complex defense vision and surveillance problems, facilitating the rapid incorporation of best-in-class video processing algorithms while simultaneously bridging the gap between research prototypes and deployable equipment.

As video processing solutions become increasingly complex and sophisticated, a new problem has emerged—the need to optimally configure FPGA-based component functions and algorithms in real time, in rapidly varying conditions.

To crack it, the team will deliver a solution that incorporates a software processing layer, previously developed for DSTL by 4Sight Imaging, that performs the adaption of the control variables to optimize the real-time video enhancement, replacing the need for a man-in-the-loop.

Using video metrics benchmarked against extensive human trials, the CPU-based configuration management layer can out-perform a human operator. Furthermore, all of the processing is performed at source, in real-time, thereby reducing off-board bandwidth and potentially alleviating downstream processing requirement. The whole is implemented in a low Size Weight and Power (SWaP) video enhancement platform and delivers a capability that never tires or misses the action, irrespective of the time of day, or the prevailing weather.

This innovative work draws together the best aspects of two approaches to video processing: high performance, implementing FPGA processing supporting the computationally intensive tasks, and the flexibility (but lower performance) of CPU-based processing. This heterogeneous, hybrid approach is possible by using contemporary system-on-chip (SoC) devices, such as Xilinx's Zynq devices, that provide embedded ARM CPUs with closely coupled FPGA fabric. The use of a modular FPGA design, with generic interfaces for each module, enables FPGA functions, which are traditionally inflexible, to be dynamically re-configured under software control.

Find more information at www.plextek.com and <http://www.rfel.com>.

Quad-Channel Digital Isolator

The ISO774x devices from Texas Instruments are high-performance, quad-channel digital isolators with 5000 VRMS (DWpackage) and 2500 VRMS (DBQ package) isolation ratings per UL 1577. This family of devices has reinforced insulation ratings according to VDE, CSA, TUV and CQC.

The ISO774x devices provide high electromagnetic immunity and low emissions at low power consumption, while isolating CMOS or LVCMOS digital I/Os. Each isolation channel has a logic input and output buffer separated by a silicon dioxide (SiO₂) insulation barrier. This device comes with enable pins which can be used to put the respective outputs in high impedance for multi-master driving applications and to reduce power consumption. The ISO7740 device has all four channels in the same direction, the ISO7741 device has three forward and one reverse-direction channels, and the ISO7742 device has two forward and two reverse-direction channels. If the input power or signal is lost, default output is for devices without suffix F and for devices with suffix F. See the section for further details.

Used in conjunction with isolated power supplies, this device helps prevent noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry. Through innovative chip design and layout techniques, electromagnetic compatibility of the ISO774x devices have been significantly enhanced to ease system-level ESD, EFT, surge, and emissions compliance. The ISO774x devices are available in 16-pin SOIC and QSOP packages.

Features include:

- Signaling Rate: Up to 100 Mbps
- Wide Supply Range: 2.25 V to 5.5 V
- 2.25-V to 5.5-V Level Translation
- Default Output and Options
- Wide Temperature Range: -55°C to 125°C
- Low Power Consumption, Typical 1.5 mA per Channel at 1 Mbps
- Low Propagation Delay: 10.7 ns Typical
- High CMTI: $\pm 100\text{ kV}/\mu\text{s}$ Typical
- Robust Electromagnetic Compatibility (EMC)
- System-Level ESD, EFT, and Surge Immunity
- Low Emissions
- Isolation Barrier Life: >40 Years
- Wide-SOIC (DW-16) and QSOP (DBQ-16) Package Options

Find more information at www.ti.com/product/ISO7741.

High-Load Linear Actuator

A linear actuator is a positioning device that provides motion in 1 degree of freedom. Designed for highly accurate and fast repetitive industrial applications, the L-239 compact linear actuator is the newest addition to the suite of motion control solutions available from PI (Physik Instrumente).

Equipped with precision ground ball screws for higher speed and a longer service life, the L-239 high force actuator has a positioning range of 52 mm (2 in), pushing force of 300 N (66lbs), and 50 mm/sec (2 in/sec) maximum velocity. The nonrotating tip enables uniform motion as it prevents wobble, torque, and wear at the point of contact. Noncontact limit switches protect the mechanics, while a direction-sensing reference point switch speeds up the homing procedure and supports automation applications. For vacuum-applications, special versions to 10^{-9} hPa are available.

Resolution of 100 nanometers (0.1 microns) and repeatability down to 0.5 microns is achieved by a closed-loop servo motor for higher velocities or a micro-stepped 2-phase directdrive motor. Other motor and encoder options for OEMs are available on request.

For specifications, datasheet or more information, please visit: www.pi-usa.us/products/Linear-actuator-linearpusher/precision_actuator_overview.php#L239.

Miniature Teardrop Accelerometer

A new miniature teardrop ICPR accelerometer has been released by PCB Piezotronics, Inc. Model 352A74 has a sensitivity of 100 mV/g and a measurement range of ± 50 g peak. The sensor is hermetically sealed in a low profile titanium housing and is adhesively mounted.

With a flexible one-foot, twisted pair integral cable, it easily mounts in tight spaces. The cable is spliced into a heavier gauge coaxial cable for a length of 10 feet, terminating in a 10-32 connector.

With built-in microelectronic signal conditioning circuitry, Model 352A74 provides a low-noise, low impedance output signal while permitting long distance signal transmission and simplicity of operation. The durable design operates in -65 to $+250$ °F temperatures and survives accidental shock inputs to $\pm 5,000$ g.

For additional information, visit www.pcb.com/accelerometers/352A74.

Non-Contact Handheld Thermometer

OMEGA introduces the new OS758-LS handheld dual laser infrared thermometer that delivers reliable noncontact measurement for instant troubleshooting. It can measure temperatures up to 1600 °C (2912 °F) with adjustable emissivity for the most accurate results. The high 60:1 D:S ratio allows precise measurements from a safe distance. Users will find lots of uses for the OS758-LS, including equipment and electrical maintenance, automotive diagnostics, monitoring production lines, and much more. Simply point, pull the trigger, and view the surface temperature within a second. The rugged design is ideal for industrial use.

For more information, visit www.omega.com/pptst/OS758-LS.html.

Safety Laser Scanner Fits in Tight Spaces

IDEC Corporation introduces the SE2L Safety Laser Scanner, their smallest, and first with master/slave functionality and dual protection zones. A laser scanner is a safety device that uses the reflection of laser beams to detect the presence of objects or people. The scanner is certified for use in safety applications including Autonomous Ground vehicles (AGVs), robots and other items of moving equipment.

Master/slave functionality allows one SE2L scanner to act as master and communicate with up to three other scanners. The safety controller only needs to communicate with the master, reducing the required number of input and communication channels on the controller. This can allow lower-cost safety controllers to be used in applications such as providing full 360-degree protection for an AGV, which requires four scanners. Dual zone protection allows one SE2L scanner to scan two adjacent zones simultaneously and independently, performing the work of two scanners for the cost of one. A common application is providing dual light curtain protection for two robots mounted side by side.

The scanner provides a standard 270-degree arc of protection at a distance up to 20 meters, and this protection area can be configured into any pattern using either free programming software provided with the scanner or with the scanner's teach mode. The scanner is configured using IDEC's SLS Project Designer Software, which can be downloaded for free. Once the

configuration is complete, it can be downloaded to the scanner through its Ethernet port, Micro USB port or Micro SD Card slot.

For complete specifications or additional information, please visit www.idec.com/SE2L.

Errata

In the April 2017 issue of *IEEE I&M Magazine*, there are two errors in the column on Basic Metrology, “From Telegraphy to the Revised SI”

1. On page 41, line 20 of the left-hand column: due to a typesetting error, $\mu 0/4p$ is incorrectly written as $\mu 0/5p$.
2. On page 41, an incorrect link was given to the second article in For Further Reading. The correct link is: <http://www.bipm.org/cc/CCEM/Allowed/29/CCEM-15-06-electrical-units-in-new-SI.pdf>