




To measure is to know   
May 17-20, 2021 | Virtual Conference

IEEE International  
Instrumentation  
and Measurement  
Technology Conference



# 2021 CONFERENCE PROGRAM

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## Welcome Message from the General Co-Chairs

On behalf of the IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Organizing Committee, the I2MTC Board of Directors and the IEEE Instrumentation and Measurement Society (IMS), we warmly welcome you to I2MTC 2021 which is taking place as a virtual event. I2MTC is the flagship conference of the IMS, and one of the top international conferences in the areas of instrumentation and measurement.

I2MTC 2021 was scheduled to be held at the Technology and Innovation Centre (TIC) in the heart of Glasgow, Scotland. Glasgow is Scotland's largest city, and historically is one of the main centers of the industrial revolution in the UK. Glasgow's scientific heritage is very strong. Lord Kelvin lived and worked in Glasgow for over 50 years. James Watt was born around 25 miles from Glasgow, and his early career was achieved in Glasgow. John Logie Baird was born around 30 miles from Glasgow, and invented an early version of television while working in Glasgow. Today, Glasgow is home to four Universities and a multitude of science, engineering and technology-based businesses of varying size. Measurement science and instrumentation are at the core of many of these businesses. It is therefore appropriate that Glasgow was selected as host city for I2MTC 2021.

The past 15 months have been unprecedented. With global lockdown commencing in early 2020 and movement restrictions continuing through the summer, autumn and early winter of 2020, it became very clear that I2MTC 2021 could not be delivered as an on-site conference, and an early decision was taken to make it a virtual event. The Organizing Committee decided that even in a virtual format, the conference would uphold all the traditions and implement the well-loved events for which I2MTC is known. The goal was for the virtual conference to mirror the features of the on-site I2MTC. The focus of the Organizing Committee on achieving this goal was sharp. It was therefore decided that all on-line presentations at the virtual event would be delivered 'live', taking advantage of the different digital conference platforms available. Accordingly, attendees at I2MTC 2021 will experience the following live talks and sessions: Tutorials; Plenary, Invited and Regular Presentations; Poster Presentations; Demos; TIM@I2MTC; Conference Paper Awards; Topical Discussion Panels; Industry Sessions and a virtual tour of Glasgow. Live presentations will be followed by live Q&A, just like at an on-site event. Live content will be supplemented by 'on-demand' viewing, so delegates have the opportunity to view a presentation they may have missed, or view a presentation again. As is the norm, all accepted papers will be published in the conference proceedings, while presented papers adhering to the presentation requirements will be uploaded to IEEE Xplore. Authors of the proceedings papers are also eligible to submit an extended version of their work to the IEEE Transactions on Instrumentation and Measurement (TIM) Special Issue dedicated to I2MTC 2021.

Our gratitude and praise go to all of the researchers who submitted papers to the virtual conference despite facing the hardship of having little or no laboratory access for over half a year, and the additional difficulties encountered due to contact limitations and travelling only for essential purposes. Yet, the I2MTC community defied these problems by finding ways of undertaking new research then submitting research papers to the conference. Through this extraordinary effort on the part of the researchers during a global lockdown, the conference received 383 original papers, of which 313 were accepted after a thorough review. Moreover, the conference received 6 Demo proposals, 6 Open Posters and 38 contributions to the TIM@I2MTC track, the latter being a record number of submissions to this track. Many authors will deliver their live presentations at unsocial hours. The strong loyalty and support that I2MTC 2021 has received from its research community during this period is both amazing and highly appreciated.

I2MTC 2021 has a group of Plenary Speakers of extraordinary caliber. Helen Margolis from the UK National Physical Laboratory will talk about recent innovations in timing infrastructure and technology. Sheila Rowan from Glasgow University will talk about gravitational-wave detectors and the related ultra-

precision measurement challenges. Erling Riis from Strathclyde University will talk about atomic-based quantum sensors, tracing their journey out of the lab towards field applications. Judy Amanor-Boadu, from Intel in the USA and recipient of the J Barry Oakes Advancement Award, will talk about high-performance VLSI processors.

We would like to extend our thanks to the following for all of their continuous hard work and efforts: Sabrina Grassini and Kurt Barbé for organizing the Tutorials; Sergio Rapuno, Ruqiang Yan and Gordon Flockhart for the high-level oversight in coordinating and organizing the Special Sessions; Sebastian Yuri Catunda and Ralf Bauer for organizing the Demo Sessions; Michael Lengden and James Bain for organizing the Industry Sessions; Alison Cleary for her work on Panels; Jacqueline Malloy for hosting the virtual tour of Glasgow; and Shervin Shirmohammadi for supporting TIM@I2MTC. Our thanks also go to all of the Special Session Topic organizers, to all of the Associate Technical Program Chairs and to all of the Reviewers for their hard work and keeping to schedule on the various conference tracks.

Thanks go to Wendy Russell and colleagues at the Glasgow City Convention Bureau for their support leading to I2MTC 2021 being awarded to Glasgow, and for their continuous support since then.

Thanks are also extended to Laura LeBlanc of Conference Catalysts for her immense efforts as Conference Manager and for attending to all conference details and taking care of all of the issues that came her way. Thanks also to the Technical Team at Conference Catalysts for handling everything linked to the IT, website and conference digital platform.

Last, and by no means the least, we have to give recognition and special thanks to the Technical Program Committee Co-Chairs namely Melanie Ooi, Pawel Niewczas and Kristen Donnell. The geographical bases of the TPC Co-Chairs span from Missouri, through the UK all the way to New Zealand. This covers 17 hours time difference from west to east. Meeting times were never optimal, some meetings starting early in the day, others late in the night. Despite the inconvenience of inhospitable meeting times, the TPC Co-Chairs have worked together closely, tirelessly and uncomplainingly to ensure that all preparations and deliverables were completed on schedule. It has been an immense pleasure and honor to work with all three of them.

We hope that all attendees will adapt to the live virtual format of I2MTC 2021, learn new things, meet up on-line with established friends and make new contacts from across the world. We wish you all an enjoyable conference.

Deepak Uttamchandani and Matthew Maynard

General Co-Chairs

# I2MTC 2021 Organizing Committee

## **General Chairs:**

Deepak Uttamchandani, *University of Strathclyde, Glasgow, Scotland*

Matthew Maynard, *University of Strathclyde, Glasgow, Scotland*

## **Technical Program Co-Chairs:**

Pawel Niewczas, *University of Strathclyde, Glasgow, Scotland*

Melanie Ooi, *University of Waikato, Hamilton, New Zealand*

Kristen M. Donnell, *Missouri University of Science and Technology, Missouri, United States*

## **Tutorial Co-Chairs:**

Sabrina Grassini, *Politecnico di Torino, Italy*

Kurt Barbé, *Vrije Universiteit Brussel, Belgium*

## **Special Session Co-Chairs:**

Sergio Rapuano, *University of Sannio, Italy*

Ruqiang Yan, *Xi'an Jiaotong University, China*

Gordon Flockhart, *University of Strathclyde, Glasgow, Scotland*

## **Demo Session Co-Chairs:**

Sebastian Yuri Catunda, *Federal University of Rio Grande do Norte, Natal, Brazil*

Ralf Bauer, *University of Strathclyde, Glasgow, Scotland*

## **Industry Session Co-Chairs:**

Michael Lengden, *University of Strathclyde, Glasgow, Scotland*

James Bain, *M Squared Lasers, Glasgow, Scotland*

## **Junior Women in Instrumentation and Measurement Chair:**

Alison Cleary, *University of Strathclyde, Glasgow, Scotland*

## **Local Arrangement Chair:**

Jacqueline Malloy, *University of Strathclyde, Glasgow, Scotland*

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Deepak Uttamchandani, *University of Strathclyde, Glasgow, Scotland*

Branislav Djokic, *National Research Council, Canada*

# I2MTC 2021 Associate Technical Program Chairs

## **Advances in Measurement Theory and Metrology**

- Marco Parvis

## **Big Data and Metrology**

- Dario Petri
- Dr Valerie Livina

## **Circuits and Embedded Systems for Measurement**

- Teddy Gunawan
- Zheng Liu

## **Data Acquisition Systems**

- Amitava Chatterjee
- Pasquale Daponte

## **Image Processing for Measurement**

- Chi Hung Hwang
- Jacob Scharcanski

## **Measurement for Advanced Manufacturing**

- Serge Demidenko

## **Measurement for Chemical and Biological Quantities**

- Gang Lu
- James Windmill
- Mick Lengden

## **Measurement for Communications and IoT**

- Domenico Capriglione
- Chao Wang

## **Measurement for Industry 4.0**

- David Macii
- Marco Mugnaini

## **Measurement for Non-Destructive Testing and Evaluation**

- Prof. M. Tayeb Al Qaseer
- Prof. Zheng Liu
- Theodosia Stratoudaki

## **Measurement for Physical and Electromagnetic Quantities**

- Grzegorz Fusiek
- Wuliang Yin

## **Measurement for Renewable Energy Systems**

- David Garcia Cava

## **Measurement in Aerospace and Space Systems**

- Catherine Jones
- Patrick Norman

## **Measurement in Agriculture, Food Production and Food Safety**

- Gourab Sen Gupta
- Sabrina Grassini

## **Measurement in Environmental Monitoring**

- Fakhru Alam
- Yong Yan

## **Measurement in Medical, Biomedical and Healthcare Systems**

- Octavian Postolache

## **Measurement Systems for Robotics**

- Ruqiang Yan
- Valner Brusamarello

## **Micro and Nanotechnology in Instrumentation and Measurement**

- Aimé Lay-Ekuakille
- Salvatore Graziani

## **Optical and Fiber Optic Measurement Systems**

- Tuan Guo
- Marcelo Werneck

## **Real-Time Measurement Systems**

- Intan Zaurah Mat Darus

## **Sensors and Transducers**

- Bruno Andò
- Dr Theodosia Stratoudaki

## **Sensors and Transducers**

- Intan Zaurah Mat Darus

## **Signal Processing for Measurement**

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- Luca De Vito

## **The Automotive and Transportation Industry**

- Daniel Watzenig

## **The Energy and Power Industry**

- Eduardo Fiorucci
- Mihaela Albu

## **The Oil and Gas Industry**

- Marcelo Werneck
- Gordon Dobie

# Special Session Organizers

## **SPS-1: Electrical & Magnetic Sensing and Imaging for NDT&E**

- Nan Li
- Xiucheng Liu

## **SPS-2: Instrumentation and Measurement for Improving Quality, Reliability and Safety: New Perspectives for Research and Industry (TC-32)**

- Lorenzo Ciani
- Marcantonio Catelani
- Loredana Cristaldi
- Giulio D'Emilia

## **SPS-3: Multifunctional Sensors and Smart Materials**

- Marcus Perry

## **SPS-4: Advanced Measurement and Data Analytics for Industrial Equipment Health (TC-3 & TC-7)**

- Shibin Wang
- Weihua Li
- Gaigai Cai

## **SPS-5: Beyond Smart Sensors Networks: Characterization and Applications of Emerging Wireless Communications for IoT/CPS System (TC-37)**

- Emiliano Sisinni
- Gianfranco Miele

## **SPS-6: In-situ Fiber-Optic Biomedical & Chemical Measurements and Applications**

- Tuan Guo
- Yong Zhao

## **SPS-7: AI- Enabled Technologies for Smart Health Monitoring**

- M. Shamim Hossain
- Abdulmotaleb El Saddik

## **SPS-8: Ophthalmic Instrumentation and Measurement Methods**

- Luigi Rovati
- Mario Ettore Giardini

## **SPS-9: Sensors, Instrumentation, and Artificial Intelligence Technologies for Environmental Measurement and Modeling (TC-18 & TC-42)**

- Der-Chen Huang
- Tuan Guo
- Huan Liu
- Chi-Hung Hwang

## **SPS-10: Transducers for a Greener Society: From Materials to Sensing Systems**

- Salvatore Graziani
- Carlo Trigona

## **SPS-11: Embedded Artificial Intelligence for Smart Sensing and IoT applications**

- Sebastian Bader
- Michele Magno

## **SPS-12: Non-visible Imaging Techniques for Measurement and Testing in Industrial and Scientific Applications**

- Emanuele Zappa
- Paola Saccomandi

## **SPS-13: Smart Measuring Systems and Measures for the Management of Emergencies. The case of COVID19 pandemic, and beyond**

- Federico Tramarin
- Stefano Cattini
- Alberto Ferrari



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**A big thank you to the I2MTC 2021 Reviewers!**

## I2MTC 2021 Conference Sponsors



## I2MTC 2021 Plenary Speakers

### Innovations in Timing Infrastructure and Technology: Improving Resilience, Access and Performance



#### Helen Margolis

Helen Margolis is the Head of Science for the Time & Frequency department at the UK National Physical Laboratory (NPL) and an NPL Fellow in Optical Frequency Standards and Metrology. She joined NPL in 1998 following a temporary lectureship at the University of Oxford, where she worked on a range of experiments designed to test the theory of quantum electrodynamics by spectroscopy of highly charged ions. She previously undertook her undergraduate and postgraduate studies in Oxford, being awarded the DPhil degree in 1994.

NPL operates the national time scale UTC(NPL) and the UK primary frequency standards, and uses these to contribute to international timekeeping, as well as to disseminate accurate time and frequency to users across the UK. NPL also carries out a broad programme of research and development in time and frequency metrology. Within this, Helen's specialist area of research expertise is optical frequency metrology using femtosecond combs, part of the effort to develop a new generation of high accuracy optical atomic clocks based on laser-cooled trapped ions and atoms. This work is expected to lead to a redefinition of the SI unit of time, the second. Helen is the coordinator of a European project Robust optical clocks for international timescales (ROCIT), and the Technical Authority for the National Timing Centre programme.

Helen represents NPL and the UK on various international committees, including the Consultative Committee for Time and Frequency (CCTF) and several of its working groups. She is the current chair of the Executive Committee of the European Frequency and Time Forum and a member of the CODATA Task Group on Fundamental Constants. She has been a Visiting Professor at the University of Oxford since 2017 and was awarded an MBE in 2019 for her services to metrology.

### Gravitational-wave Detectors: Challenges in Precision Measurement Technology for Fundamental Physics



#### Sheila Rowan

Professor Sheila Rowan holds the Chair of Natural Philosophy at the University of Glasgow, UK and since 2009, is Director of its Institute for Gravitational Research. She has held research positions split between Stanford University and Glasgow before returning full time to a Faculty position in Glasgow in 2003.

She was elected to Fellowship of the Royal Society of London in 2018 and the Royal Society of Edinburgh in 2008, and awarded Fellowship of the American Physical Society in 2012. She received the Hoyle Medal and Prize of the Institute of Physics in 2016 in recognition of her pioneering research on aspects of the opto-mechanical technology of gravitational wave observatories, which utilise ultra-low noise precision interferometric sensing. In 2016 she was seconded (part-time) to be Chief Scientific Advisor to the Scottish Government, is the UK CSA Champion for Quantum Technologies and the President Elect of the UK Institute of Physics.

## I2MTC 2021 Plenary Speakers (continued)

### Atomic-Based Quantum Sensors – the Journey Out of The Lab



**Erling Riis**

Erling Riis is a Professor of Physics at the University of Strathclyde. He joined the University in 1991 and founded the cold atom activities there after having worked as a post-doc with Nobel Laureate Steven Chu at Stanford. The main drivers for the Strathclyde research have been high-resolution atomic spectroscopy, precision measurements and the development of the highly specialised laser sources and optical technology required for these experiments. More recently this has led to a concerted effort to realise compact and portable atomic-based sensors and measurements systems operating outside a laboratory environment.

The integration of a fundamental research programme in quantum and atom optics with technology development has been a defining feature of the cold atom group's research activities. This is particularly exemplified by the development of techniques for miniaturising cold atom systems to be used in e.g. portable atomic clocks and the integration of atomic, optical and digital signal processing solutions for magnetometry. These are novel measurement systems, that form the basis for the group's involvement in the UK Quantum Technology Hub for Sensors and Timing. With additional support from industrial collaborators and Innovate UK this work has demonstrated compact and portable quantum sensors and instrumentation suitable for scalable manufacture.

Erling is the Fellow of the Institute of Physics and the Optical Society of America and serves on the programme and organising committees for several of the key international conferences covering the field of Quantum Technology.

## 2020 IEEE I&M Society J. Barry Oakes Advancement Award

### J. Barry Oakes Presentation



Judy Amanor-Boadu (Intel Corporation, USA)

“For contributions to the development of measurement-correlation methodologies that combine simulation methods with laboratory measurement, with application to increasing the efficiency and integrity of power-delivery systems for high-performance VLSI processors; and for dedicated and demonstrated service as a servant leader and a mentor.”

# I2MTC 2021 Tutorial Speakers

## **Material State Determination for Process State Awareness**

James A. Smith, *Idaho National Laboratory*

## **Medicine 4.0: When New Technologies Work with A.I.**

Eros Pasero, *Politecnico di Torino*

## **Optical and Fibre Optic Measurement Systems**

Marcelo Werneck, *Universidade Federal do Rio de Janeiro*

## **Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 1 Theory**

George Stewart, *University of Strathclyde*

## **Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 2 - Experimental Systems and their Deployment**

Walter Johnstone, *University of Strathclyde*

## **Non-invasive Monitoring of Drugs Bioavailability by Tissue Impedance Measurement**

Pasquale Arpaia, *DIETI, University of Naples Federico II*

Nicola Moccaldi, *Università di Napoli Federico II*

## **Industrial Measurements, Communications and Protocols**

José Miguel Costa Dias Pereira, *Instituto Politécnico de Setúbal*

## **Fundamentals and Applications of Distributed Electromechanical Sensing for Power Networks**

Steven Blair, *Synaptec*

Lloyd Clayburn, *Synaptec*

## **Impedance Spectroscopy for Measurement and Sensor Solutions**

Olfa Kanoun, *TU Chemnitz*

## **Harmonic Synchrophasor Estimation for Smart Grid Applications: From New Estimators to New Applications**

Lei Chen, *Tsinghua University*

# COVID 101 – Best Practices from Pandemic Life Panel

Presented by the Women in Instrumentation and Measurement Committee



**Sonia M. Garcia Blanco**  
*University of Twente, The Netherlands*

Sonia García Blanco (female) obtained her PhD in Electrical and Computer Engineering from the University of Glasgow (2003) in integrated optics for optical biosensors. After a post-doctoral fellowship at the University of Toronto, she spent almost 6 years working in an industrial research laboratory (INO in Québec City, Canada) where she led the photonic integration and wafer-level micropackaging internal research activities. She was project manager and technical coordinator in several external projects for the Canadian Space Agency, European Space Agency and other private clients. She joined the faculty of the MESA+ Institute for Nanotechnology of the University of Twente in August 2010 as assistant professor, to work towards the establishment of a research program in active integrated nanophotonic devices and plasmonics with applications in optical sensing and telecommunications within the Integrated Optical Micro-Systems Group (IOMS). Since January 2014, she leads the Integrated Optical Systems group within the Optical Sciences chair of MESA+. She is co-chair of the Integrated Optics conference at Photonics West since 2014 and symposium chair of the OPTO Symposium at Photonics West starting in 2021. She participates in technical committees of reputed international conferences such as CLEO-Europe, ECIO, IEEE GFP and ECOC. In 2014, she was awarded an ERC Consolidator grant (RENOS- 648978). She is currently the coordinator of the H2020 project Ophellia and partner of the H2020 projects SERSing and Femtochip. Prof. Dr. García-Blanco has authored and co-authored more than 50 refereed journal papers and over 150 conference contributions in the field of integrated photonics, optical biosensors, plasmonics, photonics integration and packaging.



**Tamador Salih Saeed**  
*Metrology for All Platform*

**Education:**

2017-2021: Ph.D. Department of Physics, University of Khartoum. Sudan.  
M.Sc. In Physics, Physics Department, University of Khartoum. Sudan.  
B.Sc. (Honors), Physics Department, Faculty of Science, University of Khartoum, Sudan.

**Experience:**

One of the Experts metrology on list: Arab Experts at Industrial Development and Mining Organization (AIDMO).

Physicist, Measurement and Calibration laboratories, SSMO.

Lecturer: Center for Standardization Science, SSMO, 2012-2014.

Lecturer: Khartoum College for Medical Sciences. 2007-2010.

Teaching Assistant: Bayan College for Science and Technology, 2003-2008

**Award:**

Innovative Research Award, The 25th anniversary of OWSD, SWSO, 2018.

**Workshops & Conferences:**

Online presentation "Metrology and the Update SI" Organized by AIDMO, 26 October 2020.

Conference paper, Conference on Precision Electromagnetic Measurements, CPEM 2018, July 2018 Paris, France.

Presentation "Redefining the SI units" Workshop, main speaker and organizer, December 2018. Sudanese Standards & Metrology Organization, SSMO, Sudan.

Speaker "Metrology: The mainstay of standardization and its role in consumer protection " in The Arab Standardization and Consumers Protection Forum, 16-17 October 2017, Khartoum, Sudan.

Speaker "The Importance of Standardization Activities and their role in community development", workshop entitled "Supporting Community Partnership and Sustainable Development of Standardization Activities", Saudi Standards, Metrology and Quality Org, February 14-15. 2017, Riyadh, KSA.

**Publications:**

Mrs. Tamador has many publications in her field.

She is Owner of "Metrology for All" platform.



**Erik Timpson, P.E. Ph.D.**  
*Principal Electrical Engineer*

Dr. Erik Timpson is a Principal Electrical Engineer in Quality Assurance Engineering at Honeywell Federal Manufacturing & Technologies (FM&T), which manages and operates the Department of Energy's Kansas City National Security Campus (KCNSC). With 5,000 employees in Kansas City and Albuquerque, the Kansas City National Security Campus provides diverse engineering, manufacturing and secure sourcing services for national security.

Prior to this role, Dr. Timpson served as a Product Development Engineer in the telecommunications industry.

Dr. Timpson has authored/coauthored more than 20 peer reviewed journal articles, conference proceedings, or technical magazine column articles. He has 5 patents granted. He is a member of Institute of Electrical and Electronic Engineers (IEEE), Eta Kappa Nu, Kappa Nu Epsilon, and NCSL International. He has always had a love for education marked by his extensive tutoring, peer instructing, and undergraduate research at Missouri University of Science and Technology. He was the Young Professional Representative for IEEE Instrument and Measurement Society ADCOM.

Dr. Timpson earned a Bachelor degree in Electrical Engineering with honors and minors in Math, Physics, and Biology from the University of Missouri, Rolla. He earned a Master degree in Electrical and Computer Engineering from the University of Missouri, Kansas City and a Ph.D. in Electrical and Computer Engineering from University of Missouri, Columbia. Dr. Timpson is Six Sigma Black Belt trained.



## 2021 I2MTC Student/YP Panel: The Digital Job Search

IMS invites students and young professionals to join us for our annual Student/YP Panel at I2MTC! This year's panel will focus on finding your career path and will include discussions on digitally marketing yourself, how the pandemic has changed how we find jobs, discovering the right job fit for you, how IMS can support your professional journey, and more!

### Moderators:



**Katelyn Brinker** is currently pursuing a Ph.D. in electrical engineering at Iowa State University with the support of a NASA Space Technology Research Fellowship (NSTRF/NSTGRO). She graduated from Missouri S&T

with bachelor's degrees in electrical engineering and computer engineering in 2017 and with a master's in electrical engineering in 2019. She has served as an IEEE-HKN chapter president, IEEE student branch president, IEEE-HKN Student Governor, and Undergraduate and Graduate Representative to the IEEE Instrumentation and Measurement Society AdCom. She is also the 2017 recipient of the IEEE-HKN Outstanding Student Award.



**Lijuan Wang** (M'14-SM'20) is a Lecturer in Electronic Engineering at the School of Engineering and Digital Arts, University of Kent, Canterbury, UK. She is a Senior Member of IEEE and the current Young

Professionals Rep for the IEEE Instrumentation and Measurement Society. She received her B.Eng. degree in Computer Science and Technology from Qiqihar University, Heilongjiang Province, China in 2010 and her Ph.D. degree in Measurement and Automation from North China Electric Power University, Beijing, China in 2014. She subsequently obtained a second Ph.D. degree in Electronic Engineering from the University of Kent, Canterbury, UK in 2017.

### Panelists:



#### **Dr. Erik Timpson**

Dr. Erik Timpson is a Principal Electrical Engineer in Quality Assurance Engineering at Honeywell Federal Manufacturing & Technologies (FM&T), which manages and operates the Department of Energy's Kansas City National Security Campus (KCNSC). With 5,000 employees in Kansas City and Albuquerque, the Kansas City National Security Campus provides diverse engineering, manufacturing and secure sourcing services for national security.

Prior to this role, Dr. Timpson served as a Product Development Engineer in the telecommunications industry.

Dr. Timpson has authored/coauthored more than 20 peer reviewed journal articles, conference proceedings, or technical magazine column articles. He has 5 patents granted.

He is a member of Institute of Electrical and Electronic Engineers (IEEE), Eta Kappa Nu, Kappa Nu Epsilon, and NCSL International. He has always had a love for education marked by his extensive tutoring, peer instructing, and undergraduate research at Missouri University of Science and Technology. He was the Young Professional Representative for IEEE Instrument and Measurement Society ADCOM.

Dr. Timpson earned a Bachelor degree in Electrical Engineering with honors and minors in Math, Physics, and Biology from the University of Missouri, Rolla. He earned a Master degree in Electrical

and Computer Engineering from the University of Missouri, Kansas City and a Ph.D. in Electrical and Computer Engineering from University of Missouri, Columbia. Dr. Timpson is Six Sigma Black Belt trained.



**Dr Lee Barford**

As the Fellow for Software and Analytics at Keysight Technologies, Dr Lee Barford is the top technical lead from among the over 2500 people who create software at Keysight, one of the world's leading instrumentation and measurement companies. He leads work in ensuring the safety and correctness of automated driving software and sensors and in validating quantum computers. He is a member of the IMS AdCom and Chair of the Board of I2MTC. Previously, he held technical leadership and management roles at Hewlett-Packard Laboratories and Agilent Laboratories. He received the PhD in Computer Science from Cornell University. He also serves as an Adjunct Professor of Computer Science and Engineering at the University of Nevada, Reno.



**Andrea Angioni**

Andrea Angioni is a smart grid specialist at the Unareti SPA distribution operator, part of the multiutility A2A, in Milan, Italy. He works in the field of monitoring and automation of distribution systems. In the past he was research assistant at E.ON Energy research center of RWTH University in Aachen, Germany - where he worked on numerous european and german research projects.

## I2MTC Tradition

The first IEEE Instrumentation and Measurement Technology Conference was held in 1984 aboard the Queen Mary in Long Beach, California. But its origins stretch back nearly 20 years earlier to the Electrical and Electronic Measurement and Test Instrument Conference held each year from 1966 until 1981 in Ottawa, Canada. The latter was revived by the IEEE Instrumentation and Measurement Society with a new focus on all aspects of instrumentation and measurement. The following list contains locations and themes of the I<sup>2</sup>MTC conferences:

- 1984 – Long Beach, CA, USA, Automation-Quality-Productivity
- 1985 – Tampa, FL, USA, Measurement Science
- 1986 – Boulder, CO, USA, Standards of Excellence
- 1987 – Boston, MA, USA, The Changing Face of I&M Technologies
- 1988 – San Diego, CA, USA, Intelligence in Instrumentation
- 1989 – Washington, DC, USA, Persuasive I&M Technology – A Resource
- 1990 – San Jose, CA, USA, Emerging Measurement Technologies
- 1991 – Atlanta, GA, USA, Enhancing Productivity with Instrumentation and Measurement Technologies
- 1992 – Meadowlands, NJ, USA, Smart People, Smart Instruments, Smart Measurements
- 1993 – Irvine, CA, USA, Innovative Ideas for Industry
- 1994 – Hamamatsu, Japan, Advanced Technologies in Instrumentation and Measurement
- 1995 – Waltham, MA, USA, I3C – Integrating Intelligent Instrumentation and Control
- 1996 – Brussels, Belgium, Quality Measurements – The Indispensable Bridge between Theory and Reality (No Measurements? No Science!)
- 1997 – Ottawa, Canada, Sensing, Processing, Networking
- 1998 – St. Paul, MN, USA, Where Instrumentation is Going
- 1999 – Venice, Italy, Measurements for the New Millennium
- 2000 – Baltimore, MD USA, Smart Connectivity: Integrating Measurement and Control
- 2001 – Budapest, Hungary, Rediscovering Measurement in the Age of Informatics
- 2002 – Anchorage, AK, USA, The Frontier of Instrumentation and Measurement
- 2003 – Vail, CO, USA, Instrumentation and Measurement at the Summit
- 2004 – Lake Como, Italy, From the Electrometer to the Networked Instruments: A Giant Step toward a Deeper Knowledge
- 2005 – Ottawa, Canada, The 22nd Reunion
- 2006 – Sorrento, Italy, A View on the New Technologies for Instrumentation and Measurement
- 2007 – Warsaw, Poland, Synergy of Science and Technology in Instrumentation and Measurement
- 2008 – Victoria, British Columbia, Canada, Advances in the Science of Measurement Technology
- 2009 – Singapore, Always On: Instrumentation and Measurement in the Networked World
- 2010 – Austin, TX, USA, Innovative and Integrated Applications of I&M
- 2011 – Binjiang, Hangzhou, China, Instrumentation and Measurement for Improving Quality of Life
- 2012 – Graz, Austria, Smart Measurements for a Sustainable Environment
- 2013 – Minneapolis, MN, USA, Instrumentation and Measurement for Life
- 2014 – Montevideo, Uruguay, Instrumentation and Measurement for Sustainable Development
- 2015 – Pisa, Italy, The "Measurable" of Tomorrow: Providing a Better Perspective on Complex Systems
- 2016 – Taipei, Taiwan, Measuring the Pulse of Industries, Nature and Humans
- 2017 – Torino, Italy, "Man is the measure of all things" - Protagoras
- 2018 – Houston, TX, USA, Discovering New Horizons in Instrumentation and Measurement
- 2019 – Auckland, New Zealand, The Lords of the IMS: Expanding the Frontiers of Metrology Innovations
- 2020 – Dubrovnik, Croatia (Moved Fully Virtual), Technology Advancement Through Strong Foundation and Persistent Innovation
- 2021 – Glasgow, Scotland (Moved Fully Virtual), To Measure Is To Know

## Awards and Distinctions

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 Ceremony held as part of the I2MTC conference. The Awards Committee is pleased to announce the 2019-2021 winners.

### 2020 Transaction Outstanding Associate Editors

Mohammed Abou Khoussa, *Khalifa University of Science & Technology, United Arab Emirates*

Fabricio Guimaraes Baptista, *Universidade Estadual Paulista Júlio, Brazil*

Eduardo Cabal-Yepez, *University of Guanajuato, Mexico*

Amitava Chatterjee, *Jadavpur University, India*

Lorenzo Ciani, *University of Florence, Italy*

Alessio De Angelis, *University of Perugia, Italy*

Daniele Fontanelli, *University of Trento, Italy*

Dimitrios Georgakopoulos, *National Measurement Institute, Australia*

Tarikul Islam, *Jamia Millia Islamia (University), India*

Huang-Chen Lee, *National Chung-Cheng University, Taiwan*

Jing Lei, *North China Electric Power University, China*

Datong Liu, *Harbin Institute of Technology, China*

Zhigang Liu, *Southwest Jiaotong University, China*

Subhas Mukhopadhyay, *Macquarie University, Australia*

Lihui Peng, *Tsinghua University, China*

Seyed Hossein Hesamedin Sadeghi, *Amirkabir University of Technology, Iran*

Jesús Ureña, *University of Alcalá, Spain*

Hongrui Wang, *Delft University of Technology, Netherlands*

Emanuele Zappa, *Politecnico di Milano, Italy*

### IEEE Instrumentation and Measurement Society Andy Chi Best Paper Award

Ming Yin, *Hefei University of Technology, China*

Xiaoning Liu, *Hefei University of Technology, China*

Xun Chen, *University of Science and Technology of China*

Yu Liu, *Hefei University of Technology, China*

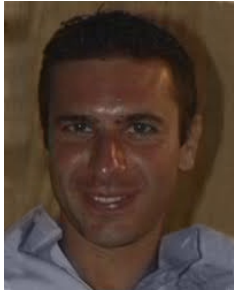
## IEEE Instrumentation and Measurement Society Best Application Award



**Wuliang Yin**, *The University of Manchester, United Kingdom*

*“for the application focusing on online monitoring of the evolution of steel microstructure in a hot rolling process.”*

## IEEE Instrumentation and Measurement Society Outstanding Young Engineer Award



**Carlo Trigona**, *University of Catania, DIEEI, Italy*

*“For his outstanding contribution to the advancement of I&M concept in sensors and transducers for energy harvesting.”*

## IEEE Instrumentation and Measurement Society Distinguished Service Award



**Georg Brasseur**, *Graz University of Technology, Austria*

*“For Distinguished Service to the IEEE I&M Society for over 25 years, contributions to the society’s leading position in worldwide measurements and sensing systems engineering.”*

# IEEE Instrumentation and Measurement Society Technical Award



**Samuel P. Benz, NIST, USA**

*“For outstanding contributions to the use of Josephson Arbitrary Waveform Synthesizer (JAWS) as a reference standard for the measurement of harmonics in distorted waveforms.”*



**Ilya Budovsky, National Measurement Institute, Australia**

*“For outstanding contributions to the use of Josephson Arbitrary Waveform Synthesizer (JAWS) as a reference standard for the measurement of harmonics in distorted waveforms.”*



**Dimitrios Georgakopoulos,  
National Measurement Institute, Australia**

*“For outstanding contributions to the use of Josephson Arbitrary Waveform Synthesizer (JAWS) as a reference standard for the measurement of harmonics in distorted waveforms.”*

## IEEE Instrumentation and Measurement Society J. Barry Oakes Advancement Award



**Judy Amanor-Boadu, Intel Corporation, USA**

*“For contributions to the development of measurement-correlation methodologies that combine simulation methods with laboratory measurement, with application to increasing the efficiency and integrity of power-delivery systems for high-performance VLSI processors; and for dedicated and demonstrated service as a servant leader and a mentor.”*

## IEEE Instrumentation and Measurement Society Career Excellence Award



**Reza Zoughi, Iowa State University**

*“For lifelong activity and outstanding achievement in pioneering microwave nondestructive testing and evaluation; and for serving the I&M Society in many roles in the past as, among others, President of the Society and EIC of the IEEE Transactions on Instrumentation and Measurement.”*

## 2021 Instrumentation and Measurement Society Senior Member Elevations

Ali Albishi  
Mohammed Alenazi  
Salman Alharthi  
Paul Annus  
Esteban Anoardo  
M Balaji  
Sekhar Babu Bandaru  
Andrea Benigni  
John Braun  
Domenico Capriglione  
Sacit Cetiner  
Chihyun Cho  
Razvan Ciocan  
Luigi Ferrigno  
Jose A. Garcia-Naya  
Jayanand Gawande  
Rosario Gerhardt  
Yongxing Guo  
David Heise  
Jon Helgeland  
Jie Huang  
Kuo-Cheng Huang  
Joseph John  
M.M. Kamruzzaman  
Chul Kim  
Chengyu Liu  
Dong Liu

Siliang Lu  
Donald Madill  
John Mccorkle  
Ziyang Meng  
Gianfranco Miele  
George Orji  
Pragnesh Patel  
Hayde Peregrina Barreto  
Alessandro Pesatori  
Mohan Phadnis  
Uday Ramteerthkar  
Alon Regev  
Paola Saccomandi  
Charles Sammut  
Lorenzo Scalise  
Jacob Scherb  
Heribert Schorn  
Mauro Serpelloni  
Abtin Spantman  
Lijuan Wang  
Soichi Watanabe  
He Wen  
Chun Hau Wong  
Zaipuna Yonah  
Xingwu Zhang  
Wei Zhao



## IEEE Instrumentation and Measurement Society: Officers

President, **Salvatore Baglio**, *University of Catania, Italy*

Executive Vice-President, **Juan Manuel Ramirez Cortes**, *National Institute of Astrophysics, Optics, & Electronics, Mexico*

Vice-President Finance, **Kristen Donnell**, *Missouri University of Science & Technology, USA*

Vice-President Conferences, **Sebastian Yuri C. Catunda**, *Federal University of Rio Grande do Norte (UFRN), at Natal, Brazil*

Vice-President Publications, **Gaozhi (George) Xiao**, *National Research Council, Canada*

Vice-President Membership, **Ruqiang Yan**, *Xi'an Jiaotong University, China*

Vice-President Technical & Standards, **Marco Parvis**, *Politecnico di Torino, Italy*

Vice-President Education, **Sergio Rapuano**, *University of Sannio, Italy*

Treasurer, **Helena Geirinhas Ramos**, *Instituto Superior Técnico Lisboa, Portugal*

Senior Past-President, **Ruth A. Dyer**, *Kansas State University, USA*

Junior Past-President, **Max Cortner**, *Boston Scientific Corp., USA*

EiC Transactions, **Shervin Shirmohammadi**, *University of Ottawa, Canada*

EiC IM Magazine, **Bruno Andò**, *University of Catania, Italy*

# IEEE Instrumentation and Measurement Society: Administrative Committee

## 2018-2021

Sebastian Yuri C. Catunda, *Federal University of Rio Grande do Norte (UFRN), at Natal, Brazil*

Marco Parvis, *Politecnico di Torino, Italy*

Gourab Sen Gupta, *Massey University, New Zealand*

Gaozhi (George) Xiao, *National Research Council, Canada*

## 2019-2022

Lee Barford, *Keysight Technologies, USA*

Melanie Ooi, *The University of Waikato, New Zealand*

Ferdinanda Ponci, *RWTH Aachen University, Germany*

Wendy Van Moer, *M&W Technics BVBA, Belgium*

## 2020-2023

Sabrina Grassini, *Politecnico di Torino, Italy*

Chi-Hung Hwang, *Taiwan Instrument Research Institute, NARLabs, Taiwan*

Juan Manuel Ramirez-Cortes, *National Institute of Astrophysics, Optics, & Electronics, Mexico*

Reza Zoughi, *Iowa State University, USA*

## 2021-2024

Kurt Barbé, *Vrije Universiteit Brussel, Belgium*

Branislav Djokic, *National Research Council, Canada*

Sergio Rapuano, *University of Sannio, Italy*

Ruqiang Yan, *Xi'an Jiaotong University, China*

## Other Members

Graduate Rep, Matthew Dvorsky, *Iowa State University, USA*

Young Professional Rep, Lijuan Wang, *University of Kent, United Kingdom*

## Program Grid: May 17

<b>9:00 - 10:30</b>	Material State Determination For Process State Awareness	Medicine 4.0: when new technologies work with A.I.	Optical and Fibre Optic Measurement Systems	
<b>10:30 - 11:00</b>	Break			
<b>11:00 - 12:30</b>	Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 1 Theory	Non-invasive monitoring of drugs bioavailability by tissue impedance measurement	Industrial Measurements, Communications, and Protocols	Fundamentals and Applications of Distributed Electromechanical Sensing for Power Networks
<b>12:30 - 14:30</b>	YP Meeting/Student Panel	Break		
<b>14:30 - 16:00</b>	Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 2 - Experimental Systems and their Deployment	Impedance Spectroscopy for Measurement and Sensor Solutions	Harmonic synchrophasor estimation for smart grid applications: from new estimators to new applications	
<b>16:00 - 16:30</b>	Break			
<b>16:30 - 17:00</b>	Lord Kelvin – His Life and Achievements			
<b>17:00 - 17:30</b>	A Comprehensive Insight into Effective and Informed Archival Journal Publication Process – “Dos and Don’ts”			

All times are in British Summer Time (BST or GMT+1).

## Program Grid: May 18

<b>9:00 - 10:30</b>	Electrical & Magnetic Sensing & Imaging for NDT&E	Sensors, Instrumentation & AI for Environmental Measurement (TC-18 & TC-42)	Energy & Power Industry	Signal Processing 1	Sensors & Transducers 1
<b>10:30 - 12:00</b>	Opening Ceremony & Plenary (Helen Margolis)				
<b>12:00 - 13:00</b>	Poster Session #1: Measurement for Society - Reliability, Safety, Quality, Environment, Medical, Agriculture and Food				
<b>13:00 - 14:30</b>	Virtual Demonstrations: Instrumentation & Measurement				
<b>14:30 - 15:00</b>	Robots on Mars: the Early Explorations of the Perseverance Rover				
<b>15:00 - 16:30</b>	Measurement for Non-Destructive Testing & Evaluation	Transducers for Greener Society	Renewable Energy Systems, Oil & Gas Industry	Signal Processing 2	Multifunctional Sensors & Smart Materials 1
<b>16:30 - 17:30</b>	Poster Session #2: Advanced Measurement Systems: Data Analytics, Real-time, Micro and Nano, Optical and Fibre Optics, Data Acquisition, Circuits and Non-Destructive Testing			TIM @ I2MTC Poster Session	

All times are in British Summer Time (BST or GMT+1).

## Program Grid: May 19

<b>9:00 - 10:30</b>	Medical & AI-Enabled Technologies for Smart Health Monitoring	Quality, Reliability & Safety 1 (TC-32)	Measurement for Industry 4.0 & Advanced Manufacturing	Embedded Artificial Intelligence for Smart Sensing & Communications & IoT	Image Processing 1
<b>10:30 - 12:00</b>	Award Ceremony & Plenary (Professor Sheila Rowan)				
<b>12:00 - 12:30</b>	Virtual Tour of Glasgow				
<b>12:30 - 13:30</b>	COVID 101 – Best Practices from Pandemic Life				
<b>13:30 - 14:30</b>	Poster Session #3: Measurement for Human-Computer Interactions: Advanced Sensors, Imaging, Image Processing, Signal Processing, Robotics and Data Analytics				
<b>14:30 - 16:00</b>	Industry Session #1: Instrumentation and Measurement in Advanced Manufacturing : An Industry Perspective				
<b>16:00 - 17:30</b>	Data Acquisition Systems 1	Quality, Reliability & Safety 2 (TC-32)	Smart Measurement Systems for Emergencies & Robotics	Emerging Wireless Communications for IoT/CPS Systems (TC-37)	Image Processing 2

All times are in British Summer Time (BST or GMT+1).

## Program Grid: May 20

<b>9:00 - 10:00</b>	J. Barry Oakes Presentation (Judy Amanor-Boadu)				
<b>10:00 - 11:30</b>	Advanced Measurement & Data Analytics for Industrial Equipment Health Monitoring (TC-3 & TC-7)	Automotive, Transportation Industry, Aerospace & Space Systems	Measurement in Medical, Biomedical & Healthcare Systems 1	Physical, Electromagnetic, Biomedical & Chemical Measurements 1	Advanced Measurement Systems - Real-Time, Micro, Nano, Optical or Fiber-Optics 1
<b>11:30 - 12:30</b>	Plenary (Erling Riis)				
<b>12:30 - 14:00</b>	Industry Session #2: Quantum Enabled Instrumentation and Measurement: An Industry Perspective				
<b>14:00 - 15:30</b>	Ophthalmic Instrumentation & Measurement	Environmental Monitoring & Agriculture, Food Production & Food Safety	Measurement in Medical, Biomedical & Healthcare Systems 2	Measurement Theory & Metrology 1	Circuits & Embedded Systems 1
<b>15:30 - 16:30</b>	Poster Session #3: Measurements for Infrastructure: Transportation, Space & Aerospace; Energy & Power; Communications & IOT; Physical & Chemical Measurements and OPEN POSTERS				
<b>16:30 - 17:00</b>	Closing Ceremony				

All times are in British Summer Time (BST or GMT+1).

# IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT

A PUBLICATION OF THE IEEE INSTRUMENTATION AND MEASUREMENT SOCIETY

IEEE Transactions on Instrumentation and Measurement (TIM) is the number 1 journal in the area of general Instrumentation and Measurement (I&M) in terms of Impact Factor without Self Cites, according to the 2018 Journal Citation Report, and in Quarter 1 (Q1) of the Instruments and Instrumentation category. In addition, according to the 2018 Scopus report, TIM is the number 1 journal in the area of general I&M with a CiteScore of 3.84 and SJR of 0.878. In terms of timeliness, TIM's average duration of submission-to-first-decision and submission-to-online-publication of 59 days and 26 weeks, respectively, are among the very best in all of IEEE journals.

In addition to regular papers, TIM also publishes short papers and survey/review papers. **Short papers** are 2 or 3-page papers that are both reviewed faster and published faster than regular papers. When a short paper gets accepted, it is assigned to the very next issue that hasn't gone to print yet, providing authors with a means for rapid publication of novel, significant and time-sensitive articles. **Survey/review papers** review the existing literature on a specific topic, and present further contributions such as a novel taxonomy that will guide other researchers, deep analysis with new findings that were previously unknown, or identifying gaps and providing new insights. TIM is a hybrid journal, so papers can be published in either conventional or Open Access modes, depending on the author's preference.

IEEE TIM is the flagship publication of the IEEE Instrumentation and Measurement Society (IMS) and publishes papers that report on innovative solutions to the development and use of electrical, electronic, or software instruments and equipment to measure, monitor and/or record physical phenomena for the purpose of advancing measurement science, methods, functionality and applications.

Q1

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#### Submit:

- Regular paper
- Short paper
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*IEEE Open Journal of*  
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***Measurement***

2022      Volume 1



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IEEE Instrumentation and  
Measurement Society





## Technical Program: May 17<sup>th</sup> (Tutorials)

### **Material State Determination For Process State Awareness**

5/17/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Speaker: James A. Smith, Idaho National Laboratory*

*Session Chair: Kurt Barbe, Vrije Universiteit Brussel, Belgium*

### **Medicine 4.0: when new technologies work with A.I.**

5/17/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Speaker: Eros Pasero, Politecnico di Torino*

*Session Chair: Deepak Uttamchandani, University of Strathclyde, Glasgow, Scotland*

### **Optical and Fibre Optic Measurement Systems**

5/17/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Speaker: Marcelo Werneck, Universidade Federal do Rio de Janeiro*

*Session Chair: Pawel Niewczas, University of Strathclyde, Glasgow, Scotland*

### **Fundamentals and Applications of Distributed Electromechanical Sensing for Power Networks**

5/17/2021 11:00:00 AM - 12:30:00 PM GMT+1

*Speaker: Steven Blair, Synaptec*

*Lloyd Clayburn, Synaptec*

*Session Chair: Pawel Niewczas, University of Strathclyde, Glasgow, Scotland*

### **Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 1 Theory**

5/17/2021 11:00:00 AM - 12:30:00 PM GMT+1

*Speaker: George Stewart, University of Strathclyde*

*Session Chair: Sabrina Grassini, Politecnico di Torino, Italy*

### **Industrial Measurements, Communications and Protocols**

5/17/2021 11:00:00 AM - 12:30:00 PM GMT+1

*Speaker: José Miguel Costa Dias Pereira, Instituto Politécnico de Setúbal*

*Session Chair: Deepak Uttamchandani, University of Strathclyde, Glasgow, Scotland*

### **Non-invasive monitoring of drugs bioavailability by tissue impedance measurement**

5/17/2021 11:00:00 AM - 12:30:00 PM GMT+1

*Speakers: Pasquale Arpaia, DIETI, University of Naples Federico II*

*Nicola Moccaldi, Università di Napoli Federico II*

*Session Chair: Kurt Barbe, Vrije Universiteit Brussel, Belgium*

### **2021 I2MTC Student/YP Panel: The Digital Job Search**

5/17/2021 12:30:00 PM - 2:30:00 PM GMT+1

**Gas Measurements for Emissions and Environmental Monitoring Using Laser Absorption: Spectroscopy: Part 2 - Experimental Systems and their Deployment**

5/17/2021 2:30:00 PM - 4:00:00 PM GMT+1

*Speaker: Walter Johnstone, University of Strathclyde*

*Session Chair: Sabrina Grassini, Politecnico di Torino, Italy*

**Harmonic synchrophasor estimation for smart grid applications: from new estimators to new applications**

5/17/2021 2:30:00 PM - 4:00:00 PM GMT+1

*Speaker: Lei Chen, Tsinghua University*

*Session Chair: Deepak Uttamchandani, University of Strathclyde, Glasgow, Scotland*

**Impedance Spectroscopy for Measurement and Sensor Solutions**

5/17/2021 2:30:00 PM - 4:00:00 PM GMT+1

*Speaker: Olfa Kanoun, TU Chemnitz*

*Session Chair: Kurt Barbe, Vrije Universiteit Brussel, Belgium*

**Lord Kelvin – His Life and Achievements**

5/17/2021 4:30:00 PM - 5:00:00 PM GMT+1



**Miles Padgett**

Miles Padgett is a Royal Society Research Professor and also holds the Kelvin Chair of Natural Philosophy in the School of Physics and Astronomy at the University of Glasgow.

His research team, covers all things optical from the basic ways in which light behaves as it pushes and twists the world around us, to the application of new optical techniques in imaging and sensing. They are currently using the classical and quantum properties of light to explore: the laws of quantum physics in accelerating frames, microscopes that see through noise, shaped light that overcomes diffraction-limited resolution and endoscopes the width of a human hair.

He is a Fellow both of the Royal Society of Edinburgh and the Royal Society. He has won a number of national and international prizes including, in 2019, the Rumford Medal of the Royal Society. In both 2019 and 2020 he was named by Web of Science as a globally highly-cited researcher.

Miles celebrates the academic and post-academic careers of his present and former group members who make all of this possible.

**A Comprehensive Insight into Effective and Informed Archival Journal Publication Process – “Dos and Don’ts”**

5/17/2021 5:00:00 PM - 5:30:00 PM GMT+1



**Reza Zoughi, Iowa State University**

**BIO:** R. Zoughi received his B.S.E.E, M.S.E.E, and Ph.D. degrees in electrical engineering (radar remote sensing, radar systems, and microwaves) from the University of Kansas where from 1981 until 1987 he was at the Radar Systems and Remote Sensing Laboratory (RSL). He is the Kirby Gray (Battelle) Chair in Engineering and a Professor Electrical and Computer Engineering (ECpE) at Iowa State University (ISU). He is also the Director of Center for Nondestructive Evaluation (CNDE) at ISU. He served as the Schlumberger Endowed Professor of Electrical and Computer Engineering at Missouri University of Science and Technology (Missouri S&T) from January 2001 to

August 2019. Prior to joining Missouri S&T and since 1987 he was with the Electrical and Computer Engineering Department at Colorado State University (CSU), where he was a professor and established the Applied Microwave Nondestructive Testing Laboratory (amntl) (<http://amntl.mst.edu/>). Dr. Zoughi held the position of Business Challenge Endowed Professor of Electrical and Computer Engineering from 1995 to 1997 while at CSU.

While at CSU he received nine teaching awards, including the State Board of Agriculture, Excellence in Undergraduate Teaching Award and the Abell Faculty Teaching Award. Since at Missouri S&T he has received seventeen Outstanding Teaching Awards & Commendations. He is the recipient of the 2007 IEEE Instrumentation and Measurement Society Distinguished Service Award, the 2009 American Society for Nondestructive Testing (ASNT) Research Award for Sustained Excellence, the 2011 IEEE Joseph F. Keithley Award in Instrumentation and Measurement and the 2020 IEEE Instrumentation and Measurement Society Career Excellence Award. In 2013 and 2020 he and his co-authors received the H. A. Wheeler Applications Prize Paper Award from the IEEE Antennas and Propagation Society (APS). He is the author of a textbook entitled "Microwave Nondestructive Testing and Evaluation Principles" KLUWER Academic Publishers, 2000, and the co-author of a chapter on Microwave Techniques in the book entitled "Nondestructive Evaluation: Theory, Techniques, and Applications" Marcel and Dekker, Inc., 2002. He is the co-author of 179+ refereed journal papers, 362+conference proceedings and presentations and 120 technical reports.

He served as the Editor-in-Chief of the IEEE Transactions on Instrumentation and Measurement (2007-2011), three terms as an at-large AdCom member of the IEEE Instrumentation and Measurement (I&M) Society, I&M Society President (2014-2015) and serves as an I&M Society Distinguished Lecturer. He served as the General Co-Chair of the 2013 IEEE Instrumentation and Measurement Technology Conference (I2MTC). He has been elected as an at-large member of IEEE Publications Services & Products Board (PSPB) for two terms (2016-2018 & 2019), and served on the IEEE TAB/PSPB (2015 & 2017-2019).

He has twenty issued US patents to his credit (in addition to several issued abroad) in the field of microwave nondestructive testing and evaluation. He has delivered numerous Invited and Keynote presentations on the subject of microwave and millimeter wave nondestructive testing and imaging. He is also a Fellow of the American Society for Nondestructive Testing (ASNT).

**ABSTRACT:** The impact that high-quality journal publication has on advancing science, technology and authors' careers is well documented. Journal publishing has evolved significantly in the past two decades, as various benchmarks have been designed to designate "quality" or degree of "impact" to a given journal. Other metrics have been developed to better indicate the impact of an author's publications. All of these have resulted in an amazing increase in the number of submitted papers and the sprouting of many journals in a given field. Many articles have been written on these issues and more will be surely written as a result of other requirements such as open-access.

Successful publication of a journal paper, in particular in a "reputable" and "high-quality" journal, starts from before an author decides to compile thoughts, ideas and results into the form of a paper. This involves deciding on the proper, most effective and relevant publications venue; having the knowledge of (and experience) how to compile the content that goes into the paper; having a clear knowledge of the publications guidelines and rules for the chosen venue; etc. Writing a journal paper requires much more than a step-by-step write-up of what was done technically. First, the choice of the journal in which to publish is critically important since the technical focus of the paper must be within the technical focus of the journal. In addition, effective journal paper writing requires many implicit and explicit issues to consider. Established publications rules related to highlighting the novelty of the work, proper citation of already-published works related to the subject matter and published in journals in the same field, properly giving credit to previously-published materials, and many more such rules must be meticulously and methodically followed. In some cases, such as preparing a technically-extended journal paper, based on a conference proceedings paper (for example the IEEE Transactions on Instrumentation and Measurement Special Issue of the I2MTC 2016), unique and specific rules must be adhered to as well.

This tutorial aims to discuss and highlight all of these issues and provide a road-map for those who may be relatively new to the journal publication realm, or could use this information in future journal paper preparation.

# Technical Program: May 18<sup>th</sup>

## **Electrical & Magnetic Sensing & Imaging for NDT&E**

5/18/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Nan Li, Northwestern Polytechnical University, Xi'an, China*

*Xiucheng Liu, Beijing University of Technology, Beijing, China*

### **[INVITED] Applications of Process Tomography for Packed Reaction Column Monitoring**

Jiabin Jia, University of Edinburgh, United Kingdom

### **3D Reconstruction in Planar Array Electrical Capacitance Tomography Based on Depth Estimation and Sparse Representation**

Peng Suo, Beihang University, China

Lijun Xu, Beihang University, China

Jiangtao Sun, Beihang University, China

Wenbin Tian, Beihang University, China

Shijie Sun, Beihang University, China

Yuedong Xie, Beihang University, China

### **A Fractional-Order PID Controlled Iterative Calderon's Method for Electrical Capacitance Tomography**

Yu Tian, Beihang University, China

Zhang Cao, Beihang University, China

Die Hu, Beihang University, China

Xin Gao, Beihang University, China

Lijun Xu, Beihang University, China

### **Research on Lung Electrical Impedance Imaging Method Based on Three-Dimensional Interpolation**

Xiuyan Li, Tianjin Polytechnic University, China

Yu Wei, Tianjin Polytechnic University, China

Qi Wang, Tianjin Polytechnic University, China

Ronghua Zhang, Tianjin Polytechnic University, China

Jianming Wang, Tianjin Polytechnic University, China;

### **Influence of Parameters in Kalman-Filter-Based Method on Image Quality for Electrical Capacitance Tomography**

Ying Wang, Beihang University, China

Lijun Xu, Beihang University, China

Shijie Sun, Beihang University, China

Xupeng Lu, Beihang University, China

Jiangtao Sun, Beihang University, China

## **Energy & Power Industry**

5/18/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Edoardo Fiorucci, DIIIE - University of L'Aquila*

*Andrea Fioravanti, DIIIE - University of L'Aquila*

### **Analysis and Visualization of Time-Varying Harmonics in Transformer Inrush Currents**

Julio Barros, University of Cantabria, Spain

Matilde de Apráiz, University of Cantabria, Spain

Ramón Diego, University of Cantabria, Spain

### **Design of a High-Accuracy and Traceable Reference Instrument for Flickermeter Certification**

Guglielmo Frigo, Swiss Federal Institute of Metrology, Switzerland

### **Improving Harmonic Measurements with Instrument Transformers: A Comparison Among Two Techniques**

Giovanni D'Avanzo, University of Campania Luigi Vanvitelli, Italy

Marco Faifer, Politecnico di Milano, Italy

Carmine Landi, University of Campania Luigi Vanvitelli, Italy

Christian Laurano, Ricerca sul Sistema Energetico S.p.A., Italy

Palma Sara Letizia, Istituto Nazionale di Ricerca Metrologica, Italy

Mario Luiso, University of Campania Luigi Vanvitelli, Italy

Roberto Ottoboni, Politecnico di Milano, Italy

Sergio Toscani, Politecnico di Milano, Italy

### **Measurement of Synchrophasors with Stand Alone Merging Units: A Preliminary Study**

Paolo Castello, University of Cagliari, Italy

Antonio Delle Femine, University of Campania Luigi Vanvitelli, Italy

Daniele Gallo, University of Campania Luigi Vanvitelli, Italy

Mario Luiso, University of Campania Luigi Vanvitelli, Italy

Carlo Muscas, University of Cagliari, Italy

Paolo Attilio Pegoraro, University of Cagliari, Italy

### **Compensation of Systematic Measurement Errors in PMU-Based Monitoring Systems for Transmission Grids**

Carlo Muscas, University of Cagliari, Italy

Paolo Attilio Pegoraro, University of Cagliari, Italy

Carlo Sitzia, University of Cagliari, Italy

Antonio Vincenzo Solinas, University of Cagliari, Italy

Sara Sulis, University of Cagliari, Italy

## **Sensors & Transducers 1**

5/18/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Bruno Ando, University of Catania*

*Theodosia Stratoudaki, University of Strathclyde*

### **PVDF Piezoelectric Sensors on 3D Low-Melting Point Substrates: A Preliminary Study on Paper**

Michela Borghetti, University of Brescia, Italy

Edoardo Cantù, University of Brescia, Italy

Emilio Sardini, University of Brescia, Italy

Mauro Serpelloni, University of Brescia, Italy

### **A Zero Offset Reduction Method for RTD-Based Thermal Flow Sensors**

Jun Long, Beijing Institute of Control and Engineering, China

Yong Li, Beijing Institute of Control and Engineering, China

Xuhui Liu, Beijing Institute of Control and Engineering, China

### **The Estimation of Absolute Permeability Distribution of Magnetic Catalyst Based on TMR-EMT System**

Chao Wang, Tianjin University, China

Zhengnan Li, Tianjin University, China

Qi Guo, Tianjin University, China

Jiamin Ye, Tianjin University, China

Ping Zou, Tianjin University, China

### **Optimization of the Structure of Electrode Array of Voltage-Driven Electrical Resistance Tomography**

Chao Wang, Tianjin University, China

Ran Pang, Tianjin University, China

Qingqing Cao, Tianjin University, China

Jiamin Ye, Tianjin University, China

### **Resistance Measurements of Polydimethylsiloxane (PDMS) Stretch-Sensors Embedded with a Conductive Gel**

Gerald Olson, Massey University, New Zealand

Clive Davies, Massey University, New Zealand

Gourab Sen Gupta, Massey University, New Zealand

Rose Davies, Massey University, New Zealand

Luke Fullard, Massey University, New Zealand

## **Sensors, Instrumentation & AI for Environmental Measurement (TC-18 & TC-42)**

5/18/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Marcus Perry, University of Strathclyde, UK*

*Leopoldo Angrisani, Università degli Studi di Napoli Federico II*

### **Machine Learning Based Calibration Time Reduction for Gas Sensors in Temperature Cycled Operation**

Yannick Robin, Saarland University, Germany

Payman Goodarzi, Saarland University, Germany

Tobias Baur, Saarland University, Germany

Caroline Schultealbert, Saarland University, Germany

Andreas Schütze, Saarland University, Germany

Tizian Schneider, Saarland University, Germany

### **Model-Based vs. Data-Driven Approaches for Anomaly Detection in Structural Health Monitoring: A Case Study**

Amirhossein Moallemi, Università di Bologna, Italy

Alessio Burrello, Università di Bologna, Italy

Davide Brunelli, University of Trento, Italy

Luca Benini, University of Bologna, ETH Zürich, Italy

### **Feedback Control System in Dredging Engineering Based on Convolutional Neural Network Prediction**

Changhao Xin, Tianjin University, China

Shihong Yue, Tianjin University, China

Liu Yang, Tianjin University, China

### **Real-Time Wave Monitoring on Coastal Areas Using LPWAN-Based Embedded Systems**

Matias Carandell, Universitat Politècnica de Catalunya, Spain

Daniel Mihai Toma, Universitat Politècnica de Catalunya, Spain

Carola Artero, Universitat Politècnica de Catalunya, Spain

Manel Gasulla, Universitat Politècnica de Catalunya, Spain

Joaquín Del Rio, Universitat Politècnica de Catalunya, Spain

### **12.5-m Distance Measurement in High-Interference Environment Using Ultrasonic Array Sensors**

Yukiko Yoshikawa, Kobe University, Japan

Yuto Yasuda, Kobe University, Japan

Ishii Toru, Kobe University, Japan

Shintaro Izumi, Kobe University, Japan

Hiroshi Kawaguchi, Kobe University, Japan

## **Signal Processing 1**

5/18/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Antonio Moschitta, University of Perugia*

*Luca DeVito, University of Sannio*

## **Slow and Steady Feature Analysis Based Status Monitoring for Gas-Liquid Two-Phase Flow in Horizontal Pipe**

Linghan Li, Tianjin University, China

Shumei Zhang, Tianjin University, China

Feng Dong, Tianjin University, China

## **Multi-Sensor Signal Statistical Feature Processing Method for Status Monitoring of Gas-Water Two-Phase Flow in Horizontal Pipe**

Wentao Wu, Tianjin University, China

Shumei Zhang, Tianjin University, China

Shangjie Ren, Tianjin University, China

Feng Dong, Tianjin University, China

## **Machine Learning Based Wavelength Modulation Spectroscopy for Rapid Gas Sensing**

Wanlu Zhang, University of Edinburgh, United Kingdom

Rui Zhang, University of Edinburgh, United Kingdom

Yalei Fu, University of Edinburgh, United Kingdom

Godwin Enemali, University of Edinburgh, United Kingdom

Jingjing Si, Yanshan University, China

## **S- and Z-Parameters in Frequency and Time Domain: in Accordance with Expectations?**

Michael Gadringer, Graz University of Technology, Austria

## **Neural Networks for the Estimation of Low-Order Statistical Moments of a Stochastic Dielectric**

Simon Stenmark, Chalmers University of Technology, Sweden

Thomas Rylander, Chalmers University of Technology, Sweden

Tomas McKelvey, Chalmers University of Technology, Sweden

## **Opening Ceremony & Plenary Presentation (Helen Margolis)**

5/18/2021 10:30:00 AM - 12:00:00 PM GMT+1

*Session Chair(s): Deepak Uttamchandani, University of Strathclyde, Glasgow, Scotland*

*Melanie Ooi, University of Waikato, Hamilton, New Zealand*

## **Innovations in Timing Infrastructure and Technology: Improving Resilience, Access and Performance**

Helen Margolis, NPL



**1: Deep Learning Approach for High Energy Efficient Real-Time Detection of Weeds in Organic Farming**

Vitali Czymmek, West Coast University of Applied Sciences, Germany  
Clarissa Möller, West Coast University of Applied Sciences, Germany  
Leif Ole Harders, West Coast University of Applied Sciences, Germany  
Stephan Hußmann, West Coast University of Applied Sciences, Germany

**2: Implementation and Calibration of a Low-Cost Sensor Node for High-Resolution, Continuous and No-Manning Recording of Fruit Growth**

Lorenzo Peppi, Università di Bologna, Italy  
Matteo Zauli, Università di Bologna, Italy  
Luigi Manfrini, Università di Bologna, Italy  
Luca Corelli Grappadelli, Università di Bologna, Italy  
Luca De Marchi, Università di Bologna, Italy  
Pier Andrea Traverso, Università di Bologna, Italy

**3: A New Processing Method to Segment Olive Trees and Detect Xylella Fastidiosa in UAVs Multispectral Images**

Francesco Adamo, Polytechnic University of Bari, Italy  
Filippo Attivissimo, Polytechnic University of Bari, Italy  
Attilio Di Nisio, Politecnico di Bari, Italy  
Mattia Alessandro Ragolia, Politecnico di Bari, Italy  
Marco Scarpetta, Politecnico di Bari, Italy

**4: Deep Learning Techniques for Enhancement of Weeds Growth Classification**

Dmitrii Vypirailenko, Skolkovo Institute of Science and Technology, Russia  
Elizaveta Kiseleva, Skolkovo Institute of Science and Technology, Russia  
Dmitrii Shadrin, Skolkovo Institute of Science and Technology, Russia  
Mariia Pukalchik, Skolkovo Institute of Science and Technology, Russia

**5: Sparse Point Cloud Generation Based on Turntable 2D Lidar and Point Cloud Assembly in Augmented Reality Environment**

Jiaqiang Zhou, Harbin Engineering University, China  
He Xu, Harbin Engineering University, China  
Zhen Ma, Harbin Engineering University, China  
Yihan Meng, Harbin Engineering University, China  
Daquan Hui, Harbin Engineering University, China

**6: Design of Strain Signal Data Acquisition System for Wind Tunnel Balance Based on Zynq**

Wang Liu, Harbin Institute of Technology, China  
Jianxin Liu, Harbin Institute of Technology, China  
Debao Wei, Harbin Institute of Technology, China  
Liyan Qiao, Harbin Institute of Technology, China

**7: A Method for Implementing Fractional Order Differentiator and Integrator Based on Digital Oscilloscope**

Bo Xu, University of Electronic Science and Technology of China, China  
Kai Chen, University of Electronic Science and Technology of China, China  
Yifan Wang, University of Electronic Science and Technology of China, China  
Hang Geng, University of Electronic Science and Technology of China, China

**8: The AC Amplitude Measurement Characteristics of High-Resolution Digitizers Based on Calibration with Thermal Voltage Converter and Swerlein Algorithm**

Jure Konjevod, University of Zagreb, Croatia  
Roman Malarić, University of Zagreb, Croatia  
Petar Mostarac, University of Zagreb, Croatia  
Marko Jurčević, University of Zagreb, Croatia

**9: Band Measurement Matrix Based Analog to Information Conversion**

Jingchao Zhang, Harbin Institute of Technology, China  
Liyao Qiao, Harbin Institute of Technology, China  
Yuting Wang, Harbin Institute of Technology, China

**10: Dual-Arm Robotic Compound-Oriented Measurement System: Integration of a Positive Pressure Solid Phase Extraction Unit**

Heidi Fleischer, University of Rostock, Germany  
Lea Ariana Kroos, University of Rostock, Germany  
Shalaka Joshi, University of Rostock, Germany  
Thomas Roddelkopf, University of Rostock, Germany  
Regina Stoll, University of Rostock, Germany  
Kerstin Thurow, University of Rostock, Central Scientific Research Center, Germany

**11: Classroom Quality: on the Amount of Ambient Light in Today's Classroom - a Field Study**

Christian Schuss, University of Oulu, Finland  
Tapio Fabritius, University of Oulu, Finland

**12: A Self-Powered Ambient Light Power Measurement Platform with Time-Domain Readout**

Roberto La Rosa, École Polytechnique Fédérale de Lausanne, Switzerland  
Mario Costanza, Femto-st, France  
Patrizia Livreri, University of Palermo, Italy  
Carlo Trigona, Università di Catania, Italy  
Catherine Dehollain, École Polytechnique Fédérale de Lausanne, Switzerland

**13: A Plant-Based Sensor for UV-A Radiation Measurements**

Carlo Trigona, Università di Catania, Italy  
Giuseppe Napoli, University of Catania, Italy  
Stefania Pasquale, University of Catania, Italy  
Ivana Puglisi, Università di Catania, Italy  
Andrea Baglieri, Università di Catania, Italy  
Anna Maria Gueli, Università di Catania, Italy

#### **14: Modelling for an Electromagnetic Groundwater Flowmeter**

Ben Mitchell, University of Canterbury, New Zealand

Michael Hayes, University of Canterbury, New Zealand

Bill Heffernan, University of Canterbury, New Zealand

#### **15: A Machine-Learning Approach for the Prediction of Internal Corrosion in Pipeline Infrastructures**

Giuseppe Canonaco, Politecnico di Milano, Italy

Manuel Roveri, Politecnico di Milano, Italy

Cesare Alippi, Politecnico di Milano, Italy

Fabrizio Podenzani, Eni, Italy

Antonio Bennardo, Eni, Italy

Marco Conti, Eni, Italy

Nicola Mancini, Eni, Italy

#### **16: Robotic Installation of Wireless Strain Gauges Into Precast Concrete Elements**

Tresor Tshimbombo, University of Strathclyde, United Kingdom

Marcus Perry, University of Strathclyde, United Kingdom

Chris Hoy, COWI UK Limited, United Kingdom

Efi Tzoura, Highways England, United Kingdom

Christos Vlachakis, University of Strathclyde, United Kingdom

Jack McAlorum, University of Strathclyde, United Kingdom

#### **17: A Correction Method for Sight Axis of Non-Orthogonal Shafting Total Station After Calibration**

Congcong Peng, Tianjin University, China

Bin Wu, Tianjin University, China

Gaoju Ma, Tianjin University, China

Jiehu Kang, Tianjin University, China

#### **18: A Dual-Input Fault Diagnosis Model Based on Convolutional Neural Networks and Gated Recurrent Unit Networks for Analog Circuits**

Tianyu Gao, Harbin Institute of Technology, China

Jingli Yang, Harbin Institute of Technology, China

Shouda Jiang, Harbin Institute of Technology, China

Cheng Yang, China Institute of Marine Technology and Economy, China

#### **19: An Experimental Device for Calibration of Concentration and Velocity of Two-Phase Flow Based on Electrical Impedance Measurement System**

Shihong Yue, Tianjin University, China

Jiacheng Wu, Tianjin University, China

Haitao Ma, Tianjin University, China

#### **20: Parameter Measurement Fusion Algorithm Based on Choquet Integral**

Xuezhen Liu, Tianjin University, China

Shihong Yue, Tianjin University, China

Lusheng Zhai, Tianjin University, China

**21: Invisible Lighting System for Remote Surveillance**

Chun-Han Chou, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

Chih-Chung Yang, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

Chen-Ju Lee, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

**22: A Novel Method to Realize Continuous Input Power Control During Acoustic Droplet Ejection**

Qing Guo, Tianjin University, China

Mengchuan Shao, Tianjin University, China

Xingguo Zhang, Tianjin University, China

Xiao Su, Tianjin University, China

Haixia Yu, Tianjin University, China

Dachao Li, Tianjin University, China

**23: Evaluation of a Voltage Ramp Generator for Low Current Calibration**

Marcus Pinto, Inmetro, Brazil

Regis Landim, Inmetro, Brazil

Rodrigo David, Inmetro, Brazil

**24: Characterization of Absolute Phase Angle in Wideband Current Shunts at Inmetro**

Rodrigo Rodrigues N. Zampilis, Inmetro, Brazil

Marcus Pinto, Inmetro, Brazil

Leonardo Souza, Inmetro, Brazil

Gean Geronymo, Inmetro, Brazil

Regis Landim, Inmetro, Brazil

**25: Measurement of Very Fast Transient Overvoltages in Current Transformers at Open Air HV Substations**

Daniel Slomovitz, UTE, Uruguay

Marcelo Brehm, UTE, Uruguay

Rogelio Sandler, UTE, Uruguay

Carlos Faverio, UTE, Uruguay

Leonardo Trigo, UTE, Uruguay

Alejandro Santos, UTE, Uruguay

Gonzalo Aristoy, UTE, Uruguay

**26: Prediction of ki-67 Expression Level Based on Non-Small Cell Lung cancer**

Chang Sun, Tianjin University, China

Yanqiu Wang, Tianjin University, China

Shihong Yue, Tianjin University, China

Jun Chen, Tianjin Medical University General Hospital, China

Qi Li, Tianjin University, China

**27: A Microcontroller Based Charge Balanced Trapezoidal Stimulus Generator for FES System**

Bijit Basumatary, Indian Institute of Technology Ropar, India

Rajat Suvra Halder, Indian Institute of Technology Ropar, India

Ashish Kumar Sahani, Indian Institute of Technology Ropar, India

**28: Finite-Element Modeling of Biological Tissue Response to Focused Ultrasound with Different Intensity**

Meiqi Kang, Tianjin University, China  
Shengnan Zhang, Tianjin University, China  
Yanbin Xu, Tianjin University, China  
Changbin Li, Tianjin University, China  
Feng Dong, Tianjin University, China

**29: Deep Transfer Learning Strategy for Invasive Lung Adenocarcinoma Classification Appearing as Ground Glass Nodules**

Chenchen Ma, Tianjin University, China  
Shihong Yue, Tianjin University, China  
Qi Li, Tianjin University, China

**30: A Wireless Flexible Electrooculogram Monitoring System with Printed Electrodes**

Shibam Debbarma, McGill University, Canada  
Seyedfakhreddin Nabavi, McGill University, Canada  
Sharmistha Bhadra, McGill University, Canada

**31: Study of a Wireless Energy Transmission System for an Endoscopy Capsule with Dynamic Tuning**

Lucas Murliky, Universidade Federal do Rio Grande do Sul, Brazil  
Gustavo Oliveira, Universidade Federal do Rio Grande do Sul, Brazil  
Gabriel Gosmann, Universidade Federal do Rio Grande do Sul, Brazil  
Fernando Sousa, Universidade Federal de Santa Catarina, Brazil  
Valner Brusamerello, Universidade Federal do Rio Grande do Sul, Brazil

**32: Evaluation of Muscle Oxygen Saturation of Human by Measuring Skin Tissue on Medial Forearm**

Hsin-Yi Tsai, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan  
Chih-Chung Yang, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan  
Cheng-Ru Li, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

**33: Homogeneous Light Stimulation of Melanopsin and Cones with a Maxwellian View Device for the Human Eye**

Patrick Flückiger, École Polytechnique Fédérale de Lausanne, Switzerland  
Jessica Schmid, University of Applied Sciences and Arts Western Switzerland, Switzerland  
Gilles Evéquoz, University of Applied Sciences and Arts Western Switzerland, Switzerland  
Pierre Bressy, University of Applied Sciences and Arts Western Switzerland, Switzerland  
Martial Geiser, University of Applied Sciences and Arts Western Switzerland, Switzerland

**34: EOG Signal Compression Using Turning Point Algorithm**

Alberto López Martínez, University of Oviedo, Spain  
Francisco Javier Ferrero Martín, University of Oviedo, Spain  
José Ramón Villar Flecha, University of Oviedo, Spain

### **35: Microwave Wearable System for Sensing Skin Hydration**

Raissa Schiavoni, University of Salento, Italy  
Giuseppina Monti, University of Salento, Italy  
Annarita Tedesco, Université de Bordeaux, France  
Luciano Tarricone, University of Salento, Italy  
Emanuele Piuze, Sapienza University of Rome, Italy  
Egidio De Benedetto, Università degli Studi di Napoli Federico II, Italy  
Antonio Masciullo, University of Salento, Italy  
Andrea Cataldo, University of Salento, Italy

### **36: Design of a QCM-Sensor for On-Line Monitoring Biofilm Growth**

Miquel Àngel Amer, Universitat Politècnica de Catalunya / Escola Universitària Salesiana de Sarrià, Spain  
Marc Navarro, Universitat Politècnica de Catalunya, Spain  
Antoni Turó, Universitat Politècnica de Catalunya, Spain  
Miguel García Hernandez, Universitat Politècnica de Catalunya, Spain

### **37: Reducing Motion Impact on Video Magnification Using Wavelet Transform and Principal Component Analysis for Heart Rate Estimation**

Ahmed Alzahrani, Carleton University, Canada  
Jila Hosseinkhani, Carleton University, Canada  
Sreeraman Rajan, Carleton University, Canada  
Eranga Ukwatta, University of Guelph, Canada

### **38: Development of Smart Alarm Based on Sleep Cycle Analysis**

Zahrina Anwar, International Islamic University Malaysia, Malaysia  
Teddy Surya Gunawan, International Islamic University Malaysia, Malaysia  
Robiah Ahmad, Universiti Teknologi Malaysia, Malaysia  
Mira Kartiwi, International Islamic University Malaysia, Malaysia

### **39: SensiTray: an Integrated Measuring Device for Monitoring Children's Mealtime Dietary Intake**

Hunter Guru, Stanford University, United States  
Anthony Weng, Stanford University, United States  
Santosh Pitla, University of Nebraska - Lincoln, United States  
Dipti Dev, University of Nebraska - Lincoln, United States

### **40: High Speed and High Precision Electrocardiographic and Plethysmographic Measurement Front-End**

Hans Herrmann, University of Rostock, Germany  
Hartmut Ewald, University of Rostock, Germany

### **41: RF Energy Harvester Integrated Self-Powered Wearable Respiratory Monitoring System**

Dilruba Parvin, University of Missouri, United States  
Omiya Hassan, University of Missouri, United States  
Taeho Oh, University of Tennessee, United States  
Syed Kamrul Islam, University of Missouri, United States

#### **42: ECG Noise Removal and Efficient Arrhythmia Identification Based on Effective Signal-Piloted Processing and Machine Learning**

Saeed Mian Qaisar, Effat University, Saudi Arabia  
Dominique Dallet, University of Bordeaux, France

#### **43: An Optimized Tongue Drive System for Disabled Persons**

Komal Chand, University of the South Pacific, United States  
Kavilash Chand, University of the South Pacific, United States  
Rahul Kumar, University of the South Pacific, United States  
Bibhya Sharma, University of the South Pacific, United States  
Mansour Assaf, University of the South Pacific, United States  
Sunil Das, University of Ottawa, Canada  
Voicu Groza, University of Ottawa, Canada  
Emil Petriu, University of Ottawa, Canada  
Satyendra Biswas, Ahsanullah University of Science and Technology, Bangladesh

#### **44: Reconstruction of Galvanic Skin Response Peaks via Sparse Representation**

Grazia Iadarola, University of Sannio, Italy  
Angelica Poli, Università Politecnica delle Marche, Italy  
Susanna Spinsante, Università Politecnica delle Marche, Italy

#### **45: Multi-Layer Convolutional Sparse Coding Framework for Restoration of Under-Sampled MR Images**

Abdul Wahid, International Islamic University, Islamabad, Pakistan  
Abdul Wahab Usman Ullah, Universiti Kuala Lumpur British Malaysian Institute, Malaysia  
Kushairy Kadir, Universiti Kuala Lumpur British Malaysian Institute, Malaysia  
Syed Saadain, Universiti Kuala Lumpur British Malaysian Institute, Malaysia

#### **46: FPGA-Based 16-Bit 20 MHz Device for the Inductive Measurement of Electrical Bio-Impedance**

Eiko Priidel, Tallinn University of Technology, Estonia  
Ksenija Pesti, Tallinn University of Technology, Estonia  
Mart Min, Tallinn University of Technology, Estonia  
Jaan Ojarand, Tallinn University of Technology, Estonia  
Olev Martens, Tallinn University of Technology, Estonia

#### **47: Fusing Pressure-Sensitive Mat Data with Video Through Multi-Modal Registration**

Daniel George Kyrollos, Carleton University, Canada  
Randa Hassan, Carleton University, Canada  
Yasmina Souley Dosso, Carleton University, Canada  
James Robert Green, Carleton University, Canada

### **Live Demonstration: Instrumentation & Measurement**

5/18/2021 1:00:00 PM - 2:30:00 PM GMT+1

*Session Chair(s): Sebastian Yuri Catunda, Federal University of Rio Grande do Norte, Natal, Brazil  
Ralf Bauer, University of Strathclyde*

### **Virtual Demonstration: Using a Heat Flux Sensor for Heart Rate Measurement**

Antti Immonen, LUT University, Finland

Andrey V. Mityakov, LUT University, Finland

Mikko Kuisma, LUT University, Finland

### **Virtual Demonstration: 2D Material-Based Conformal Electrode Array for Real Time Tactile Sensing**

Liming Chen, University of Manchester, United Kingdom

Ziqi Chen, University of Manchester, United Kingdom

Jorge Ricardo Salas Avila, University of Manchester, United Kingdom

Wuliang Yin, University of Manchester, United Kingdom

### **Virtual Demonstration: TILE<sup>3</sup>, Compensating IMU Biases Through Redundant Configuration of Consumer-Grade MEMS Sensors**

Giorgio de Alteriis, Università degli Studi di Napoli Federico II, University of Bergamo, Italy

Claudia Conte, Università degli Studi di Napoli Federico II, University of Bergamo, Italy

Domenico Accardo, Università degli Studi di Napoli Federico II, Italy

### **Virtual Demonstration: A Lite Emulator of Grid Operations**

Carlo Guarnieri Calò Carducci, RWTH Aachen University, Germany

Alberto Dognini, RWTH Aachen University, Germany

Maliheh Haghgoo, RWTH Aachen University, Germany

Ferdinanda Ponci, RWTH Aachen University, Germany

Antonello Monti, RWTH Aachen University, Germany

### **Robots on Mars: the Early Explorations of the Perseverance Rover**

5/18/2021 2:30:00 PM - 3:00:00 PM GMT+1



#### **Special Guest Speaker: Sanjeev Gupta**

Professor Sanjeev Gupta is an earth and planetary scientist whose expertise is on understanding ancient environmental changes on the Earth's surface and on Mars. He is a Long-Term Planner on the NASA Mars 2020 Perseverance rover mission which landed on Mars, February 2021. He also works on the Curiosity rover mission and the forthcoming

ESA ExoMars mission due to launch in 2022.



## **Measurement for Non-Destructive Testing & Evaluation**

5/18/2021 3:00:00 PM - 4:30:00 PM GMT+1

*Session Chair(s): Zheng Liu, University of British Columbia  
Theodosia Stratoudaki, University of Strathclyde*

### **Detection of Double-Layer Air Gap Defects Based on Terahertz Imaging Method**

Huaiyuan Jiang, Tsinghua Shenzhen International Graduate School, China  
Hongwei Mei, Tsinghua Shenzhen International Graduate School, China  
Xingming Bian, North China Electric Power University, China  
Lanxin Li, Tsinghua Shenzhen International Graduate School, China

### **Wavelength Scanning Interferometry for Topography of Microchannels at Roll-to-Roll Line with Optical Coherence Tomography**

Janne Lauri, University of Oulu, Finland  
Christina Liedert, VTT Technical Research Centre of Finland Ltd., Finland  
Tapio Fabritius, University of Oulu, Finland

### **Microwave Quantification of Porosity Level in 3D Printed Polymers**

Anna Case, Iowa State University, United States  
Aaron McCarville, Iowa State University, United States  
Mohammad Tayeb Al Qaseer, Iowa State University, United States  
Reza Zoughi, Iowa State University, United States

### **Sound Velocity Measurement in Acoustic Leak Noise Correlation Systems**

George Othon Glentis, University of Peloponnese, Greece  
Konstantinos Angelopoulos, University of Peloponnese, Greece

### **Internal and External Defects Discrimination of Pipelines Using Composite Magnetic Flux Leakage Detection**

Yue Long, Tsinghua University, China  
Songling Huang, Tsinghua University, China  
Lisha Peng, Tsinghua University, China  
Wenzhi Wang, Tsinghua University, China  
Shen Wang, Tsinghua University, China  
Wei Zhao, Tsinghua University, China

## **Multifunctional Sensors & Smart Materials 1**

5/18/2021 3:00:00 PM - 4:30:00 PM GMT+1

*Session Chair(s): Marcus Perry, University of Strathclyde, UK  
Simon Laflamme, Iowa State University, USA*

### **[INVITED] Field Validation of a Detectable, Magnetic, Cementitious Grout for Rock Fracture Grouting**

Lindsey Corson, University of Strathclyde, United Kingdom  
Rebecca Lunn, University of Strathclyde, United Kingdom  
Grainne El Mountassir, University of Strathclyde, United Kingdom  
Alasdair E. Henderson, Royal BAM Group nv, United Kingdom  
Kenneth Henderson, BAM Ritchies, United Kingdom  
Christopher Reid, BAM Ritchies, United Kingdom

### **Corrugated Compliant Capacitor Towards Smart Bandage Application**

Han Liu, Iowa State University, United States  
Simon Laflamme, Iowa State University, United States  
Eric Zellner, Iowa State University, United States  
Sarah Bentil, Iowa State University, United States  
Iris Rivero, Rochester Institute of Technology, United States

### **A Low-Cost Electrical Impedance Analyser for Interrogating Self-Sensing Cement Repairs**

Jack McAlorum, University of Strathclyde, United Kingdom  
Christos Vlachakis, University of Strathclyde, United Kingdom  
Marcus Perry, University of Strathclyde, United Kingdom

### **Self-Sensing Concrete Repairs Based on Alkali-Activated Materials: Recent Progress**

Marcus Perry, University of Strathclyde, United Kingdom  
Lorena Biondi, University of Strathclyde, United Kingdom  
Jack McAlorum, University of Strathclyde, United Kingdom  
Christos Vlachakis, University of Strathclyde, United Kingdom

### **Ultrasonic Thickness Measurement Using the Martlet Wireless Sensing System**

Yu Otsuki, Georgia Institute of Technology, United States  
Peter Lander, Georgia Institute of Technology, United States  
Yang Wang, Georgia Institute of Technology, United States

### **Renewable Energy Systems, Oil & Gas Industry**

5/18/2021 3:00:00 PM - 4:30:00 PM GMT+1

*Session Chair(s): Gordon Dobie, University of Strathclyde  
Eike Grundkötter, Ruhr-Universität Bochum*

### **Adaptive Power Management of Energy Autonomous Structural Health Monitoring Systems for Wind Turbines**

Eike Grundkötter, Ruhr-University Bochum, Germany  
Joachim Melbert, Ruhr-University Bochum, Germany

### **Degradation Prediction and Uncertainty Quantification for PEMFC Using NSGA-Optimized Deep Learning Method**

Yucen Xie, University of Electronic Science and Technology of China, China  
Jianxiao Zou, University of Electronic Science and Technology of China, China  
Chao Peng, University of Electronic Science and Technology of China, China  
Yun Zhu, University of Electronic Science and Technology of China, China

### **Flow Regimes Identification of Gas-Water Two-Phase Flow Using Conductance and Continuous Wave Ultrasonic Doppler Sensors**

Shuo Zhang, Tianjin University, China  
Xuewei Shi, Tianjin University, China  
Chao Tan, Tianjin University, China  
Feng Dong, Tianjin University, China

## **Research on Numerical Simulation of Stratified Gas-Liquid Flow Through Crescent Orifice Plate**

Zhuo-Lan Xue, Tianjin University, China

Ying Xu, Tianjin University, China

Tao Zhang, Tianjin University, China

Jing-Li Zhang, Tianda Taihe Automatic Control Instrument Technology Co., Ltd, China

Zeng-Hui Chen, Tianda Taihe Automatic Control Instrument Technology Co., Ltd, China

## **A Three-Phase Flow Visualization Method Using Wire-Mesh Sensor Based on Continuous Phase Conductance Compensation**

Lusheng Zhai, Tianjin University, China

Yuqing Wang, Tianjin University, China

Jie Yang, Tianjin University, China

Ningde Jin, Tianjin University, China

## **Signal Processing 2**

5/18/2021 3:00:00 PM - 4:30:00 PM GMT+1

*Session Chair(s): Antonio Moschitta, University of Perugia*

*Luca DeVito, University of Sannio*

## **Adaptive Fourier Analysis in the Case of Data Loss**

András Palkó, Budapest University of Technology and Economics, Hungary

László Sujbert, Budapest University of Technology and Economics, Hungary

## **Utilizing the Nonlinearity of GMI Sensors for Time-Proportional Magnetic Field Measurements**

Marvin Sandner, Ostfalia University of Applied Sciences, Germany

Phil Meier, Ostfalia University of Applied Sciences, Germany

Kris Rohrmann, Ostfalia University of Applied Sciences, Germany

Marcus Prochaska, Ostfalia University of Applied Sciences, Germany

## **In-Situ Electrochemical Impedance Spectroscopy of Battery Cells by Means of Binary Sequences**

Alessio De Angelis, University of Perugia, Italy

Roberta Ramilli, Università di Bologna, Italy

Marco Crescentini, Università di Bologna, Italy

Antonio Moschitta, University of Perugia, Italy

Paolo Carbone, University of Perugia, Italy

Pier Andrea, University of Perugia, Italy

## **Unbiased Sine-Wave Frequency Estimation by Parabolic Interpolation of DTFT Samples**

Daniel Belega, University Politehnica Timisoara, Romania

Dario Petri, University of Trento, Italy

## **Windowing Compensation in Fourier Based Surrogate Analysis**

Manouane Caza-Szoka, Université du Québec à Trois-Rivières, Canada

Daniel Massicotte, Université du Québec à Trois-Rivières, Canada

## **Transducers for Greener Society**

5/18/2021 3:00:00 PM - 4:30:00 PM GMT+1

*Session Chair(s): Carlo Trigona, University of Catania*

*Salvatore Graziani, University of Catania, Italy*

### **Impedance Characterization of a QCM-Based Measurement System in Liquid Media**

Ada Fort, University of Siena, Italy

Enza Panzardi, University of Siena, Italy

Pietro Vaccarella, University of Siena, Italy

Valerio Vignoli, University of Siena, Italy

Marco Mugnaini, University of Siena, Italy

Anna Lo Grasso, University of Siena, Italy

### **Determination of Fat, SNF and Protein Content in Cow Milk from the Voltage Output of 'MilkTester'**

Suman Biswas, Indian Institute of Technology Kharagpur, India

Ajoy Mandal, National Dairy Research Institute, Kalyani, India

Moupali Chakraborty, Indian Institute of Technology Kharagpur, India

Karabi Biswas, Indian Institute of Technology Kharagpur, India

### **Investigation of Bacterial Cellulose-Based Fractional Order Element Behaviour**

Riccardo Caponetto, Università di Catania, Italy

Giovanna Di Pasquale, Università di Catania, Italy

Salvatore Graziani, Università di Catania, Italy

Emanuele Murgano, Università di Catania, Italy

Antonino Pollicino, Università di Catania, Italy

Carlo Trigona, Università di Catania, Italy

### **Conditioning of Bacterial Cellulose-Based Motion Sensors**

Giovanna Di Pasquale, Università di Catania, Italy

Salvatore Graziani, Università di Catania, Italy

Santhosh Kurukunda, Università di Catania, Italy

Antonino Pollicino, Università di Catania, Italy

Carlo Trigona, Università di Catania, Italy

### **Investigation of a 100 $\mu\text{m}$ Magnetic Wire for Temperature Sensing Based on a Time Domain Readout**

Gianluca Caposciutti, University of Pisa, Italy

Mirko Marracci, University of Pisa, Italy

Carlo Trigona, Università di Catania, Italy

Salvatore Baglio, Università di Catania, Italy

Bernardo Tellini, University of Pisa, Italy

**1: Remote Fiber-Based Velocimeter for Interface-Strength Measurements**

James Smith, Idaho National Laboratory, United States

Bradley Benefiel, Idaho National Laboratory, United States

Clark Scott, Subsurface Energy & Water Systems, United States

**2: MRPM: Multistep Robust Prediction Machine for Degradation Time Series Projection**

Wenjuan Mei, University of Electronic and Technology of China, China

Zhen Liu, University of Electronic and Technology of China, China

Yuanzhang Su, University of Electronic Science and Technology of China, China

**3: Testing Path Searching for Digital Microfluidic Biochips Based on the Improved Particle Swarm Optimization**

Wenbin Zheng, Harbin Institute of Technology, China

Jinlong Shi, Harbin Institute of Technology, China

Jiaqing Qiao, Harbin Institute of Technology, China

Ping Fu, Harbin Institute of Technology, China

Hongyuan Jiang, Harbin Institute of Technology, China

**4: Absolute Wavenumber Determination for Distributed Feedback Laser from Absorption Spectral Profiles**

Yudong Guo, Beihang University, China

Lijun Xu, Beihang University, China

Fanghao Lu, Beihang University, China

Zhang Cao, Beihang University, China

**5: Multiphase Flowrate Measurement with Time Series Sensing Data and Sequential Model**

Haokun Wang, University of Edinburgh, United Kingdom

Delin Hu, Institute for Digital Communications, University of Edinburgh, United Kingdom

Yunjie Yang, Institute for Digital Communications, University of Edinburgh, United Kingdom

Maomao Zhang, Tsinghua Shenzhen International Graduate School / Shenzhen LeEngStar Co.,Ltd, China

**6: Optical Power Supply of a Wireless Temperature Sensor for Rotating Machines Monitoring Purpose**

Racha Benarrat, CNRS, FRE 2012 Roberval, Sorbonne Universités, Université de Technologie de Compiègne, France

Frederic Lamarque, CNRS, FRE 2012 Roberval, Sorbonne Universités, Université de Technologie de Compiègne, France

Jeremy Terrien, Sorbonne Universités, Université de Technologie de Compiègne, France

**7: Causes of Error for Turbine Radial Palette Measurement**

Alessandro Pesatori, Politecnico di Milano, Italy

Michele Norgia, Politecnico di Milano, Italy

### **8: A Weak Current to Voltage Conversion Circuit Based on Resonant Amplifiers and Crystal Filters**

Yifan Wang, University of Electronic Science and Technology of China, China  
Kai Chen, University of Electronic Science and Technology of China, China  
Xuan Gou, University of Electronic Science and Technology of China, China  
Rongdie Chen, University of Electronic Science and Technology of China, China

### **9: A Versatile Direct-Digital Interface for Resistive Sensors Using Sigma-Delta Approach**

Tapabrata Sen, Indian Institute of Technology Kharagpur, India  
Anoop Chandrika Sreekantan, Indian Institute of Space Science and Technology, India  
Siddhartha Sen, Indian Institute of Technology Kharagpur, India

### **10: Data Collection and Cloud Processing Architecture Applied to NILM Techniques for Independent Living**

Rubén Nieto, University of Alcalá, Spain  
Laura de Diego Otón, University of Alcalá, Spain  
Álvaro Hernández, University of Alcalá, Spain  
Jesús Ureña, University of Alcalá, Spain

### **11: A Simple Digitization Scheme for Resistive Sensors and its Adaptation for Remote Measurements**

Elangovan K, Indian Institute of Space Science and Technology, India  
Anoop Chandrika Sreekantan, Indian Institute of Space Science and Technology, India

### **12: Simulation Method for Ultrasonic Attenuation in Droplet Flow**

Dandan Zheng, Tianjin University, China  
Mi Wang, Tianjin University, China  
Jun Dong, Tianjin University, China  
Ying Xu, Tianjin University, China

### **13: A Modular Sampling Standard for Quantum Traceable Power Measurements: Comparison and Perspectives**

Bruno Trinchera, INRiM, Italy  
Danilo Serazio, INRiM, Italy

### **14: EIT Image Reconstruction Method Based on DnCNN**

Qi Wang, Tianjin Polytechnic University, China  
Hanyu Zhang, Tianjin Polytechnic University, China  
Ronghua Zhang, Tianjin Polytechnic University, China  
Xiuyan Li, Tianjin Polytechnic University, China  
Jianming Wang, Tianjin Polytechnic University, China

### **15: Electromagnetic Imaging of Metal Defects Based on Bayesian Statistical Model**

Qi Wang, Tianjin Polytechnic University, China  
Kexin Liu, Tianjin Polytechnic University, China  
Ronghua Zhang, Tianjin Polytechnic University, China  
Xiuyan Li, Tianjin Polytechnic University, China  
Xiaojie Duan, Tianjin Polytechnic University, China

**16: High Precision Identification Method of Fan Main Shaft Defects Based on Rotating Magnetic Field Detection**

Lisha Peng, Tsinghua University, China  
Songling Huang, Tsinghua University, China  
Shen Wang, Tsinghua University, China  
Wei Zhao, Tsinghua University, China

**17: B-Mode Ultrasound Images Guided Electrical Impedance Tomography Image Reconstruction via Cross Gradient**

Yu Wang, Tianjin University, China  
Shangjie Ren, Tianjin University, China  
Feng Dong, Tianjin University, China

**18: A Quality-Hierarchical Temperature Imaging Network for TDLAS Tomography**

Jingjing Si, Yanshan University, China  
Gengchen Fu, Yanshan University, China  
Rui Zhang, University of Edinburgh, United Kingdom  
Chang Liu, University of Edinburgh, United Kingdom

**19: Overload Current Interruption Protection Method Based on Tunnel Magnetostrictive Sensor Measurement**

Changxin Chen, Taiyuan University of Technology, North University of China, China  
Wenchao Guo, North University of China, China  
Chenbin Wang, North University of China, China  
Yifeng Ren, North University of China, China  
Tiehua Ma, North University of China, China

**20: Wireless Stress Measurement on Metal Surface Based on Passive Integrated RFID Sensor Tag**

Ximeng Cheng, University of Electronic Science and Technology of China, China  
Yating Yu, University of Electronic Science and Technology of China, China  
Lei Wang, University of Electronic Science and Technology of China, China  
Cheng Sun, University of Electronic Science and Technology of China, China

**21: An Improved MFL Method Fusing Multi-Space Magnetic Field Information for the Surface Defect Inspecting**

Wenzhi Wang, Tsinghua University, China  
Songling Huang, Tsinghua University, China  
Lisha Peng, Tsinghua University, China  
Yue Long, Tsinghua University, China  
Shen Wang, Tsinghua University, China  
Wei Zhao, Tsinghua University, China

**22: Analysis of TDR Signals with Convolutional Neural Networks**

Marco Scarpetta, Politecnico di Bari, Italy  
Maurizio Spadavecchia, Politecnico di Bari, Italy  
Gregorio Andria, Politecnico di Bari, Italy  
Mattia Alessandro Ragolia, Politecnico di Bari, Italy  
Nicola Giaquinto, Politecnico di Bari, Italy

**23: Chipless RFID Tags as Microwave Sensors for Delamination Detection in Layered Structures**

Katelyn Brinker, Iowa State University, United States  
Reza Zoughi, Iowa State University, United States

**24: Generative Data Augmentation for Learning-Based Electrical Impedance Tomography via Variational Autoencoder**

Yangen Zhan, Tianjin University, China  
Ru Guan, Tianjin University, China  
Shangjie Ren, Tianjin University, China  
Feng Dong, Tianjin University, China

**25: Supershape Augmented Reconstruction Method for Electrical Impedance Tomography**

Danping Gu, University of Science and Technology of China, China  
Dong Liu, University of Science and Technology of China, China  
Jiansong Deng, University of Science and Technology of China, China  
Jiangfeng Du, University of Science and Technology of China, China

**26: Bistatic Microwave Sensor for In-Situ Composite Inspection and Structural Health Monitoring**

Katelyn Brinker, Iowa State University, United States  
Anna Case, Iowa State University, United States  
Mohammad Tayeb Al Qaseer, Iowa State University, United States

**27: An Excitation Method for Fault Diagnosis of DC-AC Converter Based on Simulation**

Yun Yang, Harbin Institute of Technology, China  
Cen Chen, Harbin Institute of Technology, China  
Xuerong Ye, Harbin Institute of Technology, China  
Chengzhi Sun, Harbin Institute of Technology, China



## 1: Early Fault Diagnosis and Classification of Ball Bearing Using Enhanced Kurtogram and Gaussian Mixture Model

Youngsun Hong, Korea Institute of Industrial Technology, Korea

Minsu Kim, Hyundai Motor Company, Korea

Hyunho Lee, Samsung Heavy Industries, Korea

Jong Jin Park, Samsung Heavy Industries, Korea

Dongyeon Lee, Samsung Heavy Industries, Korea

**Abstract:** Ball bearing failure is one of the major obstacles to the effective operation of large mechanical systems. During maintenance, the initial diagnosis of a fault within the bearing is key to reducing repair costs and improving the efficiency of the system. However, such faults are difficult to accurately diagnose due to noise and the unusual and unpredictable phenomena that they cause in the peaks of the measured signal. In this paper, we present an effective analytical technique for the early diagnosis of ball bearing faults based on vibration data derived from the bearings. We apply a feature extraction technique based on spectral kurtosis (SK) and then filter the results using statistical approaches. The actual defects in the bearings are evaluated in terms of a Gaussian mixture model; principal component analysis is then used to reduce the misclassifications caused by noise and weak fault symptoms. We verified the proposed algorithm experimentally and compared the results of our diagnostic technique to those obtained using the root mean square (rms) of the vibration data to evaluate the performance of the SK-based technique.

## 2: FBG-Based Sensor Applied to Flow Rate Measurements

Alexandre Silva Allil, Federal University of Rio de Janeiro, Brazil

Fabio Da Silva Dutra, Petrobras, Brazil

Alex Dante, Federal University of Rio de Janeiro, Brazil

Cesar C. Carvalho, Federal University of Rio de Janeiro, Brazil

Regina Célia Da Silva Barros Allil, Federal University of Rio de Janeiro, Brazil

Marcelo Martins Werneck, Federal University of Rio de Janeiro, Brazil

**Abstract:** A flare system in oil platform is a combustion stack used to burn off excess gases that cannot be processed and gases that have to be eliminated in emergency shutdown to avoid the risk of explosion. Gas flow measurement in flares is still considered challenging because the measurement has to attend many specific demands, quite different from any other flow measurement application. For these types of measurements many sensor technologies are available, however they are all very expensive, and only a few ones can attend all demands. The objective of this paper is to present a flow rate sensor based on Fiber Bragg Grating (FBG), cross-correlation and heatwave travel time techniques. The system was developed with inexpensive components and is little-intrusive, capable of attaining the rangeability of the flare demand and independent of gas composition, pressure and temperature. DOI: 10.1109/TIM.2020.3014751

### 3: Error Corrections for Ultrawideband Ranging

Juri Sidorenko, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung IOSB, Germany

Volker Schatz, Fraunhofer IOSB, Germany

Norbert Scherer-Negenborn, Fraunhofer IOSB, Germany

Michael Arens, Fraunhofer IOSB, Germany

Urs Hugentobler, TUM, Germany

**Abstract:** Precise indoor localization is a major challenge in the field of localization. In this article, we investigate multiple error corrections for the ultrawideband (UWB) technology, in particular the DecaWave DW1000 transceiver. Both the time-of-arrival (TOA) and the time-difference-of-arrival (TDOA) methods are considered. Various clock-drift correction methods for TOA from the literature are reviewed and compared experimentally. The best performing method is extended to TDOA, corrections for the signal power dependence and the hardware delay are added, and two additional enhancements suggested. These are compared with each other and TOA in positioning experiments. DOI: 10.1109/TIM.2020.2996706

### 4: A Novel Method for Removing Baseline Drifts in Multivariate Chemical Sensor

Abhishek Grover, Indian Institute of Technology Delhi, India

Brejesh Lall, Indian Institute of Technology Delhi, India

**Abstract:** This article proposes a sensor signal processing method for removing baseline drifts in multimodal chemical sensors. The response of a sensor is modeled as an autoregressive (AR) process associated with an observation zero-mean Gaussian noise. The parameters of the state-space model are learned using the calibration data. The variance of the Gaussian noise is estimated using an adaptive online method. The AR process equation and the observation equation are used to construct the adaptive Kalman filter. Each sensor response is passed through a separate Kalman filter, and then, a regression technique is used to predict the sensor response.

### 5: Accelerometer Fault-Tolerant Model-Aided State Estimation for High-Altitude Long-Endurance UAV

Wonkeun Youn, Korean Aerospace Research Institute, Korea

Hyoungsik Choi, Korean Aerospace Research Institute, Korea

Am Cho, Korean Aerospace Research Institute, Korea

Sungyug Kim, Korean Aerospace Research Institute, Korea

Matthew Rhudy, Penn State Berks, United States

**Abstract:** This article proposes a novel fault-tolerant dynamic model-aided navigation filter to cope with accelerometer faults. An algorithm to estimate the three-axis accelerations of a high-altitude long-endurance (HALE) unmanned aerial vehicle (UAV) utilizing control input signals and aerodynamic coefficient parameters is newly proposed. To address the fault of the accelerometer, two model-aided navigation filters that utilize the measured acceleration, denoted as Acc-measure algorithm, and estimated acceleration, denoted as Acc-free algorithm, respectively, are effectively combined under the interacting multiple model (IMM) framework to integrate the optimality of Acc-measure algorithm and robustness of Acc-free algorithm. Flight test results demonstrated that the proposed algorithm yields robust attitude and wind estimation results in the presence of different types of accelerometer faults compared with Acc-measure and Acc-free algorithms while accurately detecting the fault of the accelerometer.

## **6: Aging Monitoring Method for Lithium-Ion Batteries Using Harmonic Analysis**

Seon Hyeog Kim, Yonsei University, Korea

Hyeong Min Lee, Yonsei University, Korea

Yong-June Shin, Yonsei University, Korea

**Abstract:** Monitoring the aging battery cells is important to maintain battery performance. In this article, a harmonic analysis method for monitoring aging battery is proposed. The proposed diagnostic technique applies the designed 1-kHz sinusoidal signal, comprising a sinusoidal current component and a direct current component, to the battery. Harmonics are generated when signals passing through nonlinear systems are distorted. A battery is an asymmetric nonlinear system with different bidirectionality. The proposed in situ technique can be applied during charge/discharge cycles, even in the case of an apparent reduction of even harmonics. DOI: 10.1109/TIM.2020.3043097

## **7: Performance of EGNSS-Based Timing in Various Threat Conditions**

Salomon Honkala, Finland, Finland

Sarang Thombre, Finnish Geospatial Research Institute FGI, Finland

Martti Kirkko-Jaakkola, National Land Survey, Finnish Geospatial Research Institute FGI, Finland

Hein Zelle, Netherlands Aerospace Center NLR, Netherlands

**Abstract:** We studied the performance of a GNSS timing receiver under different operating conditions, and tested techniques to improve robustness under interference and navigation message errors. We found that interference or meaconing-type spoofing can threaten GNSS timing but is detected by automatic gain control and carrier-to-noise ratio based methods. GNSS interruptions due to interference is bridged by a local oscillator holdover technique using a Kalman filter. Navigation message errors are mitigated by EGNOS, and constellation-wide timing errors are detected by dual-constellation (GPS-Galileo) cross-check. Dual-frequency operation mitigates first-order ionospheric effects and is robust to interference by allowing fall back to single frequency.

## **8: Visual Sensor Placement Based on Risk Maps**

Altahir Altahir, Universiti Teknologi PETRONAS, Malaysia

Vijanth Asirvadam, Universiti Teknologi PETRONAS, Malaysia

Nor Hisham Hamid, Universiti Teknologi PETRONAS, Malaysia

Patrick Sebastian, Universiti Teknologi PETRONAS, Malaysia

Mohamed Abul Hass Ameen, University of Alabama, United States

Nordin Saad, Universiti Teknologi PETRONAS, Malaysia

Rosdiazli Ibrahim, Universiti Teknologi PETRONAS, Malaysia

Sarat C.Dass, Universiti Teknologi PETRONAS, Malaysia

**Abstract:** The research work on camera placement has focused on maximizing the coverage or minimizing the installation cost of video surveillance systems. Typical placement schemes mount surveillance cameras with no emphasis on the coverage demand divergences, which impacts the system's cost and efficiency. This paper addresses the camera placement problem based on an inverse modeling taxonomy. Thus, rather than performing the optimization on uniformly distributed grids, this paper introduces an underlying mechanism to elaborate the security sensitive zones prior to the coverage optimization. The outcome of the prioritization process is termed as Risk Maps. Obtained empirical results show the reliability of the placement using inverse modeling. Finally, the validation of the proposed placement scheme is carried out in a constraint environment. Digital Object Identifier 10.1109/TIM.2019.2927650

### **9: Automated Visual Defect Detection for Flat Steel Surface: a Survey**

Qiwu Luo, Central South University, China

Xiaoxin Fang, Hefei University of Technology, China

Li Liu, University of Oulu, Finland

Chunhua Yang, Central South University, China

Yichuang Sun, University of Hertfordshire, United Kingdom

**Abstract:** Automated computer-vision-based defect detection has received much attention with the increasing surface quality assurance demands for the industrial manufacturing of flat steels. This article attempts to present a comprehensive survey on surface defect detection technologies by reviewing about 120 publications over the last two decades for three typical flat steel products of con-casting slabs and hot- and cold-rolled steel strips. According to the nature of algorithms as well as image features, the existing methodologies are categorized into four groups: statistical, spectral, model-based, and machine learning. These works are summarized in this review to enable easy referral to suitable methods for diverse application scenarios in steel mills. Realization recommendations and future research trends are also addressed at an abstract level. DOI: 10.1109/TIM.2019.2963555

### **10: Automated Visual Defect Classification for Flat Steel Surface: a Survey**

Qiwu Luo, Central South University, China

Xiaoxin Fang, Hefei University of Technology, China

Jiaojiao Su, Central South University, China

Jian Zhou, Central South University, China

Bingxing Zhou, Central South University, China

Chunhua Yang, Central South University, China

Yichuang Sun, Central South University, China

**Abstract:** For a typical surface automated visual inspection (AVI) instrument of planar materials, defect classification is an indispensable part after defect detection, which acts as a crucial precondition for achieving the online quality inspection of end products. This article attempts to present a focused but systematic review of the traditional and emerging automated computer-vision-based defect classification methods by investigating approximately 140 studies on three specific flat steel products of con-casting slabs, hot-rolled steel strips, and cold-rolled steel strips. According to the natural image processing procedure of defect recognition, the diverse approaches are grouped into five successive parts: image acquisition, image preprocessing, feature extraction, feature selection, and defect classifier. Recent literature has been reviewed from an industrial goal-oriented perspective to provide some guidelines for future studies and recommend suitable methods for boosting the surface quality inspection level of AVI instruments. DOI: 10.1109/TIM.2020.3030167

## **11: Harmonic Amplitude Dispersion: When Production Intrinsic Prior Meets Oxygen Concentration Detection of Pharmaceutical Glass Vials**

Zihuai Liu, Central South University, China  
Yonggang Li, Central South University, China  
Qiwu Luo, Central South University, China  
Chunhua Yang, Central South University, China  
Weihua Gui, Central South University, China

**Abstract:** In situ and accurate oxygen concentration detection is drawing great attention in the pharmaceutical manufacturing industry. This paper proposes a novel concept of harmonic amplitude dispersion (HAD) under the framework of wavelength-modulation-based tunable diode laser absorption spectroscopy (TDLAS/WMS). Then, a reliable production intrinsic prior of the long-term information entropy distribution pattern is learned from the demodulated 2nd harmonic signals. Interestingly, the performance in oxygen concentration detection can be improved in two rounds by the HAD concept. At last, the proposed HAD robustly narrowed the average variance in the signal peak-to-peak values by nearly 30%, and together with the HAD-guided OS-ELM, an average detection accuracy of 98.1% within an acceptable time cost of 300 ms/vial was realized during a long-term test. (10.1109/TIM.2020.3007294)

## **12: Headspace Oxygen Concentration Measurement for Pharmaceutical Glass Bottles in Open-Path Optical Environment Using TDLAS/WMS**

Qiwu Luo, Central South University, China  
Cao Song, Central South University, China  
Chunhua Yang, Central South University, China  
Weihua Gui, Central South University, China  
Yichuang Sun, University of Hertfordshire, United Kingdom  
Zoe Jeffrey, University of Hertfordshire, United Kingdom

**Abstract:** Accurate measurement of oxygen concentration for pharmaceutical glass bottles is of great significance to ensure the asepsis of medicine and stability of ingredients. With merits of high sensitivity, low cost, non-contact, and real time response, the wavelength-modulation-based tunable diode laser absorption spectroscopy (TDLAS/WMS) technology shows great potential to achieve in-site oxygen concentration detection by the single-line spectrum measurement. This paper focuses on headspace oxygen concentration measurement in open-path optical environment, which is extremely challenging owing to the short light path length and random ambient noises. This paper also designed a TDLAS/WMS prototype, the experimental results aiming at glass bottles with different oxygen concentration of 0%, 5%, 10% and 21% in open path optical environment indicate our method has achieved an encouraging average absolute error of 0.54%, and can survive well when the normalized SNR is within 0.85 to 1. These results promise that the proposed methodology can be widely applied in in-site AOI instrumentation of headspace oxygen concentration measurement for glass vials. (10.1109/TIM.2019.2958582)

### **13: Characteristics of Arbitrary Ramp Generator: a Tuning Voltage Setup for the FMCW Reflectometer**

Gibin George, Birla Institute of Technology and Science, Pilani, India

Bittu N, Birla Institute of Technology and Science, Pilani, India

Janmejay Buch, Institute for Plasma Research, India

A. Amalin Prince, Birla Institute of Technology and Science, Pilani, India

**Abstract:** Ultra-wideband Voltage Controlled Oscillator (VCO), used as a frequency source for reflectometer, has a non-linear frequency response to the linear tuning voltages. A remotely configurable, custom instrument is presented, generating a non-linear voltage ramp of 0 to 20V with ultrafast sweep durations of  $\approx 5 \mu\text{s}$ . The instrument's voltage ramps are used to drive VCO to give a linear frequency response. The proposed design is developed using hardware-software co-design techniques and implemented on a system-on-chip (SoC) platform. The instrument can configure every voltage ramp's parameters to match the reflectometer application requirements.

### **14: Multi-Bs Spatial Spectrum Fusion for 2D DOA Estimation and Localization by Using UCA in Massive MIMO System**

Di He, Shanghai Jiao Tong University, China

Xin Chen, Shanghai Jiao Tong University, China

Ling Pei, Shanghai Jiao Tong University, China

Fusheng Zhu, Guangdong Communications & Networks Institute, China

Lingge Jiang, Shanghai Jiao Tong University, China

**Abstract:** In the indoor environment, where global positioning system (GPS) fails, the presence of multipath, non-line-of-sight (NLOS), and dense scatterer yield unreliable position estimation. In this study, a novel spatial spectrum fusion estimation and localization (SSFEAL) algorithm using the uniform circular array (UCA) structure is proposed, which is based on the two-dimensional (2D) direction of arrival (DOA) estimation. The spatial spectrum of the incoherent narrowband uplink pilot signal on each frequency bin received at the distributed massive MIMO base stations is used for spectrum fusion. It is demonstrated that the proposed method using UCA gives higher-resolution estimation performance compared with the rectangular array in the localization accuracy. Comprehensive Monte Carlo simulation and real application test results show the validity and sub-meter precision in the indoor environment. (DOI: 10.1109/TIM.2020.3029363)

### **15: Feasibility Study of Permanent Magnet-Based Tumor Tracking Technique for Precise Lung Cancer Radiotherapy**

Houde Dai, Quanzhou Institute of Equipment Manufacturing, Haixi Institutes, Chinese Academy of Sciences, China

Lifei Dong, Quanzhou Institute of Equipment Manufacturing, Haixi Institutes, Chinese Academy of Sciences, China

Bowen Lv, Quanzhou Institute of Equipment Manufacturing, Haixi Institutes, Chinese Academy of Sciences, China

**Abstract:** During lung cancer radiotherapy, tumor motion caused by respiration and heartbeat significantly affect the radiotherapy efficacy. The real-time and high-precision tracking of the lung tumor during the radiotherapy process remains a big challenge, as the traditional tracking methods have disadvantages such as slow tracking speed, radiation issue, or tracking and radiotherapy cannot be carried out at the same time. In this study, a magnetic tracking technique based on three permanent magnets was employed to localize the tumor in real-time.

## **16: Temperature and Nonlinearity Compensation of Pressure Sensor with Common Sensors Response**

Jacek Pieniazek, Rzeszow University of Technology, Poland

Piotr Ciecinski, Rzeszow University of Technology, Poland

**Abstract:** Temperature sensitivity compensation of pressure sensor considering its nonlinearity is crucial to obtain a highly accurate measurement. Unfortunately, various software methods are known to have some drawbacks, thus a large number of calibration points is necessary to model the sensor response properly. This paper aims to present a new compensation method that features the utilization of common response of the given type of sensors and the reduction of particular sensor calibration data set, which subsequently reduces the duration of necessary experiments.

Mathematical formulas, which are the basis of a solution, are derived from the sensor general model.

Two cases have been considered and analyzed theoretically. The method is experimentally verified using two sets of sensors. There is a tenfold increase in accuracy after compensation. Furthermore, the comparison of various cases confirms the validity of sensors similarity assumption and correctness of a theoretical analysis presented in this paper.

<https://doi.org/10.1109/TIM.2019.2910922>

## **17: Wind Turbine Gearbox Failure Detection Based on SCADA Data: a Deep Learning-Based Approach**

Luoxiao Yang, City University of Hong Kong, Hong Kong

Zijun Zhang, City University of Hong Kong, Hong Kong

**Abstract:** In this paper, we propose a deep joint variational autoencoder (JVAE) based monitoring method using wind farm supervisory control and data acquisition (SCADA) data to more effectively detect wind turbine gearbox failures. The JVAE utilizes two types of pre-defined parameters, behavior parameters (BPs) and conditional parameters (CPs), to produce reconstruction errors (REs) of the BP, which reflects the gearbox abnormality. DOI: 10.1109/TIM.2020.3045800

## **18: Deep Feature Clustering for Seeking Patterns in Daily Harmonic Variations**

Chenjie Ge, Chalmers University of Technology, Sweden

Roger de Oliveira, Luleå University of Technology, Sweden

Irene Gu, Chalmers University of Technology, Sweden

Math Bollen, Luleå University of Technology, Sweden

**Abstract:** This article proposes a novel scheme for analyzing power system measurement data. The main question that we seek answers in this study is on a whether one can find some important patterns that are hidden in the large data of power system measurements such as variational data.

The proposed scheme uses an unsupervised deep feature learning approach by first employing a deep autoencoder (DAE) followed by feature clustering. An analysis is performed by examining the patterns of clusters and reconstructing the representative data sequence for the clustering centers.

The scheme is illustrated by applying it to the daily variations of harmonic voltage distortion in a low-voltage network. The main contributions of the article include: 1) providing a new unsupervised deep feature learning approach for seeking possible underlying patterns of power system variation measurements and 2) proposing an effective empirical analysis approach for understanding the measurements through examining the underlying feature clusters and the associated reconstructed data by DAE.

## 19: K- and W-Band Free-Space Characterizations of Highly Conductive Radar Absorbing Materials

Nagma Vohra, University of Arkansas, United States

Magda El-Shenawee, University of Arkansas, United States

**Abstract:** This work presents a characterization technique of highly conductive material in the K- and W-bands. The transmission line theory model is modified to adapt to the phase challenges observed in the measured S-parameters at high frequency. The S-parameters measurements are obtained using the nondestructive focused beam free-space system connected with the network analyzer and the millimeter-wave frequency extenders. The system provides measurements in a frequency range from 5.8 to 110 GHz, and it includes focused beam horn lens antennas to minimize sample edge reflection. The thru-reflect-line (TRL) calibration and the time-gated feature of the network analyzer are used. Good agreement between the measured and calculated S-parameters in the transmission mode is achieved using the extraction algorithm. The measured S-parameters are further used to obtain the electromagnetic shield effectiveness parameters and the percentage of power absorbed in the material. In addition, the return loss of the metal-backed material is calculated using the extracted permittivity to obtain the maximum absorption at the desired frequencies. DOI:

10.1109/TIM.2020.3041821

## 20: Test Setup for Dynamic On-State Resistance Measurement of High- and Low-Voltage GaN-HEMTs Under Hard and Soft Switching Operation

Benedikt Kohlhepp, Electromagnetic Fields, Germany

Daniel Kübrich, Electromagnetic Fields, Germany

Marvin Tannhäuser, Siemens AG, Germany

Andreas Hoffmann, Siemens AG, Germany

Thomas Dürbaum, Electromagnetic Fields, Germany

**Abstract:** GaN-HEMTs impress with excellent properties and therefore power electronics engineers pay a lot of attention to it. However, during switching operation some devices show increased on-state resistance. Since for switch mode power supply designers, the internal device structure is not apparent, measuring the on-state resistance under the targeted operating conditions is the only method to gain this information. In order to characterize the dynamic on-state resistance, this paper proposes clamping circuits for accurate measurement. Using a high resolution digitizer card ensures precise results. The presented measurement setup allows to measure the on-state resistance under hard and soft switching conditions with parameters of the intended application. In inverter applications, each switch works under hard as well as soft switching. Therefore, the transition between these two operating modes must also be studied in detail. Finally, an extension of the clamping circuit is presented allowing measurements with high-voltage GaN-HEMTs as well. First results verify this improved setup. doi: 10.1109/TIM.2020.2985186

## 21: Verification of a Capacitive Voltage Divider with 6- $\mu$ rad Uncertainty Up to 100 kV

Gu Ye, VSL, Netherlands

Wei Zhao, National Institute of Metrology of China, China

Gert Rietveld, VSL, Netherlands

**Abstract:** The uncertainty level of the current-comparator-based capacitive voltage divider (CVD) used in the transformer loss measurement (TLM) reference setup of the Van Swinden Laboratorium (VSL) is extensively verified both from the component level and the system as a whole. Different on-site practical conditions are considered. The verification results show an agreement of better than  $(6\text{Å}\pm 6)\text{Å}\text{—}10\text{Å}^{\wedge}6$  in ratio error and  $(4\text{Å}\pm 6)\text{Å}\text{ }^{\wedge}1/4\text{rad}$  in phase displacement between the component and system calibrations up to 100 kV, which is well within the required  $10\text{Å}\text{ }^{\wedge}1/4\text{rad}$  limit to achieve on-site TLM system calibrations with  $20\text{Å}\text{ }^{\wedge}1/4\text{W}/\text{VA}$  overall uncertainty at low power factors.

10.1109/TIM.2021.3056647



## **22: An Adaptive Particle Filter Technique for System State Estimation and Prognosis**

Mohamed Ahwiadi, Lakehead University, Canada

Wilson Wang, Lakehead University, Canada

**Abstract:** System state estimation and prognostics are the key issues in dynamic system monitoring and management. Although the particle filter (PF) has been applied to model the nonlinear degradation feature of the system aging mechanism in several studies, it has two potential problems: the sample degeneracy and the impoverishment. To tackle these problems, a new adaptive particle filter (APF) technique is proposed in this article to enhance the performance of PFs. In the APF, a self-evaluation method is suggested to track the posterior distribution and detect the low-weight particles (sample degeneracy). A new adaptive weight adjustment approach is proposed to adaptively explore the posterior space, process those low-weight particles, and tackle the sample degeneracy. The effectiveness of the proposed APF technique is validated by simulation tests using several model conditions. It is also implemented for battery-health monitoring and prognosis. Test results show that the proposed APF technology can effectively capture and track the system's dynamic characteristics. DOI: 10.1109/TIM.2020.2973850

## **23: An Enhanced Mutated Particle Filter Technique for System State Estimation and Battery Life Prediction**

Mohamed Ahwiadi, Lakehead University, Canada

Wilson Wang, Lakehead University, Canada

**Abstract:** The particle filter (PF) has some limitations in real-world applications, for instant, the sample degeneracy and the impoverishment. Although several approaches have been proposed in the literature to tackle these problems, they have some limitations: for example, they cannot represent the entire probability density function (PDF) effectively. In this paper, an enhanced mutated PF (EMPF) technique is proposed to improve the performance of PFs. In the EMPF technique, first, an enhanced mutation approach is proposed to actively explore the posterior PDF to locate the high-likelihood area. Second, a new selection scheme is suggested to process low-weight particles for optimizing the posterior distribution and tackling sample degeneracy. Third, an outlier assessment method is adopted to monitor the overall pattern of the posterior distribution based on the interquartile range statistical analysis. The effectiveness of the proposed EMPF technique is verified by simulation tests. It is also implemented for the remaining useful life prediction of lithium-ion batteries. DOI: 10.1109/TIM.2018.2853900

## **24: Characterization of Cryogenic Material Properties of 3-D-Printed Superconducting Niobium Using a 3-D Lumped Element Microwave Cavity**

Benjamin McAllister, University of Western Australia, Australia

Jeremy Bourhill, IMT Atlantique, France

Wing Him Jacob Ma, University of Western Australia, Australia

Tim Sercombe, University of Western Australia, Australia

Maxim Goryachev, University of Western Australia, Australia

Michael Tobar, University of Western Australia, Australia

**Abstract:** We present an experimental characterisation of the electrical properties of 3D-printed Niobium. The study was performed by inserting a 3D-printed Nb post inside an Aluminium cylindrical cavity, forming a 3D lumped element re-entrant microwave cavity resonator. The resonator was cooled to temperatures below the critical temperature of Niobium (9.25 K) and then Aluminium (1.2 K), while measuring the quality factors of the electromagnetic resonances. This was then compared with finite element analysis of the cavity and a measurement of the same cavity with an Aluminium post of similar dimensions and frequency, to extract the surface resistance of the Niobium post. The 3D-printed Niobium exhibited a transition to the superconducting state below 9.25 K, as well as a surface resistance of  $3.1 \pm 0.54 \times 10^{-4} \Omega$ . DOI: 10.1109/TIM.2020.3031364

## **25: A New Technique to Obtain an Equivalent Indirect Hysteresis Loop from the Distortion of the Voltage Measured in the Excitation Coil**

Itsaso Artetxe Querejeta, Ceit, Spain

Fernando Arizti, Ceit, Spain

Ane Martinez-De-Guerenu, Ceit, Spain

**Abstract:** A new technique to calculate an equivalent indirect hysteresis loop, Bec-H loop, from the distortion of the voltage measured in the magnetic excitation coil is proposed. The aim is to facilitate the industrial implementation of magnetic characterization reducing hardware and error sources of the measuring system, as pick-up coils and their conditioning stages are not necessary. With the Bec-H technique, the characterization of two sets of materials with very different properties using a simplified electromagnetic system has been achieved. Specifically, the change in the microstructure of annealed low-carbon steel samples was monitored and the hardness of ultrahigh steel sheets was characterized. Moreover, the conventional hysteresis cycles and Bec-H loops are compared, and the obtained lineal relationships between the parameters derived from conventional hysteresis and Bec-H loops verify that the Bec-H loops can provide equivalent parameters for magnetic characterization of steel samples as conventional hysteresis loops. DOI: 10.1109/TIM.2020.3022444

## **26: Paving the Way for Suitable Metasurfaces' Measurements Under Oblique Incidence: Mono-/Bistatic and Near-/Far-Field Concerns**

Humberto Fernández Álvarez, University of Oviedo, Spain

María Elena de Cos Gómez, University of Oviedo, Spain

Fernando Las-Heras Andrés, University of Oviedo, Spain

**Abstract:** Due to the growing demand of angularly stable metasurfaces, this paper aims to tackle the experimental characterization of metasurfaces (MTS) reflectivity under oblique incidence. The critical aspect for enlarging the angular margin that can be properly measured is analysed, using the phase reflection coefficient of an AMC, which is more challenging to retrieve than its amplitude. The suitability of monostatic versus bistatic measurements set-ups for comparison with plane-wave simulation is studied. The tradeoff between the manufactured prototype dimensions versus the required anechoic chamber size is addressed, which is not considered by most authors. Moreover, the errors from comparison between near-field measurements versus plane-wave simulation is unveiled, which is showed to be more critical when analysing angular stability.

## **27: A Low-Cost LED-Based Solar Simulator**

Eduardo López-Fraguas, Carlos III University of Madrid, Spain

José Manuel Sánchez-Pena, Carlos III University of Madrid, Spain

Ricardo Vergaz, Carlos III University of Madrid, Spain

**Abstract:** Solar simulators are a fundamental instrument to characterize solar cells parameters, as they can reproduce the operating conditions under which the solar cells are going to work. However, these systems are frequently big, heavy, and expensive, and a small solar simulator could be a good contribution to test small prototyping devices manufactured in research labs, especially if it could manage the irradiation at any wavelength interval in a custom way. We have designed, developed, and calibrated a small solar simulator made entirely with LEDs, no optics inside, and electronically controlled through a PC using an Arduino microcontroller. The whole structure is 3-D printed in black PLA plastic. The electrical current through the LEDs, and thus the spectral irradiance of the simulator, is controlled with a very intuitive LabVIEW interface. As our calibration proves, we have built an easily reproducible and low-cost Class AAA solar simulator in a central illumination area of 1 cm<sup>2</sup>, according to the IEC60904-9 standard [...] DOI: 10.1109/TIM.2019.2899513

## **28: TScatNet: an Interpretable Cross-Domain Intelligent Diagnosis Model with Antinoise and Few-Shot Learning Capability**

Chao Liu, Shanghai Jiao Tong University, China

Chengjin Qin, Shanghai Jiao Tong University, China

Xi Shi, Shanghai Jiao Tong University, China

Zengwei Wang, Shanghai Jiao Tong University, China

Gang Zhang, Shanghai Jiao Tong University, China

Yunti Han, Shanghai Jiao Tong University, China

**Abstract:** Currently, domain adaptation-based models eliminate domain shift by calibrating unlabeled target-domain data using labeled source-domain data. These models may fail when encountering unseen working conditions, lacking unlabeled target-domain data for learning domain-invariant features. This article develops a cross-domain diagnosis model named time-scattering convolutional network (TScatNet) to remedy these gaps. TScatNet extracts domain-invariant features using Morlet wavelet as the predefined convolutional kernel, modulus as nonlinearity, and scaling averaging as pooling layer. This predefined architecture eliminates domain shift without any domain adaptation, endows TScatNet few-shot learning capability, simplifies the hyperparameter tuning process, and brings interpretability. Experiments results shows TScatNet's excellent diagnosis performance.

## **29: Super-Resolution 3-D Laser Scanning Based on Interval Arithmetic**

Peter Walecki, Brown University, United States

Gabriel Taubin, Brown University, United States

**Abstract:** Most 3-D laser scanners are based on 3-D optical triangulation algorithms, where the location of each 3-D point is estimated as the intersection of a camera ray and a plane of light projected by a laser line generator. Since a physical laser-line generator projects a sheet of light of finite thickness, inaccurate measurements and errors result from assuming that the plane of light is infinitesimally thin. We propose a new mathematical formulation for 3-D optical triangulation based on interval arithmetic, where 3-D points are only determined within certain bounds along the camera rays, and multiple measurements are used to tighten these bounds.

<https://doi.org/10.1109/TIM.2020.2987619>

### **30: Gain Invariant Coordinate Reconstruction for SiPM Based pixelated Gamma Detectors with Multiplexed Readout**

Harutyun Poladyan, Lakehead University, Canada  
Oleksandr Bubon, Lakehead University, Canada  
Aram Teymurazyan, University of Regina, Canada  
Sergii Senchurov, Teleoptic PRC, Ukraine  
Alla Reznik, Lakehead University, Canada

**Abstract:** In this article, we report on the Truncated Center of Gravity (TCoG) and Raised-To-the-Power (RTP) algorithms for calculation of gamma photon scintillation position as applied to our newly developed small-scale prototype PET system consisting of a pair of opposing detectors based on 24 Å— 24 LYSO scintillation crystal matrices and 8 Å— 8 SiPM arrays with 64:16 multiplexed readout. The major notable advantage of using TCoG or RTP algorithm in contrast to basic CoG is shown to be their independence of photosensor gain variations. An improvement in the calculation of scintillation positions is demonstrated both for TCoG and RTP algorithms, the Field of View (FOV) distortion inherent to CoG reconstruction is eliminated. On average, the Peak-to-Valley Ratio (PVR) is increased at least by a factor of 2.25. The energy resolution is  $\hat{\approx}$ 13.5% when using CoG, TCoG, or RTP reconstruction algorithms. <https://doi.org/10.1109/23.596981>

### **31: POISON: Human Pose Estimation in Insufficient Lighting Conditions Using Sensor Fusion**

Viviana Crescitelli, Hitachi Ltd., Research and Development Group, Japan  
Atsutake Kosuge, Hitachi Ltd., Research and Development Group, Japan  
Takashi Oshima, Hitachi Ltd., Research and Development Group, Japan

**Abstract:** POISON is an end-to-end deep neural network method to estimate the human pose in real-time and under the variability of lighting conditions. A lightweight version of the open-source library, OpenPose, is used to extract human keypoints from RGB and infrared images, and the contribution of each image is combined by a fusion step. We propose a method to fuse these two types of information, using a fusion strategy followed by a refinement stage DNN. Experimental results validate that POISON improves the performance of conventional single-camera methods by a factor 1.79Å—. POISON achieves real-time performance on Intel Core i7 CPU. (DOI: 10.1109/TIM.2020.3043872)

### **32: Prediction of Oxygen Content Using Weighted PCA and Improved LSTM Network in MSWI Process**

Jian Sun, Beijing University of Technology, China  
Xi Meng, Beijing University of Technology, China  
Junfei Qiao, Beijing University of Technology, China

**Abstract:** The accurate and real-time measurement of oxygen content in flue gas is the cornerstone of high incineration efficiency and economic benefits for municipal solid waste incineration (MSWI) plants. The weighted PCA feature extraction method, named WPCA, is developed to improve the information representation ability of the conventional PCA algorithm. An improved LSTM (ILSTM) network is designed whose main hyper-parameters are selected through the PSO algorithm without the manual influence. The hybrid model WPCA-ILSTM is proposed, combining with better data features and an accurate modeling framework. The prediction performance of the proposed model is verified by benchmark simulation and MSWI process data.

### **33: Participatory Air Quality and Urban Heat Islands Monitoring System**

Mohamed Anis Fekih, University of Lyon, INSA Lyon, CITI, France

Walid Bechkit, University of Lyon, INSA Lyon, CITI, France

Hervé Rivano, University of Lyon, INSA Lyon, CITI, France

Manoël Dahan, University of Lyon, INSA Lyon, CITI, France

Florent Renard, University Jean Moulin Lyon 3, UMR CNRS Environment City Society, France

Luccille Alonso, University Jean Moulin Lyon 3, UMR CNRS Environment City Society, France

Florent Pineau, TOTAL Raffinage-Chimie, Laboratoire de la Qualité de l'Air, France

**Abstract:** The widespread use of low-cost environmental monitoring systems has given new impetus to smart city applications. In this paper, we present the 3M<sup>€</sup>™ Air project that aims to explore the potential of participatory citizen measures using low-cost sensors to improve the local knowledge of air quality and temperature. We present the design, implementation and evaluation of our participatory monitoring system. To validate our platform, we have carried out multiple tests to compare our sensor nodes to reference stations and to each other. The results are satisfactory and show that our nodes can be used in environmental participatory monitoring.

<https://doi.org/10.1109/TIM.2020.3034987>

### **34: Anchor Calibration for Real-Time-Measurement Localization Systems**

Peter Krapež, Faculty of Electrical Engineering, University of Ljubljana, Slovenia

Marko Munih, Faculty of Electrical Engineering, University of Ljubljana, Slovenia

**Abstract:** A quick calibration is desirable for new anchors that are positionally undetermined in working coordinate system. Accuracy of the anchor localization was studied by simulating a change in the number of additional CMs and their positions. Tests on real system with ultrawideband modules were performed to validate the improvements in anchor calibration when using additional CMs. Experimental results revealed improvement in anchor localization, where average error was improved by 0.01 m in first and 0.30 m in second scenario. Calibration of anchor positions in working coordinate system using additional CMs resulted in 3-D error of less than 0.32 m. 10.1109/TIM.2020.3005258

### **35: High Precision ADC Testing with Relaxed Reference Voltage Stationarity**

Vivek Varier, University of Texas at Austin, United States

Nan Sun, UT Austin, United States

**Abstract:** This paper seeks to simplify the scope of on-chip built-in self-test (BIST) schemes for the static testing of analog-to-digital converters (ADCs) by relaxing the precision and constancy requirements for the reference voltage of the system. The proposed testing methodology is based on appropriate modifications to the "Stimulus Error Identification and Removal (SEIR)" algorithm, which already addresses the stringent linearity constraints on the input stimulus. Simulation results with the proposed algorithm are presented for a prototype 14-bit SAR ADC; wherein the non-linearities of the input signal and the non-stationarities of the reference voltages are estimated to obtain the actual ADC performance. Once the ADC linearity is known, standard digital calibration schemes can be employed to achieve higher resolution. <https://doi.org/10.1109/TIM.2020.3031208>

### **36: Tracking of a Gunning Jet Using Particle Filtering in Infrared Image Sequences**

Nikolaus Mutsam, Graz University of Technology, Austria

Franz Pernkopf, Graz University of Technology, Austria

**Abstract:** To counteract the wear of refractory linings, gunning is used as a common procedure in steelmaking to prolong the usability of the lining. We focus on tracking the gunning jet using infrared images. In particular, we use a particle filter with online learning to update the reference template. Template matching is used for tracker stabilization and object verification. We use a parametric model of the gunning jet for feature extraction and dynamic reference template generation. For tracker initialization, we combine template matching with geometric- and temperature-based constraints. We provide experiments on real and synthetic data to demonstrate the capabilities of the presented tracker. Paper DOI: 10.1109/TIM.2020.2972170

### **37: Novel Noniterative Orientation Estimation for Wearable Motion Sensor Units Acquiring Accelerometer, Gyroscope, and Magnetometer Measurements**

Aras Yurtman, KU Leuven, Belgium

Billur Barshan, Bilkent University, Turkey

**Abstract:** We propose a novel noniterative orientation estimation method based on the physical and geometrical properties of the acceleration, angular rate, and magnetic field vectors to estimate the orientation of motion sensor units. The proposed algorithm aims that the vertical axis of the earth coordinate frame is as close as possible to the measured acceleration and that the north axis of the earth makes an angle with the detected magnetic field vector as close as possible to the estimated magnetic dip angle. We obtain the sensor unit orientation based on the rotational quaternion transformation between the earth and the sensor unit frames. We evaluate the proposed method by incorporating it into an activity recognition scheme for daily and sports activities, which requires accurately estimated sensor unit orientations to achieve invariance to the orientations at which the units are worn on the body. Using four different classifiers on a publicly available dataset, the proposed methodology achieves an average activity recognition accuracy higher than the state-of-the-art methods, as well as being computationally efficient enough to be executed in real time. 10.1109/TIM.2019.2930437

### **38: Composite Aircraft Lightning Strike Protection Damage Evaluation Using Microwave Microscopy**

Leandro Rufail, Polytechnique Montreal, Canada

Jean-Jacques Laurin, Polytechnique Montreal, Canada

**Abstract:** This work presents a new application of microwave microscopy for the diagnostic of the painted lightning strike protection (LSP) mesh used in composite aircraft skin. A new flexible probe is presented. This probe can sweep over the surface of the composite skin and detect breaks in the LSP laying underneath. It is demonstrated that shielding of the probe feeding line leads to better balancing and consequently highly improved immunity to the presence of nearby objects. With this new approach it is possible to localize faults as small as one cut strand under the paint. Also, this technique features the possibility to measure the paint thickness with a resolution in the order of micrometers. DOI: 10.1109/TIM.2019.2941039

# Technical Program: May 19<sup>th</sup>

## **Embedded Artificial Intelligence for Smart Sensing & Communications & IoT**

5/19/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Michele Magno, ETH Zurich*

*Domenico Capriglione, University of Cassino & Southern Lazio*

## **[INVITED] Embedded Artificial Intelligence for Smart Sensing and IoT Applications**

Tinoosh Mohsenin, University of Maryland Baltimore County, United States

## **Towards Always-on Event-Based Cameras for Long-Lasting Battery-Operated Smart Sensor Nodes**

Moritz Scherer, ETH Zürich, Switzerland

Philipp Mayer, ETH Zürich, Switzerland

Alfio Di Mauro, ETH Zürich, Switzerland

Michele Magno, ETH Zürich, Switzerland

Luca Benini, University of Bologna, ETH Zürich, Switzerland

## **Smart Gravimetric System Based on Deep Learning for Enhanced Safety of Accesses to Public Places**

Tommaso Addabbo, University of Siena, Italy

Ada Fort, University of Siena, Italy

Marco Mugnaini, University of Siena, Italy

Valerio Vignoli, University of Siena, Italy

Matteo Intravaia, University of Siena, Italy

Marco Tani, University of Siena, Italy

## **Study Case in Mining Industry: Monitoring Rollers Using Embedded LoRaWAN**

Ralf Moura, Vale S.A., Brazil

Danilo Bibancos, Superior Industries Inc., Brazil

Luiz Barreto, Vale S.A., Brazil

Alex Fracaroli, TCS S.A., Brazil

Eduardo Martinelli, Superior Industries Inc., Brazil

## **Enable Software-Defined Radios for Real-Time MIMO Channel Sounding**

Daniel Stanko, Fraunhofer Institute for Integrated Circuits IIS, Germany

Gerd Sommerkorn, Technische Universität Ilmenau, Germany

Alexander Ihlow, Fraunhofer Institute for Integrated Circuits IIS, Germany

Giovanni Del Galdo, Fraunhofer Institute for Integrated Circuits IIS, Germany

## **Image Processing 1**

5/19/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Chi Hung Hwang, NARL*

*Grzegorz Fusiek, University of Strathclyde*

### **Image Reconstruction for Electrostatic Tomography Based on Residual Network Considering the Prior Knowledge of Boundary Measurement**

Chao Wang, Tianjin University, China

Xuechen Zhang, Tianjin University, China

Hongjun Sun, Tianjin University, China

Xiao Liang, Tianjin University, China

Jiamin Ye, Tianjin University, China

### **Improving Broadband Emission-Based Soot Pyrometry Using Convolutional Neural Networks**

Alonso Rodríguez, Universidad Técnica Federico Santa María, Chile

Jorge Portilla, Universidad Técnica Federico Santa María, Chile

Juan Cruz, Universidad Técnica Federico Santa María, Chile

Felipe Escudero, Universidad Técnica Federico Santa María, Chile

### **Production of Data Set Based on Adjustable Rotary Table and Part Identification Based on Deep Learning**

Yihan Meng, Harbin Engineering University, China

He Xu, Harbin Engineering University, China

Zhen Ma, Harbin Engineering University, China

Jiaqiang Zhou, Harbin Engineering University, China

Daquan Hui, Harbin Engineering University, China

### **Measuring Camera Exposure Time Using Equivalent Sampling**

Márk Rátosi, University of Pannonia, Hungary

Gergely Vakulya, ElectrIT, Hungary

Gyula Simon, Óbuda University, Hungary

### **Investigation of Liquid Film in Horizontal Slug Flow Based on the Image Processing**

Ting Xue, Tianjin University, China

Jingyu Zhao, Tianjin University, China

Tao Zhang, Tianjin University, China

## **Measurement for Industry 4.0 & Advanced Manufacturing**

5/19/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Marco Mugnaini, University of Siena*

*Salvatore Graziani, University of Catania*

### **Instrumentation of a Roving Inspection Test Rig with Surface Geometry Measurement of Fiber Bundles**

Sophia Lehner, Montanuniversität Leoben, Austria

Stefan Neunkirchen, Montanuniversität Leoben, Austria

Ewald Fauster, Montanuniversität Leoben, Austria

Paul O'Leary, University of Leoben, Austria



## **Remote Ultrasonic Imaging of a Wire Arc Additive Manufactured Ti-6Al-4V Component Using Laser Induced Phased Array**

Peter Lukacs, University of Strathclyde, United Kingdom  
Geo Davis, University of Strathclyde, United Kingdom  
Theodosia Stratoudaki, University of Strathclyde, United Kingdom  
Stewart Williams, University of Cranfield, United Kingdom  
Charles MacLeod, University of Strathclyde, United Kingdom  
Anthony Gachagan, University of Strathclyde, United Kingdom

## **On the Use of Correlation Analysis in the Estimation of Finite-Time Delay in Soft Sensors Design**

Salvatore Graziani, Università di Catania, Italy  
Maria Gabriella Xibilia, Università di Messina, Italy

## **Multivariate Data Prediction in a Wireless Sensor Network Based on Sequence to Sequence Models**

Carlos Raul Morales, Universidade Federal de Santa Catarina, Brazil  
Fernando Rangel de Sousa, Universidade Federal de Santa Catarina, Brazil  
Valner Brusamarello, Universidade Federal do Rio Grande do Sul, Brazil  
Nestor Fernandes, Traceback Technologies, Brazil

## **A CNN-Based Approach to Measure Wood Quality in Timber Bundle Images**

Marco Carratù, Università degli Studi di Salerno, Italy  
Vincenzo Gallo, Università degli Studi di Salerno, Italy  
Consolatina Liguori, Università degli Studi di Salerno, Italy  
Antonio Pietrosanto, Università degli Studi di Salerno, Italy  
Mattias O'Nils, Mid Sweden University, Sweden  
Jan Lundgren, Mid Sweden University, Sweden

## **Medical & AI-Enabled Technologies for Smart Health Monitoring**

5/19/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): M. Shamim Hossain, King Saud University, KSA*

*Sivagunalan Sivanathan, University of South Wales Prifysgol De Cymru*

## **[INVITED] Exploration of Smart eHealth Technologies in the Era of COVID-19 and beyond with Case Study of Using the Siamese Neural Networks for Early Detection of COVID-19 Cases from CT-Scans**

Sabah Mohammed, Lakehead University, Canada

## **An Optimized Hardware Implementation of Deep Learning Inference for Diabetes Prediction**

Md Maruf Hossain Shuvo, University of Missouri, United States  
Omiya Hassan, University of Missouri, United States  
Dilruba Parvin, University of Missouri, United States  
Mengrui Chen, University of Missouri, United States  
Syed Kamrul Islam, University of Missouri, United States

### **Attention Based Inception Model for Robust EEG Motor Imagery Classification**

Syed Umar Amin, King Saud University, Saudi Arabia

Hamdi Altaheri, King Saud University, Saudi Arabia

Ghulam Muhammad, King Saud University, Saudi Arabia

Mansour Alsulaiman, King Saud University, Saudi Arabia

Wadood Abdul, King Saud University, Saudi Arabia

### **Real-Time Bluetooth Low Energy (BLE) Electrocardiogram Monitoring Device**

Sivagunalan Sivanathan, University of South Wales, United Kingdom

Alexandre Oleon, University of South Wales, United Kingdom

### **Quality, Reliability & Safety 1 (TC-32)**

5/19/2021 9:00:00 AM - 10:30:00 AM GMT+1

*Session Chair(s): Lorenzo Ciani, DINFO - University of Florence*

*Giulio D'Emilia, University of L'Aquila*

### **[INVITED] Investigating the Use of Low-Cost and Low-Power Millimeter Wave Radar to Improve Quality of Tomato Harvesting**

Matthew Smithson, University of Waikato, New Zealand

Melanie Po-Leen Ooi, University of Waikato, New Zealand

Lauren Gris, University of Waikato, New Zealand

Ye Chow Kuang, University of Waikato, New Zealand

Merilyn Manley-Harris, University of Waikato, New Zealand

### **Reliability and Functional Analysis of IMU Systems Under Temperature-Based Stress Tests**

Marco Carratù, Università degli Studi di Salerno, Italy

Marcantonio Catelani, University of Florence, Italy

Lorenzo Ciani, University of Florence, Italy

Gabriele Patrizi, University of Florence, Italy

Antonio Pietrosanto, Università degli Studi di Salerno, Italy

### **Pulse-Based Technique for Hard Faults Identification in Complex Wire Networks**

Dhia Haddad, Technische Universität Chemnitz, Germany

Ahmed Yahia Kallel, Technische Universität Chemnitz, Germany

Najoua Essoukri Ben Amara, Université de Sousse, Tunisia

Olfa Kanoun, Technische Universität Chemnitz, Germany

### **Adaptive Variance Estimation of Sensor Noise Within a Sensor Data Fusion Framework**

Dominik Schneider, Technische Hochschule Ingolstadt, Germany

Bernhard Liebhart, Technische Hochschule Ingolstadt, Germany

Christian Endisch, Technische Hochschule Ingolstadt, Germany

### **Distributed IoT System to Enhance Worker Safety in Large Open Areas**

Marco Tani, University of Siena, Italy

Lorenzo Parri, University of Siena, Italy

Riccardo Moretti, University of Siena, Italy

Elia Landi, University of Siena, Italy

Ada Fort, University of Siena, Italy

Valerio Vignoli, University of Siena, Italy

**Award Ceremony & Plenary Presentation (Sheila Rowan)**

5/19/2021 10:30:00 AM - 12:00:00 PM GMT+1

*Session Chair(s): Pawel Niewczas, University of Strathclyde, Glasgow, Scotland*

*Kristen Donnell, Missouri University of Science and Technology, Missouri, United States*

**Gravitational-wave detectors: Challenges in Precision Measurement Technology for Fundamental Physics**

Sheila Rowan, University of Glasgow, UK

**Virtual Tour of Glasgow**

5/19/2021 12:00:00 PM - 12:30:00 PM GMT+1

*Session Chair(s): Jacqueline Malloy, University of Strathclyde, Glasgow, Scotland*

**COVID 101 – Best Practices from Pandemic Life,  
Presented by the Women in Instrumentation and Measurement Committee**

5/19/2021 12:30:00 PM - 1:30:00 PM GMT+1

*Session Chair(s): Alison Cleary, University of Strathclyde, Glasgow, Scotland*

*Kristen Donnell, Missouri University of Science and Technology, Missouri, United States*

*Melanie Po-Leen Ooi, University of Waikato, New Zealand*

**Poster Session #3: Measurement for Human-Computer Interactions: Advanced Sensors, Imaging, Image Processing, Signal Processing, Robotics and Data Analytics**

5/19/2021 1:30:00 PM - 2:30:00 PM GMT+1

**1: Inter-Batch Gap Filling Using Compressive Sampling for Low-Cost IoT Vibration Sensors**

Boon-Yaik Ooi, Universiti Tunku Abdul Rahman, Malaysia

Soung-Yue Liew, Universiti Tunku Abdul Rahman, Malaysia

Woan-Lin Beh, Universiti Tunku Abdul Rahman, Malaysia

Shervin Shirmohammadi, University of Ottawa, Canada

**2: The Noninvasive and Optical Only Glucose Monitoring Investigation and Analysis**

Yi-Hsiung Lee, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

Yu-Hsuan Lin, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

Hsin-Yi Tsai, Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan

**3: An Autocorrelation Method for Asynchronous Vibration Feature Extraction in Blade Tip Timing**

Zengkun Wang, Xi'an Jiaotong University, China

Zhibo Yang, Xi'an Jiaotong University, China

Haoqi Li, Xi'an Jiaotong University, China

Shuming Wu, Xi'an Jiaotong University, China

Ruqiang Yan, Xi'an Jiaotong University, China

Shaohua Tian, Xi'an Jiaotong University, China

**4: Comparative Study of Electricity-Theft Detection Based on Gradient Boosting Machine**

Zhongzong Yan, Hunan University, China

He Wen, Hunan University, China

### **5: A Virtual Blade Tip Timing Measurement Method for Foreign Object Damage**

Shuming Wu, Xi'an Jiaotong University, China  
Zhibo Yang, Xi'an Jiaotong University, China  
Haoqi Li, Xi'an Jiaotong University, China  
Zengkun Wang, Xi'an Jiaotong University, China  
Shaohua Tian, Xi'an Jiaotong University, China  
Ruqiang Yan, Xi'an Jiaotong University, China

### **6: Performance Degradation Prediction of Aircraft Auxiliary Power Unit Using the Improved SVR**

Xiaolei Liu, Harbin Institute of Technology, China  
Liansheng Liu, Harbin Institute of Technology, China  
Lulu Wang, China Southern Airlines Engineering Technology Research Center, China  
Xiyuan Peng, Harbin Institute of Technology, China

### **7: Anomaly Detection of Spacecraft Telemetry Data Using Temporal Convolution Network**

Yuan Wang, Harbin Institute of Technology, China  
Yan Wu, Harbin Institute of Technology, China  
Qiong Yang, Institute of Navigation Satellite, China  
Jun Zhang, Institute of Navigation Satellite, China

### **8: Fault Diagnosis Method of Diesel Engine Injector Based on Hierarchical Weighted Permutation Entropy**

Yun Ke, Harbin Engineering University, China  
Chong Yao, Harbin Engineering University, China  
Enzhe Song, Harbin Engineering University, China  
Liping Yang, Harbin Engineering University, China  
Quan Dong, Harbin Engineering University, China

### **9: An Improved Sparse Reconstruction Algorithm Based on Singular Value Decomposition for Electrical Resistance Tomography**

Shouxiao Li, Tianjin Agricultural University, China  
Huaxiang Wang, Tianjin University, China  
Joanna N. Chen, Tianjin University of Technology, China  
Ziqiang Cui, Tianjin University, China

### **10: Identifying Pristine and Processed Animal Fibers Using Machine Learning**

Oliver Rippel, RWTH Aachen University, Germany  
Niclas Bilitewski, RWTH Aachen University, Germany  
Khosrow Rahimi, RWTH Aachen University, Germany  
Juliana Kurniadi, RWTH Aachen University, Germany  
Andreas Herrmann, RWTH Aachen University, Germany  
Dorit Merhof, RWTH Aachen University, Germany

### **11: Performance Evaluation of Range Hood Based on Visual Quantification**

Rongbo Fan, Northwestern Polytechnical University, China  
Zhongcheng Wang, Northwestern Polytechnical University, China  
Jianhua Yang, Northwestern Polytechnical University, China  
Jiajia Gao, Ningbo Fotile Kitchen Ware Co.,Ltd., China  
Da Wang, Ningbo Fotile Kitchen Ware Co.,Ltd., China

### **12: An Image Reconstruction Algorithm Based on Two-Step Iterative Shrinkage/Thresholding for Electrical Resistance Tomography**

Shouxiao Li, Tianjin Agricultural University, China  
Joanna N. Chen, Tianjin University of Technology, China  
Huaxiang Wang, Tianjin University, China  
Ziqiang Cui, Tianjin University, China

### **13: Regularization Parameters Determination Method Based on Random Matrix Clustering**

Yuanyuan Zhang, Tianjin University, China  
Shihong Yue, Tianjin University, China  
Jia Li, Tianjin University, China  
Chang Sun, Tianjin University, China

### **14: Dorsal Hand Veins Biometrics Using NIR Images with Fusion of Classifiers at Score Level**

Juan Manuel Ramirez-Cortes, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico  
Julian Mauricio Ruiz-Echeverri, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico  
Juan Carlos Bernal-Romero, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

### **15: A Lightweight Ship Detection Method in Optical Remote Sensing Image Under Cloud Interference**

Jinxiang Yu, Harbin Institute of Technology, China  
Xiyuan Peng, Harbin Institute of Technology, China  
Shaoli Li, Harbin Institute of Technology, China  
Yibo Lu, Shanghai Institute of Satellite Engineering, China  
Wenjia Ma, Shanghai Institute of Satellite Engineering, China

### **16: Investigation of Asymmetry in Horizontal Gas-Liquid Annular Flow Based on Planar Laser Induced Fluorescence**

Ting Xue, Tianjin University, China  
Tao Zhang, Tianjin University, China  
Mengrui An, Tianjin University, China

### **17: Localization of Blood Vessels in In-Vitro LSCI Images with K-Means**

Javier Lopez-Tiro, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico  
Hayde Peregrina-Barreto, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico  
Jose de Jesus Rangel-Magdaleno, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

**18: Constrained Model Predictive Control for Six-DOF Vibration Isolator of the Absolute Marine Gravimeter**

Zhenxing Li, Tsinghua University, China  
Kang Wu, Tsinghua University, China  
Meiying Guo, Tsinghua University, China  
Yicong Chen, Tsinghua University, China  
Yi Wen, Tsinghua University, China  
Lijun Wang, Tsinghua University, China

**19: Method and Implementation of Rock Melon Detection and Localisation for Fast and Reliable Autonomous Harvesting**

Michael Jay Ellis, University of Waikato, New Zealand  
Melanie Po-Leen Ooi, University of Waikato, New Zealand  
Shen Hin Lim, University of Waikato, New Zealand

**20: Monocular Stereo Vision Based Method for Validating Path Accuracy of Industrial Robots**

Xiao Li, China University of Petroleum, China  
Wei Li, China University of Petroleum, China  
Xiaokang Yin, China University of Petroleum, China  
Xin Ma, Purdue University, United States  
Xin'an Yuan, China University of Petroleum, China  
Jianming Zhao, China University of Petroleum, China

**21: Noise Attenuation on IMU Measurement for Drone Balance by Sensor Fusion**

Minh Long Hoang, Università degli Studi di Salerno, Italy  
Marco Carratù, Università degli Studi di Salerno, Italy  
Vincenzo Paciello, Università degli Studi di Salerno, Italy  
Antonio Pietrosanto, Università degli Studi di Salerno, Italy

**22: Evaluation of Filtering Methods for the Prediction of Human Position During Walking by Means of Kinematical Models**

Leticia González, University of Oviedo, Spain  
Antonio Miguel López, University of Oviedo, Spain  
Diego Álvarez, University of Oviedo, Spain  
Juan Carlos Álvarez, University of Oviedo, Spain

**23: 3D Printed Self-Sensing Alkali-Activated Coatings for Civil Infrastructure**

Christos Vlachakis, University of Strathclyde, United Kingdom  
Marcus Perry, University of Strathclyde, United Kingdom  
Jack McAlorum, University of Strathclyde, United Kingdom

**24: Enhancement of the Measurement Stability of Conductive Ink Based Sensor by Topology Optimization**

Yudong Zhang, Harbin Engineering University, China  
He Xu, Harbin Engineering University, China  
Feng Sun, Harbin Engineering University, China  
Yuhan Zhao, Harbin Engineering University, China

**25: ESA-Net: A Network with Efficient Spatial Attention for Smoky Vehicle Detection**

Jianan Zhou, Hunan University, China  
Shaowei Qian, China Academy of Sciences, China  
Zhongzong Yan, Hunan University, China  
Jingbo Zhao, Hunan University, China  
He Wen, Hunan University, China

**26: Magnetic Resonance-Based Measurement System: Comparison of 2D and 3D Echo-Planar Imaging Sequences for Thermometry Application**

Martina De Landro, Politecnico di Milano, Italy  
Sanzhar Korganbayev, Politecnico di Milano, Italy  
Khalid Ambarki, Siemens Healthcare SAS Saint-Denis, France  
Juan Verde, Institute of Image-Guided Surgery, Strasbourg, France  
Henrik Odeen, University of Utah, United States  
Celine Giraudeau, Institute of Image-Guided Surgery, Strasbourg, France  
Paola Saccomandi, Politecnico di Milano, Italy

**27: A Calibration Method for 77GHz Millimeter-Wave Radar Based on Virtual Instrument Technology**

Tianqi Xu, National Institute of Metrology of China, China  
Lei Du, National Institute of Metrology of China, China

**28: Evaluation of Coil Location of TMR-Based Electromagnetic Tomography Sensor**

Chao Wang, Tianjin University, China  
Xiao Liang, Tianjin University, China  
Jiamin Ye, Tianjin University, China  
Xuechen Zhang, Tianjin University, China

**29: An Affordable Airborne Ultrasonic Sensor for Predictive Maintenance Applications**

José Ramón Blanco González, Ingen10 SL, Spain  
Juan Menéndez Blanco, TWave SL, Spain  
Francisco Javier Ferrero Martín, University of Oviedo, Spain  
Alberto López Martínez, University of Oviedo, Spain  
José Ramón Villar Flecha, University of Oviedo, Spain

**30: Linear Electrode Array for Flow Velocity Estimation**

Ziqiang Cui, Tianjin University, China  
Long Yan, Tianjin University, China  
Pengyu Yang, Tianjin University, China  
Yu Sun, Tianjin University, China  
Huaxiang Wang, Tianjin University, China

**31: Thermal Characterization of Electrical Resistance of 3D Printed Sensors**

Mattia Alessandro Ragolia, Politecnico di Bari, Italy  
Attilio Di Nisio, Politecnico di Bari, Italy  
Anna Maria Lucia Lanzolla, Politecnico di Bari, Italy  
Gianluca Percoco, Politecnico di Bari, Italy  
Marco Scarpetta, Politecnico di Bari, Italy  
Gianni Stano, Politecnico di Bari, Italy

**32: A Cross-Conductive Sensor to Measure Bottled Water Quality**

Tarikul Islam, Jamia Millia Islamia Central University, India  
Arshi Salamat, Jamia Millia Islamia Central University, India  
Sandeep Kumar Singh, Jamia Millia Islamia Central University, India  
Mahfoozur Rehman, Aligarh Muslim University, India

**33: Testing of an Ultrasonic Thermometer Developed at the Idaho National Laboratory**

Joshua Daw, Idaho National Laboratory, United States  
Lance Hone, Idaho National Laboratory, United States  
Kris Woodbury, Idaho National Laboratory, United States

**34: Ultrasound Attenuation Analysis of Liquid-Solid Mixtures with Multi-Frequency Ultrasound Excitation**

Chao Tan, Tianjin University, China  
Wenxiu Hou, Tianjin University, China  
Feng Dong, Tianjin University, China

**35: A Digital Readout Suitable for Resistive Sensors Affected with a Parasitic Capacitance Element**

Elangovan K, Indian Institute of Space Science and Technology, India  
Anoop Chandrika Sreekantan, Indian Institute of Space Science and Technology, India

**36: Signal Processing Method for Flight Time Measurement of Gas Ultrasonic Flowmeter**

Dandan Zheng, Tianjin University, China  
Jianqiang Mei, University of Technology and Education, China  
Yang Mao, Tianjin University, China  
Zhibin Yang, Tianjin University, China

**37: Spacecraft Leakage Detection Using Acoustic Emissions Based on Empirical Mode Decomposition and Support Vector Machine**

Hongbing Ding, Tianjin University, China  
Zhenxin Liang, Tianjin University, China  
Lei Qi, Beijing Institute of Spacecraft Environment Engineering, China  
Hongjun Sun, Tianjin University, China  
Xixi Liu, Tianjin University, China

**38: Vortex Convection Characteristics in Mist Flow Based on Fluctuating Pressure Measurement**

Hongjun Sun, Tianjin University, China  
Chenrui Song, Tianjin University, China  
Hongbing Ding, Tianjin University, China  
Jinxia Li, Civil Aviation University of China, China  
Pengfei Lv, Tianjin University, China  
Yuhang Liu, Tianjin University, China

**39: General Density-Peaks-Clustering Algorithm**

Tianyi Li, Tianjin University, China  
Shihong Yue, Tianjin University, China  
Chang Sun, Tianjin University, China



#### **40: Phase Sensitive Detector for Multi-Electrode Electromagnetic Flowmeter**

Kai Gao, Tianjin University, China  
Ziqiang Cui, Tianjin University, China  
Zihan Xia, Tianjin University, China  
Huaxiang Wang, Tianjin University, China

#### **41: On the Use of Wavelet Transform Based Adaptive Filtering for de-Noiseing of Pulse Oximeter Signals**

Venumaheswar Rao B, Kakatiya Institute of Technology & Science, India  
Ashoka Reddy Komalla, Kakatiya Institute of Technology & Science, India

#### **42: Feature Extraction Method for Rolling Bear Fault Signal Based on Time-Delayed Feedback Asymmetric Tristable Stochastic Resonance**

Xiao Su, Tianjin University, China  
Peiming Shi, Yanshan University, China  
Qing Guo, Tianjin University, China  
Xingguo Zhang, Tianjin University, China  
Haixia Yu, Tianjin University, China  
Dachao Li, Tianjin University, China

#### **43: Chaos Game Representation of Audio Signals**

Madison Cohen-McFarlane, Carleton University, Canada  
Kevin Dick, Carleton University, Canada  
James Robert Green, Carleton University, Canada  
Rafik Goubran, Carleton University, Canada

#### **44: Sampling LFM Signal with Stretch Processing Based on Finite Rate of Innovation Method**

Zhiliang Wei, Harbin Institute of Technology, China  
Ning Fu, Harbin Institute of Technology, China  
Yan Wang, School of Astronautics, Harbin Institute of Technology, China  
Siyi Jiang, Harbin Institute of Technology, China  
Liyang Qiao, Harbin Institute of Technology, China

#### **45: Joint Carrier and 2D-DOA Estimation for L-Shaped Array Based on Sub-Nyquist Sampling**

Siyi Jiang, Harbin Institute of Technology, China  
Ning Fu, Harbin Institute of Technology, China  
Zhiliang Wei, Harbin Institute of Technology, China  
Liyang Qiao, Harbin Institute of Technology, China  
Xiyuan Peng, Harbin Institute of Technology, China

#### **46: Low Peak Derivative Sum of Sines**

Manouane Caza-Szoka, Universite du Quebec a Trois-Rivieres, Canada  
Daniel Massicotte, Universite du Quebec a Trois-Rivieres, Canada  
Messaoud Ahmed Ouameur, Universite du Quebec a Trois-Rivieres, Canada

#### **47: Recovery of Noisy Compressively Sensed Speech via Regularized Maximum Feasible Subsystem Algorithm**

Fereshteh Fakhra Firouzeh, Carleton University, Canada  
Sreeraman Rajan, Carleton University, Canada  
John W. Chinneck, Carleton University, Canada

## **48: A Deep Convolutional Neural Network Classification of Heart Sound Using Fractional Fourier Transform**

Ebrahim Ali Nehary, Carleton University, Canada  
Zaid Abduh, Cairo University, Egypt  
Sreeraman Rajan, Carleton University, Canada

### **Industry Session #1: Instrumentation and Measurement in Advanced Manufacturing: An Industry Perspective**

5/19/2021 2:30:00 PM - 4:00:00 PM GMT+1  
*Session Chair(s): Peter Loftus, Evalu8ion Ltd*  
*Matthew Maynard, University of Strathclyde*

### **Paul Wilcox - Instrumentation and Measurement in Advanced Manufacturing : An Industry Perspective**

Paul Wilcox, University of Bristol

### **Steven Stahley - Instrumentation and Measurement in Advanced Manufacturing : An Industry Perspective**

Steven Stahley, Cummins Inc

### **Chris Jones - Instrumentation and Measurement in Advanced Manufacturing : An Industry Perspective**

Chris Jones, Micro-Epsilon Ltd

### **Panel Discussion - Instrumentation and Measurement in Advanced Manufacturing : An Industry Perspective**

Peter Loftus, Panel Chair, Evalu8ion Ltd  
Paul Wilcox, University of Bristol  
Steven Stahley, Cummins Inc  
Chris Jones, Micro-Epsilon Ltd

### **Data Acquisition Systems 1**

5/19/2021 4:00:00 PM - 5:30:00 PM GMT+1  
*Session Chair(s): Pasquale Daponte, University of Sannio*  
*Florian Strakosch, HTWK Leipzig*

### **Compressive Sampling on RFSoc for Distributed Wideband RF Spectrum Measurements**

Luca De Vito, University of Sannio, Italy  
Francesco Picariello, University of Sannio, Italy  
Sergio Rapuano, University of Sannio, Italy  
Ioan Tudosa, University of Sannio, Italy

### **Improve the Sensing Matrix Model for Random Demodulation in the Case of Mixer with Non-Ideal Characteristics**

Xiaodong Li, Harbin Institute of Technology, China  
Ning Fu, Harbin Institute of Technology, China  
Liyang Qiao, Harbin Institute of Technology, China

## **On Multi-Label Classification for Non-Intrusive Load Identification Using Low Sampling Frequency Datasets**

Mohamed Aymane Ahajjam, TICLab, International University of Rabat, Morocco  
Chaimaa Essayeh, TICLab, International University of Rabat, Morocco  
Mounir Ghogho, TICLab, International University of Rabat, Morocco  
Abdellatif Kobbane, ENSIAS, Mohammed V University in Rabat, Morocco

## **Performance Measurement of Piezoelectric Energy Harvester with Permanent Magnet Assembly for Wearable Devices**

Mohamad Safiddin Mohd Tahir, International Islamic University Malaysia, Malaysia  
Noor Hazrin Hany Mohamad Hanif, International Islamic University Malaysia, Malaysia  
Muhammad Hafizuddin Che Kassim, Eng Engineering Sdn Bhd, Malaysia

## **Analysis and Evaluation of Vibration Sensors for Predictive Maintenance of Large Gears with an Appropriate Test Bench**

Florian Strakosch, Leipzig University of Applied Sciences, Germany  
Holger Nikoleizig, Leipzig University of Applied Sciences, Germany  
Faouzi Derbel, Leipzig University of Applied Sciences, Germany

## **Emerging Wireless Communications for IoT/CPS Systems (TC-37)**

5/19/2021 4:00:00 PM - 5:30:00 PM GMT+1

*Session Chair(s): Gianfranco Miele, University of Cassino and Southern Lazio  
Federico Tramarin, University of Modena and Reggio Emilia*

## **[INVITED] Experimental Characterization of an IoV Framework Leveraging Mobile Wireless Technologies**

Paolo Ferrari, University of Brescia, Italy  
Emiliano Sisinni, University of Brescia, Italy  
Paolo Bellagente, University of Brescia, Italy  
Alessandro Depari, University of Brescia, Italy  
Alessandra Flammini, University of Brescia, Italy  
Marco Paset, University of Brescia, Italy

## **Data Transmission from ATEX Boxes by Means of LoRa Technology for Industrial Internet of Things (IIoT) Applications**

Gabriele Di Renzone, University of Siena, Italy  
Ada Fort, University of Siena, Italy  
Marco Mugnaini, University of Siena, Italy  
Alessandro Pozzebon, University of Siena, Italy  
Valerio Vignoli, University of Siena, Italy

## **Analysis and Initial Design of Bidirectional Acoustic Tag Modulation Schemes and Communication Protocol**

Daniel Corregidor Luna, Universidad Politécnica de Madrid, Spain  
Iván Masmitja, Universitat Politècnica de Catalunya, Spain  
Juan Manuel López Navarro, Universidad Politécnica de Madrid, Spain  
Spartacus Gomariz, Universidad Politécnica de Madrid, SARTI, Spain

## **SNR-Based Reinforcement Learning Rate Adaptation for Time Critical Wi-Fi Networks: Assessment Through a Calibrated Simulator**

Giovanni Peserico, University of Padova, Autec s.r.l., Italy  
Tommaso Fedullo, University of Padova, Italy  
Alberto Morato, University of Padova, CMZ Sistemi Elettronici s.r.l., Italy  
Federico Tamarin, University of Modena and Reggio Emilia, Italy  
Luigi Rovati, University of Modena and Reggio Emilia, Italy  
Stefano Vitturi, National Research Council of Italy, IEIIT, Italy

## **Repeatability Analysis of Decoder-Based EMF Exposure Measurements in LTE Cellular Systems**

Giovanni Betta, University of Cassino and Southern Lazio, Italy  
Domenico Capriglione, University of Cassino and Southern Lazio, Italy  
Gianfranco Miele, University of Cassino and Southern Lazio, Italy  
Marco Donald Migliore, University of Cassino and Southern Lazio, Italy

### **Image Processing 2**

5/19/2021 4:00:00 PM - 6:00:00 PM GMT+1

*Session Chair(s): Marco Carratù, Università degli Studi di Salerno  
Leila Es Sebar, Politecnico di Torino*

## **[INVITED] Hyperspectral Imaging for Material Characterization**

Silvia Serranti, SAPIENZA - UNIVERSITA' DI ROMA, Italy

## **Wavelet Multi-Resolution Analysis of Liquid Film Thickness in Vertical Upward Annular Flow**

Ting Xue, Tianjin University, China  
Mengrui An, Tianjin University, China  
Jingyu Zhao, Tianjin University, China

## **Effect of Image Acquisition and Processing Parameters on the Estimation of Crowd-Induced Dynamic Loading on Stadium Grandstands**

Simone Turrise, Politecnico di Milano, Italy  
Emanuele Zappa, Politecnico di Milano, Italy  
Alfredo Cigada, Politecnico di Milano, Italy  
Miguel Ruiz Vivanco, Politecnico di Milano, Italy  
Nerea Carrera Avin, Politecnico di Milano, Italy

## **Computational Imaging for Drill Bit Wear Estimation**

Salvatore Dello Iacono, Università degli Studi di Salerno, Italy  
Giuseppe Di Leo, Università degli Studi di Salerno, Italy  
Consolatina Liguori, Università degli Studi di Salerno, Italy

## **Characterization of 3D Image-Based Biometric Systems in Dynamic Acquisition Conditions**

Giovanni Betta, University of Cassino and Southern Lazio, Italy  
Marzia Salone D'Amata, University of Cassino and Southern Lazio, Italy  
Consolatina Liguori, Università degli Studi di Salerno, Italy  
Emanuele Zappa, Politecnico di Milano, Italy

## **A Low-Cost Automatic Acquisition System for Photogrammetry**

Leila Es Sebar, Politecnico di Torino, Italy  
Sabrina Grassini, Politecnico di Torino, Italy  
Marco Parvis, Politecnico di Torino, Italy  
Luca Lombardo, Politecnico di Torino, Italy

## **Quality, Reliability & Safety 2 (TC-32)**

5/19/2021 4:00:00 PM - 5:30:00 PM GMT+1

*Session Chair(s): Lorenzo Ciani, DINFO - University of Florence*

*Giulio D'Emilia, University of L'Aquila*

## **How Simplifying a Condition Monitoring Procedure Affects its Performances**

Antonella Gaspari, Politecnico di Bari, Italy  
Emanuela Natale, University of L'Aquila, Italy  
Giulio D'Emilia, University of L'Aquila, Italy

## **Study on Performance Improvements of a Flow Excitation System**

Pengda Ren, Nanjing University of Aeronautics and Astronautics, China  
Bin Wang, Nanjing University of Aeronautics and Astronautics, China  
Youkun Zhu, Nanjing University of Aeronautics and Astronautics, China

## **Cascade Based Methods in Detecting Rotating Faults Using Vibration Measurements**

Moise Avoci Ugwiri, Università degli Studi di Salerno, Italy  
Marco Carratù, Università degli Studi di Salerno, Italy  
Aime Lay-Ekuakille, University of Salento, Italy  
Vincenzo Paciello, Università degli Studi di Salerno, Italy  
Antonio Pietrosanto, Università degli Studi di Salerno, Italy

## **Femtocoulomb Range Triboelectric Noise Meter for Super-Low Noise Cables**

Karl-Olov Wallin, Habia Cable AB, Sweden  
Richard L. Andersson, Habia Cable AB, Sweden  
Per Ångskog, University of Gävle, Sweden  
Jose Chilo, University of Gävle, Sweden

## **Precision Chemical Compounds Analysis in Chemical Tank Reactors Using Conductivity Analysis and Model Predictive Control**

Nawshin Rafiq, International Islamic University Malaysia, Malaysia  
Teddy Surya Gunawan, International Islamic University Malaysia, Malaysia  
Robiah Ahmad, Universiti Teknologi Malaysia, Malaysia  
Azhar Rahman, Meditech Gloves Sdn Bhd, Malaysia  
Mira Ka, Universiti Teknologi Malaysia, Malaysia

## **Smart Measurement Systems for Emergencies & Robotics**

5/19/2021 4:00:00 PM - 5:30:00 PM GMT+1

*Session Chair(s): Brusamarello Valner, Universidade Federal do Rio Grande do Sul  
Alberto Ferrari, University of Modena & Reggio Emilia*

### **[INVITED] Experience of a Network of 7 Italian Laboratories in Testing Surgical Face Masks during the First Wave of COVID-19 Pandemic**

Nicola Paone, Università Politecnica delle Marche, Italy

### **Novel Wearable Thermal-Color Dual Modal Imaging System for COVID-19 Temperature Screening**

Mazyar Askari, University of Iowa, United States

Yang Liu, University of Iowa, United States

### **A Simple Multiparametric Analysis to Guide, Compare and Optimize the Design of "Lensless" LED Illuminators**

Stefano Cattini, University of Modena and Reggio Emilia, Italy

Fabrizio Pancaldi, University of Modena and Reggio Emilia, Italy

Alessandro Bertacchini, University of Modena and Reggio Emilia, Italy

Andrea Parmeggiani, REI Foundation — REI Lab srl, Italy

### **An Uncertainty-Driven Analysis for Delayed Mapping SLAM**

Davide Dorigoni, University of Trento, Italy

Daniele Fontanelli, University of Trento, Italy

### **Ruling Uncertainties in Range-Only Robot Localisation**

Farhad Shamsfakhr, University of Trento, Italy

Luigi Palopoli, University of Trento, Italy

David Macii, University of Trento, Italy

Daniele Fontanelli, University of Trento, Italy

## Technical Program: May 20<sup>th</sup>

### **J. Barry Oakes Presentation: Judy Amanor-Boadu**

5/20/2021 9:00:00 AM - 10:00:00 AM GMT+1

*Session Chair(s): Sergio Rapuano, University of Sannio, Italy*

*Ruqiang Yan, Xi'an Jiaotong University, China*

### **Advanced Measurement & Data Analytics for Industrial Equipment Health Monitoring (TC-3 & TC-7)**

5/20/2021 10:00:00 AM - 11:30:00 AM GMT+1

*Session Chair(s): Weihua Li, South China University of Technology, China*

*Shibin Wang, Xi'an Jiaotong University, China*

### **[INVITED] Advanced Measurement & Data Analytics for Industrial Equipment Health Monitoring**

Ruqiang Yan, Xi'an Jiaotong University, China

### **Cost-Sensitive Fault Identification in Predictive Maintenance Applications: A Case Study**

Roberto Bodo, Università degli Studi di Padova, Italy

Matteo Bertocco, Università degli Studi di Padova, Italy

Alberto Bianchi, Carel Industries SPA, Italy

### **Machine Anomaly Detection Under Changing Working Condition with Syncretic Self-Regression Auto-Encoder**

Jingyao Wu, Xi'an Jiaotong University, China

Zhibin Zhao, Xi'an Jiaotong University, China

Hongbing Shang, Xi'an Jiaotong University, China

Chuang Sun, Xi'an Jiaotong University, China

Ruqiang Yan, Xi'an Jiaotong University, China

Xuefeng Chen, Xi'an Jiaotong University, China

### **A Global-Local Dynamic Adversarial Network for Intelligent Fault Diagnosis of Spindle Bearing**

Jipu Li, South China University of Technology, China

Ruyi Huang, South China University of Technology, China

Jingyan Xia, South China University of Technology, China

Zhuyun Chen, South China University of Technology, China

Weihua Li, South China University of Technology, China

**Development of a Cryogenic System for the Characterization of Advanced CMOS Technologies Down to 350 mK**

Ismael Martinez, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Omar López-L, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Daniel Ferrusca, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Miguel Velázquez, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Edmundo Antonio Gutierrez-D, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Daniel Durini, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Francisco Javier De La Hidalga-W, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

**An FPGA-Based Low Latency AWG for Superconducting Quantum Computers**

Yuchen Yang, University of Science and Technology of China, China

Zhongtao Shen, University of Science and Technology of China, China

Xing Zhu, Alibaba Quantum Laboratory, China

Chunqing Deng, Alibaba Quantum Laboratory, China

Shubing Liu, University of Science and Technology of China, China

Qi An, University of Science and Technology of China, China

**Dynamic Measurement of Thickness Distribution in a Soap Film by Using a Phase-Modulated Large Lateral Shearing Interferometer**

Xiaoyang Tang, Beihang University, China

Zhang Cao, Beihang University, China

Zhonghong Wang, Beihang University, China

Heng Xie, Beihang University, China

Lijun Xu, Beihang University, China

**A Fast Feature Point Extraction Method for Optical Tracking System**

Songlin Bi, University of Science and Technology of China, China

Yonggang Gu, University of Science and Technology of China, China

Zhihong Zhang, Stomatological Center, First Affiliated Hospital University of Science and Technology of China, China

Jiaqi Zou, University of Science and Technology of China, China

Chao Zhai, University of Science and Technology of China, China

Ming Gong, University of Science and Technology of China, China

**Fast Transient Harmonic Selective Extraction Based on Modulation-CDSC-SDFT**

Jingwen Zhang, Huazhong University of Science and Technology, China

Zhenglei Wang, Huazhong University of Science and Technology, China

Xiaotao Han, Huazhong University of Science and Technology, China



## **Automotive, Transportation Industry, Aerospace & Space Systems**

5/20/2021 10:00:00 AM - 11:30:00 AM GMT+1

*Session Chair(s): Yang Liu, University of Iowa*

*Melanie Ooi, University of Waikato, Hamilton, New Zealand*

### **A Calibration Method for Vehicular Dual-Channel Radar Doppler Velocimeter with Janus Configuration**

Lei Du, National Institute of Metrology of China, China

Qiao Sun, National Institute of Metrology of China, China

Jie Bai, National Institute of Metrology of China, China

Xiaolei Wang, National Institute of Metrology of China, China

Tianqi Xu, National Institute of Metrology of China, China

### **Machine Learning Models for Drowsiness Detection**

Harshit Meda, Indian Institute of Technology Ropar, India

Janapareddy Mohan Padmanabha Ganesh, Indian Institute of Technology Ropar, India

Ashish Kumar Sahani, Indian Institute of Technology Ropar, India

### **Development of Automated Test System for Multibeam Communication Payloads**

Jatin Trivedi, Space Applications Centre, ISRO, India

Amit Nihalchandani, Space Applications Centre, ISRO, India

Devanand Panjwani, Space Applications Centre, ISRO, India

Rakesh Vyas, Space Applications Centre, ISRO, India

### **Regional Navigation Reconstruction Strategy and Performance Simulation Based on Micro-Nano Satellites**

Yang Liu, Innovation Academy for Microsatellites at the Chinese Academy of Sciences, China

Longfei Tian, Innovation Academy for Microsatellites at the Chinese Academy of Sciences, China

Guohua Liu, Innovation Academy for Microsatellites at the Chinese Academy of Sciences, China

### **A Neutron Generator Testing Platform for the Radiation Analysis of SRAM-Based FPGAs**

Ludovia Bozzoli, Politecnico di Torino, Italy

Corrado De Sio, Politecnico di Torino, Italy

Boyang Du, Politecnico di Torino, Italy

Luca Sterpone, Politecnico di Torino, Italy

## **Measurement in Medical, Biomedical & Healthcare Systems 1**

5/20/2021 10:00:00 AM - 11:30:00 AM GMT+1

*Session Chair(s): Octavian Postolache, Instituto Universitário de Lisboa*

### **FPGA Implementation of Linear Combination for Single Pixel Image Reconstruction**

Freddy Del Angel-Arrieta, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Carlos Morales-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Jose de Jesus Rangel-Magdaleno, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

### **A Preliminary Investigation of the Robustness of a Measuring Instrument for Blood-pCO<sub>2</sub> Measurement During ECC**

Stefano Cattini, University of Modena and Reggio Emilia, Italy  
Luca Accorsi, Science & Technology Park for Medicine, Italy  
Stefano Truzzi, Science & Technology Park for Medicine, Italy  
Alberto Ferrari, University of Modena and Reggio Emilia, Italy  
Luigi Rovati, University of Modena and Reggio Emilia, Italy

### **Planar MIT Sensor Array with Gradiometers for Local Hemorrhage Detection**

Yixuan Chen, Tianjin University, China  
Shu Zhao, Chinese Academy of Medical Sciences, Peking Union Medical, China  
Chao Tan, Tianjin University, China  
Feng Dong, Tianjin University, China

### **Recurrent LSTM Architecture for Appliance Identification in Non-Intrusive Load Monitoring**

Laura de Diego Otón, University of Alcalá, Spain  
David Fuentes-Jimenez, University of Alcalá, Spain  
Álvaro Hernández, University of Alcalá, Spain  
Rubén Nieto, University of Alcalá, Spain

### **Measuring Heart Rate with a Heat Flux Sensor**

Antti Immonen, LUT University, Finland  
Saku Levikari, LUT University, Finland  
Heikki Peltonen, University of Jyväskylä, Finland  
Mika Silvennoinen, University of Jyväskylä, Finland  
Heikki Kyröläinen, University of Jyväskylä, Finland  
Andrey V. Mityakov, LUT University, Finland  
Pertti Silventoinen, LUT University, Finland  
Mikko Kuisma, LUT University, Finland

### **Physical, Electromagnetic, Biomedical & Chemical Measurements 1**

5/20/2021 10:00:00 AM - 11:30:00 AM GMT+1

*Session Chair(s): Grzegorz Fusiek, University of Strathclyde*

*Reza Ghiri, Texas A and M*

### **[INVITED] Flexible Microfiber Sensors for Health Monitoring**

Fei Xu, Nanjing University, China

### **Progress in Real-Time Capacitance Tomography of Multiphase Flows Based on the Maxwell-Wagner-Sillars Effect**

Rafiul Rasel, Ohio State University, United States  
Qussai Marashdeh, Tech4Imaging, United States  
Fernando Teixeira, Ohio State University, United States

## **Measurement Methodology to Characterize Permittivity-Mass Concentration Relations of Aerated Bulk Materials**

Thomas Suppan, Graz University of Technology, Austria  
Markus Neumayer, Graz University of Technology, Austria  
Thomas Bretterkieber, Graz University of Technology, Austria  
Hannes Wegleiter, Graz University of Technology, Austria  
Stefan Puttinger, Johannes Kepler University Linz, Austria

## **Ultra-Wide Band Microwave Chemical Sensing with Time-Domain Measurement Systems**

Reza Ebrahimi Ghiri, Texas A&M University, United States  
Kamran Entesari, Texas A&M University, United States

## **Dual-Band Metamaterial-Inspired Microwave Sensor for Liquid Dielectric Spectroscopy**

Mahdieh Gholami Mayani, Comillas Pontifical University, Spain  
Francisco Javier Herraiz-Martínez, Comillas Pontifical University, Spain  
Javier Matanza Domingo, Comillas Pontifical University, Spain  
Romano Giannetti, Comillas Pontifical University, Spain

### **Plenary Presentation (Erling Riis)**

5/20/2021 11:30:00 AM - 12:30:00 PM GMT+1

*Session Chair(s): Matthew Maynard, University of Strathclyde, Glasgow, Scotland  
Gordon Flockhart, University of Strathclyde, Glasgow, Scotland*

## **Atomic-Based Quantum Sensors – the Journey Out of The Lab**

Erling Riis, University of Strathclyde

### **Industry Session #2: Quantum Enabled Instrumentation and Measurement: An Industry Perspective**

5/20/2021 1:00:00 PM - 2:30:00 PM GMT+1

*Session Chair(s): Michael Lengden, University of Strathclyde  
James Bain, M Squared Lasers Ltd*

### **Graeme Malcolm - Quantum Enabled Instrumentation and Measurement: An Industry Perspective**

Graeme Malcolm, M Squared Lasers Ltd

### **David Vettese - Quantum Enabled Instrumentation and Measurement: An Industry Perspective**

David Vettese, Alpine Quantum Technology

### **Tim Ballance - Quantum Enabled Instrumentation and Measurement: An Industry Perspective**

Tim Ballance, ColdQuanta

### **Panel Discussion - Quantum Enabled Instrumentation and Measurement: An Industry Perspective**

Miles Padgett, Panel Chair, University of Glasgow  
Graeme Malcolm, M Squared Lasers Ltd  
David Vettese, Alpine Quantum Technology  
Tim Ballance, ColdQuanta

## **Circuits & Embedded Systems 1**

5/20/2021 2:00:00 PM - 3:30:00 PM GMT+1

*Session Chair(s): Zheng Liu, University of British Columbia*

*Teddy Surya Gunawan, Universiti Teknologi Malaysia*

### **Experimental Study on the Power Consumption of Timers Embedded Into Microcontrollers**

Ferran Reverter, Universitat Politècnica de Catalunya, Spain

Manel Gasulla, Universitat Politècnica de Catalunya, Spain

### **An Automated V-I Acquisition System for Microbolometer Array with FPGA-Based Drive**

Julio Hernandez, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Jose de Jesus Rangel-Magdaleno, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

Ricardo Jimenez, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico

### **Self-Timed Ring Oscillator Based Time-to-Digital Converter: A 0.35 $\mu$ m CMOS Proof-of-Concept Prototype**

Assia El-Hadbi, Institut National des Postes et Télécommunications, Morocco

Oussama Elissati, Institut National des Postes et Télécommunications, Morocco

Laurent Fesquet, Université Grenoble Alpes, France

### **Simple and Robust Microcontroller-Based Acquisition System for Differential Capacitive Sensors**

Alessandro Depari, University of Brescia, Italy

Emiliano Sisinni, University of Brescia, Italy

Paolo Bellagente, University of Brescia, Italy

Paolo Ferrari, University of Brescia, Italy

Alessandra Flammini, University of Brescia, Italy

Stefano Rinaldi, University of Brescia, Italy

### **Wireless Sensor Nodes for Early Detection of Food Degradation in Restaurants and Commercial Kitchens**

Jorge Enrique Quiroz Oviedo, Universidad Nacional de San Agustín, Peru

Tobias Alanko, University of Gävle, Sweden

Jorge Javier Mendoza Montoya, Andina Néstor Cáceres Velásquez University Juliaca, Peru

Mauricio Postigo-Malaga, Universidad Nacional de San Agustín, Peru

## **Environmental Monitoring & Agriculture, Food Production & Food Safety**

5/20/2021 2:00:00 PM - 3:30:00 PM GMT+1

*Session Chair(s): Yong Yan, University of Kent*

*Sabrina Grassini, Politecnico di Torino*

### **Robot-Assisted Measurement of Heavy Metals in Indoor Dust Using ICP-MS**

Heidi Fleischer, University of Rostock, Germany

Janne Widmer, Innerstädtisches Gymnasium Rostock, Germany

Sascha Statkevych, Innerstädtisches Gymnasium Rostock, Germany

Regina Stoll, University of Rostock, Germany

Thomas Roddelkopf, University of Rostock, Germany

### **A Novel Technique for Earthquakes Magnitude Estimation**

Marco Carratù, Università degli Studi di Salerno, Italy  
Antonio Espírito-Santo, University of Beira Interior, Portugal  
Gustavo Monte, Universidad Tecnológica Nacional, Argentina  
Vincenzo Paciello, Università degli Studi di Salerno, Italy

### **Area Yield Performance Evaluation of a Nonchemical Weeding Robot in Organic Farming**

Leif Ole Harders, West Coast University of Applied Sciences, Germany  
Vitali Czymbek, West Coast University of Applied Sciences, Germany  
Florian Johannes Knoll, naiture GmbH & Co. KG, Germany  
Stephan Hußmann, West Coast University of Applied Sciences, Germany

### **Deep Learning for Improving the Storage Process: Accurate and Automatic Segmentation of Spoiled Areas on Apples**

Nikita Stasenkov, Skolkovo Institute of Science and Technology, Russia  
Elizaveta Chernova, Skolkovo Institute of Science and Technology, Russia  
Dmitrii Shadrin, Skolkovo Institute of Science and Technology, Russia  
George Ovchinnikov, Skolkovo Institute of Science and Technology, Russia

### **Regression Applied to Measure Normalized Difference Vegetation Index in Soybean Images with Visible Color Spaces Collected by Smartphones**

Murilo Caminotto Barbosa, Londrina State University, Brazil  
Ana Carolina Sottana de Padua, Londrina State University, Brazil  
Deryk Sedlak Ribeiro, Londrina State University, Brazil  
Alan Salvany Felinto, Londrina State University, Brazil  
Lucas Henrique, Londrina State University, Brazil  
Marcelo Giovanetti, Londrina State University, Brazil

### **Measurement in Medical, Biomedical & Healthcare Systems 2**

5/20/2021 2:00:00 PM - 3:30:00 PM GMT+1

*Session Chair(s): Octavian Postolache, Instituto Universitário de Lisboa*

### **Heart Rate Variability Analysis with Wearable Devices: Influence of Artifact Correction Method on Classification Accuracy for Emotion Recognition**

Gloria Cosoli, Università Politecnica delle Marche, Italy  
Angelica Poli, Università Politecnica delle Marche, Italy  
Lorenzo Scalise, Università Politecnica delle Marche, Italy  
Susanna Spinsante, Università Politecnica delle Marche, Italy

### **A Flexible and Low-Cost Solution to Measure and Stimulate NNS Skills of Premature Babies**

José Miguel Costa Pereira, ESTSetúbal/IPS, Portugal  
Vítor Manuel Viegas, CINAV-Escola Naval, Base Naval de Lisboa, Portugal  
Octavian Adrian Postolache, ISCTE – Instituto Universitário de Lisboa, Portugal  
Pedro Manuel Girão, Instituto Superior Técnico, Universidade de Lisboa, Portugal

### **A Wavelet-Based Methodology for Features Extraction in Postural Instability Analysis**

Bruno Ando, Università di Catania, Italy  
Salvatore Baglio, Università di Catania, Italy  
Salvatore Castorina, Università di Catania, Italy  
Ruben Crispino, Università di Catania, Italy  
Vincenzo Marletta, Università di Catania, Italy  
Giovanni Mostile, Università di Catania, Italy  
Mario Zappia, Università di Catania, Italy

### **Brain-Computer Interfaces for Daily-Life Applications: A Five-Year Experience Report**

Leopoldo Angrisani, Università degli Studi di Napoli Federico II, Italy  
Pasquale Arpaia, Università degli Studi di Napoli Federico II, Italy  
Egidio De Benedetto, Università degli Studi di Napoli Federico II, Italy  
Antonio Esposito, Politecnico di Torino, Italy  
Nicola Moccaldi, Università degli Studi di Napoli Federico II, Italy  
Marco Parvis, Politecnico di Torino, Italy

### **Multiple Weighted Frequency-Difference Method for Electrical Impedance Tomography**

Qingwei Hu, Tianjin University, China  
Yanbin Xu, Tianjin University, China  
Ziqi Liu, Tianjin University, China  
Changbin Li, Tianjin University, China  
Feng Dong, Tianjin University, China

### **Measurement Theory & Metrology 1**

5/20/2021 2:00:00 PM - 3:30:00 PM GMT+1

*Session Chair(s): Sabrina Grassini, Politecnico di Torino*

*Dimitar Ninevski, University of Leoben*

### **Estimating Parameters of a Sine Wave by the Method of Variable Projection**

Paul O'Leary, University of Leoben, Austria  
Dimitar Ninevski, University of Leoben, Austria

### **Effects of Inaccurate Electrode Positioning in Subsurface Resistivity Measurements for Archeological Purposes**

Marcantonio Catelani, University of Florence, Italy  
Lorenzo Ciani, University of Florence, Italy  
Giulia Guidi, University of Florence, Italy  
Gabriele Patrizi, University of Florence, Italy  
Nicola Casagli, University of Firenze, Italy  
Mattia Ceccatelli, University of Firenze, Italy  
Veronica Pazzi, University of Firenze, Italy  
Luca Cappuccini, University of Firenze, Italy

### **A Novel Measurement Technique for DC Voltage and Current Reducing the DMM Loading Effects**

Emilio Torres, Universitat Politècnica de Catalunya, Spain  
Carlos Monzo, Universitat Oberta de Catalunya, Spain  
Ferran Reverter, Universitat Politècnica de Catalunya, Spain

### **Frequency and the PMU Standard**

Artis Riepnieks, Pacific Northwest National Laboratory, United States  
Dani Strickland, Loughborough University, United Kingdom  
Rod White, Semi-retired metrologist, New Zealand  
Harold Kirkham, Pacific Northwest National Laboratory, United States

### **Comparison of Ultrasonic Attenuation Model in Mid-Wavelength Region for Droplet Measurement**

Dandan Zheng, Tianjin University, China  
Wenqin Wang, Tianjin University, China  
Mi Wang, Tianjin University, China  
Jun Dong, Tianjin University, China

### **Ophthalmic Instrumentation & Measurement**

5/20/2021 2:00:00 PM - 3:30:00 PM GMT+1

*Session Chair(s): Luigi Rovati, University of Modena and Reggio Emilia  
Mario Giardini, University of Strathclyde*

### **[INVITED] Automated Algorithmic Assessment of Retinal Images: Experiences from Real-World Applications**

Sam Philip, JJR MacLeod Centre for Diabetes and Endocrinology, United Kingdom

### **An Imaging-Based Autorefractor**

Matteo Menolotto, Tyndall National Institute, Ireland  
Iain Livingstone, NHS Forth Valley, United Kingdom  
Mario Ettore Giardini, University of Strathclyde, United Kingdom

### **Fast 3-Dimensional Estimation of the Foveal Avascular Zone from Octa**

Giovanni Ometto, City, University of London, United Kingdom  
Giovanni Montesano, City, University of London, United Kingdom  
Usha Chakravarthy, Queen's University Belfast, United Kingdom  
Frank Kee, Queen's University Belfast, United Kingdom  
Ruth Hogg, Queen's University Belfast, United Kingdom  
David Crabb, City, University of London, United Kingdom

### **A Machine Learning Approach for a Vision-Based Van-Herick Measurement System**

Tommaso Fedullo, University of Padova, Italy  
Davide Cassanelli, University of Modena and Reggio Emilia, Italy  
Giovanni Gibertoni, University of Modena and Reggio Emilia, Italy  
Federico Tamarin, University of Modena and Reggio Emilia, Italy  
Luciano Quaranta, University of Pavia / IRCCS Fondazione Policlinico San Matteo, Italy  
Giovanni De Angelis, IRCCS Fondazione Policlinico San Matteo, Italy  
Luigi Rovati, University of Modena and Reggio Emilia, Italy

### **Stereo Vision Based Optic Nerve Head 3D Reconstruction Using a Slit Lamp Fitted with Cameras: Performance Trial with an Eye Phantom**

Ian Coghill, University of Strathclyde, United Kingdom  
Mario Ettore Giardini, University of Strathclyde, United Kingdom

**1: Design of on Board X-Band Data Transmission System of SVOM Mission**

Yuanyuan Dai, Innovation Academy for Microsatellites at the Chinese Academy of Sciences, China  
Yang Liu, Innovation Academy for Microsatellites at the Chinese Academy of Sciences, China  
Shunjing Yu, Shanghai Engineering Center for Microsatellites, China

**2: Generalized Minimax-Concave Regularization for Aero-Engine Fan Acoustic Mode Measurements**

Zepeng Li, Xi'an Jiaotong University, China  
Baijie Qiao, Xi'an Jiaotong University, China  
Bi Wen, AECC Sichuan Gas Turbine Establishment, China  
Xuefeng Chen, Xi'an Jiaotong University, China

**3: An Improved Error Correction Algorithm for SINS Based on Star Sensor**

Yanze Zhu, Northwestern Polytechnical University, China  
Rong Ma, Northwestern Polytechnical University, China  
Yihong Quan, XianYang Natural GAS Corporation, China  
Di Pan, State Grid Beijing Electric Power Construction, China

**4: A Huber Function Based Restoration Algorithm for Astronomy Image Compression**

Lei Xin, Qian Xuesen Laboratory of Space Technology, China  
Feng Li, Qian Xuesen Laboratory of Space Technology, China  
Xue Yang, Qian Xuesen Laboratory of Space Technology, China  
Shijie Sun, Beihang University, China  
Yu Zhou, DFH Satellite Co., Ltd, China  
Zhijia Liu, DFH Satellite Co., Ltd, China

**5: Lithium-Ion Battery SoC Estimation Based on Unscented Kalman Filter Considering Temperature Effects**

Filippe Tertuliano, Federal University of Paraíba, Brazil  
Euler Macêdo, Federal University of Paraíba, Brazil  
Juan Villanueva, Federal University of Paraíba, Brazil

**6: Miniaturised Bidirectional Acoustic Tag to Enhance Marine Animal Tracking Studies**

Iván Masmitja, Universitat Politècnica de Catalunya, Spain  
Daniel Corregidor Luna, Universidad Politécnica de Madrid, Spain  
Juan Manuel López Navarro, Universidad Politécnica de Madrid, Spain  
Enoc Martínez, Universidad Politécnica de Madrid, Spain  
Joan Navarro, Institut de Ciències del Mar, CSIC, Spain  
Spartacus Gomariz, Universidad Politécnica de Madrid, SARTI, Spain



### **7: Exploiting Augmented Reality and Internet of Things for Gamma Ray Experiments in Educational Field**

Rosario Schiano Lo Moriello, Università degli Studi di Napoli Federico II, Italy  
Enzo Caputo, Università degli Studi di Napoli Federico II, Italy  
Francesco de Pandi, Università degli Studi di Napoli Federico II, Italy  
Annalisa Liccardo, Università degli Studi di Napoli Federico II, Italy

### **8: LoRaWAN Transmission System Capability Assessment in Industrial Environment Under Temperature and Humidity Characterization**

Gabriele Di Renzone, University of Siena, Italy  
Ada Fort, University of Siena, Italy  
Marco Mugnaini, University of Siena, Italy  
Giacomo Peruzzi, University of Siena, Italy  
Alessandro Pozzebon, University of Siena, Italy  
Valerio Vignoli, University of Siena, Italy

### **9: DNN-Based RFID Antenna Tags Localization**

Sohel Patel, Missouri University of Science and Technology, United States  
Maciej Zawodniok, Missouri University of Science and Technology, United States

### **10: Microstrip Patch Antenna Bioinspired in Primrose Flower for WLAN and Bluetooth Applications**

Dailan Bernardes, Universidade Estadual do Maranhão, Brazil  
Ewaldo Santana, Universidade Estadual do Maranhão, Brazil  
Paulo Fernandes de Silva Júnior, Universidade Estadual do Maranhão, Brazil  
Maciel A. Oliveira, Universidade Estadual do Maranhão, Brazil

### **11: Design and Implementation of IoT Platform for Electrical Resistance Tomography System**

Qian Zhang, Tianjin University, China  
Ziqiang Cui, Tianjin University, China  
Long Yan, Tianjin University, China  
Zihan Xia, Tianjin University, China  
Huaxiang Wang, Tianjin University, China

### **12: Development of Smart Surveillance System Using Cloud for Security Application**

Abdul Wahab Usman Ullah, Universiti Kuala Lumpur British Malaysian Institute, Malaysia  
Jawad Ali Shah, Universiti Kuala Lumpur British Malaysian Institute, Malaysia  
Kushsairy Kadir, Universiti Kuala Lumpur British Malaysian Institute, Malaysia  
Abdul Wahid, International Islamic University, Islamabad, Pakistan

### **13: Pilot Analysis on Soil Moisture Impact on Underground to Aboveground LoRaWAN Transmissions for IoUT Contexts**

Stefano Parrino, University of Siena, Italy  
Giacomo Peruzzi, University of Siena, Italy  
Alessandro Pozzebon, University of Siena, Italy

**14: A UWB–Based Localization System: Analysis of the Effect of Anchor Positions and Robustness Enhancement in Indoor Environments**

Luigi Ferrigno, University of Cassino and Southern Lazio, Italy  
Gianfranco Miele, University of Cassino and Southern Lazio, Italy  
Filippo Milano, University of Cassino and Southern Lazio, Italy  
Valentina Pingerna, University of Cassino and Southern Lazio, Italy

**15: Long Range (LoRa) Transmission Through Ice: Preliminary Results**

Irene Cappelli, University of Siena, Italy  
Gabriele Di Renzone, University of Siena, Italy  
Ada Fort, University of Siena, Italy  
Marco Mugnaini, University of Siena, Italy  
Alessandro Pozzebon, University of Siena, Italy  
Valerio Vignoli, University of Siena, Italy

**16: Comparison of RTV Coating Thickness Identified by Different Frequency Domain Thermal Characteristics**

Chenglong Cong, Tsinghua Shenzhen International Graduate School, China  
Hongwei Mei, Tsinghua Shenzhen International Graduate School, China  
Hui Niu, Inner Mongolia Extra High Voltage Power Supply Bureau Inner Mongolia Electric Power (Group) Co.,Ltd., China

**17: Implementation of a PLC Field Analyzer on a G3 Modem Platform**

Giovanni Artale, University of Palermo, Italy  
Giuseppe Caravello, University of Palermo, Italy  
Antonio Cataliotti, University of Palermo, Italy  
Valentina Cosentino, University of Palermo, Italy  
Dario Di Cara, National Research Council of Italy, Italy

**18: Thermography of Photovoltaic Panels and Defect Detection Under Outdoor Environmental Conditions**

Christian Schuss, University of Oulu, Finland  
Kari Remes, University of Oulu, Finland  
Kimmo Leppänen, Mettler-Toledo GmbH, Switzerland  
Bernd Eichberger, Graz University of Technology, Austria  
Tapio Fabritius, University of Oulu, Finland

**19: An Advanced PV Simulation Model for Electric Vehicles with Photovoltaic Installations**

Christian Schuss, University of Oulu, Finland  
Bernd Eichberger, Graz University of Technology, Austria  
Tapio Fabritius, University of Oulu, Finland

**20: Measurement of Circumferential Liquid Film Thickness in Horizontal Gas-Liquid Annular Flow Using Ultrasound**

Mi Wang, Tianjin University, China  
Dandan Zheng, Tianjin University, China  
Wenqin Wang, Tianjin University, China

**21: Water Content Measurement by an Orthogonal Two-Dimensional Electromagnetic Field Based Microwave Sensor**

Hui-Min Ma, Tianjin University, China

Ying Xu, Tianjin University, China

Tao Zhang, Tianjin University, China

Yi-Guang Yang, Tianjin University, China

Jing Wang, Tianjin University, China

Xi-Gang Wang, Tianjin Institute of Metrological Supervision and Testing, China

**22: The Influence of Pseudo-Slug Flow on the Measurement Characteristics of Venturi**

Jing Wang, Tianjin University, China

Ying Xu, Tianjin University, China

Hai-Tao Wu, Tianjin University, China

Yi-Guang Yang, Tianjin University, China

Tao Zhang, Tianjin University, China

Xi-Gang Wang, Tianjin Institute of Metrological Supervision and Testing, China

**23: Study on the Measurement Method of Wet Gas Flow Velocity by Ultrasonic Flow Meter**

Dandan Zheng, Tianjin University, China

Mengxu Zhai, Tianjin University, China

Jiayu Hu, Tianjin University, China

**24: Pseudo-Slug Detection of Horizontal Gas-Liquid Flow Using Ultrasonic Transducer**

Lusheng Zhai, Tianjin University, China

Haiyan Xia, Tianjin University, China

Jie Yang, Tianjin University, China

Yinglin Wu, Tianjin University, China

**25: Gas-Liquid Two-Phase Flow Pattern Identification by Differential Pressure and Ultrasonic Echoes**

Bixiao Sun, Tianjin University, China

Chao Tan, Tianjin University, China

Xuwei Shi, Tianjin University, China

Shangjie Ren, Tianjin University, China

Feng Dong, Tianjin University, China

**26: Efficient Selection of Time Domain Features for Leakage Detection in Pipes Carrying Liquid Commodities**

George Othon Glentis, University of Peloponnese, Greece

Kristina Georgoulaki, University of West Attica, Greece

Konstantinos Angelopoulos, University of Peloponnese, Greece

**27: Dealing with Stochastic Signals and Physical Phenomena Impacting Pipeline Leak Localization Accuracy**

Georgios-Panagiotis Kousiopoulos, Aristotle University of Thessaloniki, Greece

Nikolaos Karagiorgos, Aristotle University of Thessaloniki, Greece

Dimitrios Kampelopoulos, Aristotle University of Thessaloniki, Greece

Vasileios Konstantakos, Aristotle University of Thessaloniki, Greece

**28: An RMS-Based Approach for Leak Monitoring in Noisy Industrial Pipelines**

Dimitrios Kampelopoulos, Aristotle University of Thessaloniki, Greece

Nikolaos Karagiorgos, Aristotle University of Thessaloniki, Greece

Georgios-Panagiotis Kousiopoulos, Aristotle University of Thessaloniki, Greece

Dimitrios Porlidas, Hellenic Petroleum S.A., Greece

**29: Conceptual Design and Evaluation of an Optical Sensor for Wide-Area High-Voltage Metering and Protection Applications**

Grzegorz Fusiek, University of Strathclyde, United Kingdom

Pawel Niewczas, University of Strathclyde, United Kingdom

**30: Performance Assessment Framework for Electrical Capacitance Tomography Based Mass Concentration Estimation in Pneumatic Conveying Systems**

Thomas Suppan, Graz University of Technology, Austria

Markus Neumayer, Graz University of Technology, Austria

Thomas Bretterklieber, Graz University of Technology, Austria

Hannes Wegleiter, Graz University of Technology, Austria

Stefan Puttinger, Johannes Kepler University Linz, Austria

**31: Quantitative Sound Velocity Reconstruction Based on Ultrasonic Tomography**

Miaobo Wang, Tianjin University, China

Chao Tan, Tianjin University, China

Yong Bao, University of Edinburgh, United Kingdom

Feng Dong, Tianjin University, China

**32: Miniaturized Magnetic Energy Harvester: Lightweight and Safe Transformer Design**

Gabriel Gruber, Graz University of Technology, Austria

Markus Neumayer, Graz University of Technology, Austria

Thomas Bretterklieber, Graz University of Technology, Austria

Alexander Siegl, Graz University of Technology, Austria

Richard Felsberger, Graz University of Technology, Austria

**33: Integer Linear Programming for Optimizing the Position of IEDs in Medium Voltage Smart Grids**

Claudio Sterle, Università degli Studi di Napoli Federico II, Italy

Vincenzo Caragallo, e-distribuzione S.p.A., Italy

Annalisa Liccardo, Università degli Studi di Napoli Federico II, Italy

Adriano Masone, Università degli Studi di Napoli Federico II, Italy

**34: Measurement System for Time Variable Subcycle Impedance on Power Lines**

Christoph Nieß, Hochschule Ruhr West, University of Applied Sciences, Germany

Jan-Philipp Kitzig, Hochschule Ruhr West, University of Applied Sciences, Germany

Gerd Bumiller, Hochschule Ruhr West, University of Applied Sciences, Germany

**35: Multi-State Appliances Identification Through a NILM System Based on Convolutional Neural Network**

Giovanni Bucci, University of L'Aquila, Italy  
Fabrizio Ciancetta, University of L'Aquila, Italy  
Edoardo Fiorucci, University of L'Aquila, Italy  
Simone Mari, University of L'Aquila, Italy  
Andrea Fioravanti, University of L'Aquila, Italy

**36: High-Precision Metrology with High-Resolution Computed Tomography Using 3D X-Ray Microscopes**

Herminso Villarraga-Gómez, Carl Zeiss Industrial Metrology, LLC, United States  
N. Kotwal, Carl Zeiss X-ray Microscopy, Inc., United States  
V. Ninov, Carl Zeiss X-ray Microscopy, Inc., United States  
L. Omlor, Carl Zeiss Industrielle Messtechnik GmbH, Germany

**37: Ai Based RF Amplifier Power Delivery and Measurement Control Method for Transient Load Conditions**

Abdullah Eroglu, North Carolina A&T State University, United States  
Thisara Walpita, North Carolina A&T State University, United States

**38: Converting an Electrochemical Current Into a Fluorescence Signal, a New Strategy for the High Sensitive Detection of Electron Transfer Events**

Rabia Djoumer, LEM UMR 7591 CNRS, Université de Paris, France  
Christophe Demaille, LEM UMR 7591 CNRS, Université de Paris, France  
Arnaud Chovin, LEM UMR 7591 CNRS, Université de Paris, France  
Agnès Anne, LEM UMR 7591 CNRS, Université de Paris, France

**39: Simultaneous Detection of Acceleration and Liquid Adhesion Using Light Intensity-Based Hetero-Core Fiber Optic Sensors**

Miyuki Kadokura, Soka University, Japan  
Kenta Suzuki, Soka University, Japan  
Hiroshi Yamazaki, Soka University, Japan  
Michiko Nishiyama, Soka University, Japan  
Kazuhiro Watanabe, Soka University, Japan

**40: Water Gauge Development Based on Multiple Hetero-Core Fiber Optic Surface Plasmon Resonance Sensors**

Michiko Nishiyama, Soka University, Japan  
Koji Yuhashi, Soka University, Japan  
Shoichi Kubodera, Soka University, Japan  
Kazuhiro Watanabe, Soka University, Japan

**41: Lite Emulator of Grid Operations**

Carlo Guarnieri Calò Carducci, RWTH Aachen University, Germany  
Alberto Dognini, RWTH Aachen University, Germany  
Maliheh Haghgoo, RWTH Aachen University, Germany  
Ferdinanda Ponci, RWTH Aachen University, Germany  
Antonello Monti, RWTH Aachen University, Germany

**42: Conducted Noise Voltage Measurement Using Shoe-Shaped Wearable Devices in a Raised-Floor Office Room**

Naruto Arai, NTT Corporation, Japan  
Toshihisa Masuda, NTT Corporation, Japan  
Masato Maruyama, NTT Corporation, Japan  
Jun Kato, NTT Corporation, Japan  
Ken Okamoto, NTT Corporation, Japan  
Ken Sasaki, University of Tokyo, Japan

**43: Localized Surface Strain Measurement for Load Detection Using Diamond Like Carbon Coating on a Linear Guide**

David Krampert, Bosch Rexroth AG, Germany  
Sebastian Unsleber, Bosch Rexroth AG, Germany  
Leonhard Reindl, Albert-Ludwigs-University Freiburg, Germany

**44: Development of a Design for SiPMs Readout in Cryogenic Environment for Large Area Photon Detectors**

Niccolo' Gallice, Università degli Studi di Milano, Italy  
Andrea Zani, Istituto Nazionale di Fisica Nucleare - Sezione di Milano, Italy  
Paola Sala, INFN - Sezione di Milano, Italy  
Massimo Lazzaroni, Università degli Studi di Milano, Italy  
Mauro Citterio, INFN - Sezione di Milano

**45: Frequency Span Optimization for Asymmetric Resonance Curve Fitting**

Kostiantyn Torokhtii, Università Roma Tre, Italy  
Andrea Alimenti, Università Roma Tre, Italy  
Nicola Pompeo, Università Roma Tre, Italy  
Enrico Silva, Università Roma Tre, Italy

**46: Nanoparticle-Based Fiber Optofluidic Laser for Label-Free Protein Detection**

Xi Yang, University of Electronic Science and Technology of China, China  
Yanqiong Wang, University of Electronic Science and Technology of China, China  
Yiling Liu, University of Electronic Science and Technology of China, China  
Wanjing Zhao, University of Electronic Science and Technology of China

**47: Measurement and Signal Processing Techniques for Extracting Highly Accurate and Wideband RCS**

Rachel Jarvis, University of Oklahoma, United States  
Justin Metcalf, University of Oklahoma, United States  
Jessica Ruyle, University of Oklahoma, United States  
Jay McDaniel, University of Oklahoma, United States

**48: A Novel Single-Element Inductance-to-Digital Converter with Automatic Offset Eliminator**

Narayanan P. P., Indian Institute of Technology Palakkad, India  
Sreenath Vijayakumar, Indian Institute of Technology Palakkad, India

**49: A Switched-Capacitor CVC and CFC for Capacitive Sensors Representable Using  $\pi$ -Model**

Pinku Sebastian, Indian Institute of Technology Palakkad, India  
Narayanan P. P., Indian Institute of Technology Palakkad, India  
Sreenath Vijayakumar, Indian Institute of Technology Palakkad, India

**Closing Ceremony**

5/20/2021 4:30:00 PM - 5:00:00 PM GMT+1

*Session Chair(s): Deepak Uttamchandani, University of Strathclyde, Glasgow, Scotland*

*Matthew Maynard, University of Strathclyde, Glasgow, Scotland*