

# 2MTC 2020

International Instrumentation  
& Measurement Technology Conference

May 25-29, 2020 | Valamar Riviera | Dubrovnik, Croatia



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# 2020 CONFERENCE PROCEEDINGS

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**2020 IEEE International Instrumentation and Measurement  
Technology Conference (I2MTC 2020) Proceedings**

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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), it is our great pleasure to warmly welcome all of you to the I2MTC 2020. The I2MTC is the IMS flagship conference and it is ranked number one in the Instrumentation and Measurement (I&M) area in terms of Google H-5 index.

The I2MTC 2020 has been planned to be held in Dubrovnik, Croatia. Dubrovnik is an old city on the Adriatic Sea coast in the south of the Republic of Croatia. It is one of the most prominent tourist destinations in the Mediterranean Sea. It joined the UNESCO list of World Heritage sites in 1979. For these reasons we thought of Dubrovnik as an ideal venue for the conference. Unfortunately, over the past few months, the world has transformed, as we have gone through a rapidly changing and unsettling time due to the Covid-19 outbreak. As a consequence, the I2MTC 2020 entirely run virtually. All Authors of accepted papers have been invited to upload a presentation of their work in an innovative online platform. The accepted presentations are now available for all attendees. We perfectly understand that this solution may negatively impact the conference outcomes, but safety and well-being of all participants has been our first priority. We sincerely apologize for any inconvenience that this choice may have caused, and we heartfelt thanks and appreciate your understanding.

The I2MTC 2020 theme that we have selected is “Technology advancement through strong foundation and persistent innovation”. Probably, the public awareness about the relevance of technology advancement and innovation has not been so clear as in this situation in which the Covid-19 is deeply challenging all of us. Advanced instrumentation technology and solid measurement fundamentals can surely help in understanding the evolution of disease diffusion as well as in providing tools and techniques to fight it, also thanks to the I&M interdisciplinary nature. These are difficult times and we know that many of you are directly or indirectly engaged in the fight against the Covid-19 outbreak, supporting data analysis and modeling, biomedical research and applications, critical communications and power infrastructure and, above all, caring for each other. We are very proud to be part of this community.

New ideas and approaches in the I&M research area will be explored during the conference through the topics selected for the main tracks, complemented by special sessions, tutorials and invited talks. About 400 delegates from 40 countries are going to attend remotely the event, having fruitful time with prospective colleagues by presenting their latest on-going research achievements, sharing ideas, thoughts and visions with the goal of shaping a better future for the benefit of humanity.

All the accepted and presented papers will be published in the conference proceedings and submitted for publication on IEEE Xplore. Authors of the proceedings papers are also welcome to submit an extended version of their work to the Special Issue dedicated to the I2MTC by the IEEE Transactions on Instrumentation and Measurement.

Many people have worked tirelessly to make the 2020 edition of the IEEE IMS flagship conference a successful event despite the Covid-19 outbreak. Firstly, we owe deep and sincere gratitude to the Technical Program Co-Chairs, Prof. Sergio Rapuano, Dr. Wendy Van Moer, and Prof. Darko Vasić. They have done a stellar job in putting together a very strong technical program and in finding innovative ways for organizing remote paper presentations. Their job was one of the hardest and most challenging. In total, over 590 papers were submitted. Each paper was allocated to reviewers, the received review reports were analyzed, and acceptance decisions were achieved. Then the Authors uploaded their

presentations on the online platform and the final fine-tuned program was wisely shaped: the program main tracks cover both areas of traditional interest for the I&M community and new interesting topics that are attracting the attention of researcher. At the end of the selection process, 400 papers were accepted for presentation and 405 presentations were uploaded on the online platform, including the invited ones.

The Special Sessions Co-Chairs, Prof. David Macij, Dr. Michele Magno, and Prof. Hubert Zangl have coordinated the process of soliciting special session proposals and evaluating them through an effective and rigorous process. The program includes 15 special sessions, which traditionally foster in-depth discussions on specific topics. We are glad to certify that also this year the IMS Technical Committees have played a very active and relevant role in promoting and organizing special sessions.

In addition, the session TIM @ I2MTC20, coordinated by the Editor in Chief of the IEEE Transactions on Instrumentation and Measurement, Prof. Shervin Shirmohammadi, gives to Authors of papers published on the journal during the previous year the opportunity to further disseminate their findings within the I&M community, thus strengthen the connection between the conference and the main IMS publication venue.

We are also very grateful to all the Technical Program Committee members and 372 Reviewers who actively participated to the paper selection process, spending valuable time to assess the papers and submitting their reports in a timely manner.

Thanks also go to the Publications Chair, Prof. Željka Lučev Vasić who helped tuning the conference web site and social networks channels. This conference would not have been possible if the Authors had not submitted papers so we would like to thank all of them for their participation to the conference. Sincere appreciation goes to the invited speakers for sharing their valuable time and insights with us. In addition, we would like to acknowledge the speakers for their valuable work in preparing good presentations and all participants for their contribution to the success of the conference.

We wish to extend our gratitude to the Tutorial Co-Chairs, Prof. Octavia Dobre and Prof. Igor Lacković, who worked very hard to propose a very interesting program including both well established and appreciated topics and new “hot topics”. Thanks to the tutorial speakers who recorded their presentations and make it available to the conference participants.

A special mention and acknowledge is due to the hard work of Prof. Ivana Palunko as a local arrangement chair and to all the members of the local arrangement committee.

We are delighted to have so many patrons, exhibitors and supporters. Their presence testify the interest of industry for the contents of I2MTC contributions, but also the great coordination effort of both the Exhibits co-chairs - Prof. Vana Jeličić and Prof. Hrvoje Džapo – and Industry Liaison Co-chairs Prof. Dubravko Sabolić and Dr. Vladimir Djapić. We really appreciated their dedication since support from patrons and exhibitors is of key importance for a successful conference. Moreover, we would like to express our deep and sincere gratitude to the conference patrons - Rimac, GlobalLogic, AVL, Greyp, MTEH, dSPACE – and the exhibitors: Zurich Instruments and Nextron. We would like to acknowledge also the supporters: Faculty of Electrical Engineering and Computing of University of Zagreb, Dubrovnik Tourist Board and Center of Research Excellence Datacross.

We aimed to organize this year conference by valuing our traditions, and by starting new initiatives. One of them is Demo Session - chaired by Prof. Carlo Trigona, which provides an intriguing opportunity for researchers, from Industry and Academia, to present live demonstrations of results of their R&D activities. The other initiative is I2MTC Open Day, when high school students attend the conference

sessions and present their projects. And the last one, which still can be reached on the conference web site, is Engineering Heritage devoted to creative innovators and engineers who were born or worked in Croatia. We sincerely thank to all individuals and organizations that contributed to those initiatives.

Sincere and special thanks to the Conference Catalyst staff, especially Ms Laura Le Blanc for her day by day collaboration and precious support in tackling many minute or complex organizational details.

Last but not least we would like to thank the Board of Directors for having trusted us by assigning the commitment to organize the 2020 edition of the Society's flagship conference. We deeply appreciated their continuous guidance during this huge and ambitious challenge. It has been a great honor for us to be selected for serving the Society and its members by organizing this conference.

Despite being connected remotely, we sincerely hope all attendees can have a stimulating time while sharing research findings with colleagues as well as exchanging and discussing new ideas. We wish you all enjoy the 2020 IEEE International Instrumentation and Measurement Conference.

Again, we apologize for any inconvenience related to remote attendance and, please, know that those affected by the COVID-19 outbreak are in our thoughts.

Sincerely,  
Vedran Bilas and Dario Petri  
General Co-Chairs

## COVID-19 Notification

*The COVID-19 global pandemic is a unique challenge that has impacted many members of the IEEE family and some of you are directly or indirectly engaged in the fight against it. We would like to express our concern and support for all members of the IEEE community, our staff, our families and others affected by this health crisis. These are difficult times, but we will get through them by working together. Thank you for your support of our shared mission to advance technology for humanity.*

IEEE has been monitoring the developing Coronavirus outbreak closely. After studying and evaluating the recent announcements, guidance, and news released by relevant national departments, we are sorry to announce that I2MTC 2020, scheduled to be held May 25-28, 2020 in Dubrovnik, Croatia will no longer be held at the Valamar Lacroma Hotel.

The IEEE I2MTC 2020 Organizing Committee is pleased to announce that the I2MTC 2020 Online Conference will be held on May 25 – June 25, 2020. The online platform will host pre-recorded presentations for authors. Accepted papers for the I2MTC 2020 will be eligible for inclusion in IEEE Xplore Digital Library after they are presented at the online conference. Presentations will be organized in a similar format as used the former schedule and Q&A will be handled through the online platform.

We extend our heartfelt thanks and appreciation to all of our technical community for your understanding and community engagement. Although IEEE I2MTC 2020 cannot be held physically, the integrity and quality of the research and content will remain and now be experienced in the online environment. Thank you for your support of our shared mission to advance technology for humanity.



# I2MTC 2020 Organizing Committee

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Dario Petri, *IEEE Fellow & Professor University of Trento*

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Igor Lackovic, *University of Zagreb, Croatia*

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## **Exhibit Chairs:**

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Hrvoje Dzapo, *University of Zagreb, Croatia*

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Vladimir Djapic, *American Haval Motor Technology, USA*

## **Local Arrangement Chair:**

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## **Publication Chair:**

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## **Conference Management:**

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Vedran Bilas, University of Zagreb, Croatia

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**Alessandra Flammini** - University of Brescia

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Okanagan

**Consolatina Liguori** - University of Salerno

## **Data Acquisition Systems and Real-Time Measurement Systems**

**Amitava Chatterjee** - Jadavpur University

**Ján Šaliga** - Technical University of Košice

**Pasquale Daponte** - University of Sannio

## **Signal Processing for Instrumentation and Measurement**

**Luca de Vito** - University of Sannio

**Antonio Moschitta** - University of Perugia

**Kurt Barbé** - Vrije Universiteit Brussel

## **Image Processing for Instrumentation and Measurement**

**Jacob Scharcanski** - Federal University of Rio Grande do Sul

**Tomislav Petković** - University of Zagreb

## **Micro- and Nanotechnology for Instrumentation and Measurement**

**Salvatore Graziani** - University of Catania

**Emile Martincic** - CNRS, Univ. Paris-Sud,

Univ. Paris-Saclay

## **Networked Embedded Systems and Communication Systems**

**Michele Magno** - ETH Zürich

**Domenico Capriglione** - University of Salerno

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

**Ratko Magjarević** - University of Zagreb

**Sabrina Grassini** - Politecnico di Torino

**Octavian Postolache** - Instituto de Telecomunicações, Lisboa/IT

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

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**Marco Ricci** - University of Calabria

**Davorin Ambruš** - University of Zagreb

## **Instrumentation and Measurement in Robotics**

**Stjepan Bogdan** - University of Zagreb

**Valner Brusamarello** - Federal University of Rio Grande do Sul

**Ruqiang Yan** - Xi'an Jiaotong University

## **Instrumentation and Measurement in Energy and Power Industry**

**Edoardo Fiorucci** - University of L'Aquila

**Sara Sulis** - University of Cagliari

## **Instrumentation and Measurement in Environmental Protection, Agriculture and Food Production**

**Dinko Oletić** - University of Zagreb

**Francesco Lamonaca** - University of Sannio

## **Instrumentation and Measurement in Automotive and Transportation Industry**

**Georg Basseur** - Graz University of Technology

**Mario Hrgetić** - University of Zagreb

## **Instrumentation and Measurement in Aerospace Systems**

**Marco Pertile** - University of Padova

**Pavel Pačes** - Czech Technical University in Prague

## Special Session Organizers

### **SPS-1: Advanced Measurement and Data Analytics for Industrial Equipment Health Monitoring**

Organizer: Weihua Li - South China University of Technology, China

Co-Organizer: Wang, Shibin - Xi'an Jiaotong University, China

### **SPS-2: Smart Sensors in the Context of Industry 4.0**

Organizer: Vincenzo Paciello - Univ. Cassino, Italy

Co-Organizer: Marco Carratù - Univ. Salerno, Italy; Reza Abrishambaf, Univ. Miami, USA; Antonio Espirito-Santo - Univ. of Beira Interior, Covilhã, Portugal; Victor Huang - Sage Technologies, USA

### **SPS-4: Measurements for Demanding Communications: Broadband and Industrial Networking**

Organizer: Gianfranco Miele, University of Cassino and Southern Lazio, Italy - Emiliano Sisinni - Univ. Brescia, Italy

Co-Organizer: Mikael Gidlund, MidSweden University, Sundsvall

### **SPS-5: Unobtrusive Systems and Wearable Technologies for Medical Applications**

Organizer: Carlo Massaroni - Università Campus Bio-Medico di Roma, Rome, Italy  
Co-Organizer: Emiliano Schena, Università Campus Bio-Medico di Roma, Rome, Italy

### **SPS-6: Instrumentation and Measurement for Improving Quality, Reliability and Safety: New Perspectives for Research and Industry**

Organizer: Lorenzo Ciani - Univ. Florence, Italy  
Co-Organizer: Marcantonio Catelani, University of Florence, Italy; Loredana Cristaldi, Politecnico di Milano, Italy; Giulio D'Emilia, University of L'Aquila, Italy

### **SPS-7: Green Sensors: Sensing Systems and Transducers for the Implementation of a Sustainable Economy**

Organizer: Carlo Trigona - Univ. of Catania, Italy

Co-Organizer: Salvatore Graziani, salvatore.graziani@dieei.unict.it, Univ. of Catania, Italy

### **SPS-8: Sensors and Sensing System for Assistive Technology**

Organizer: Vincenzo Marletta - Univ. Of Catania, Italy

Co-Organizer: Ramiro Velázquez, Universidad Panamericana, Aguascalientes, Mexico

### **SPS-9: Innovative Measurement Systems for Applications in Harsh Environments**

Organizer: Georg Brasseur - Graz University of Technology

### **SPS-10: Multichannel Imaging for Scientific and Industrial Application**

Organizer: Maik Rosenberger - Technische Universität Ilmenau

### **SPS-11: Recent Advances in Fiber Optic Sensing: Sensors, Instrumentations, Measurements and Applications**

Organizer: Tuan Guo - Jinan University, China  
Co-Organizer: Tongyu Liu, Jinan University, China; Prof. Yong Zhao, Northeastern University, China

### **SPS-14: From Low-Energy to Energy-Autonomous Sensor and Measurement Systems**

Organizer: Sebastian Bader  
Co-Organizer: Michele Magno, ETH Zurich

### **SPS-15: Near Field Electromagnetic Sensing and Imaging**

Organizer: Gui Yun Tian - Newcastle University, UK  
Co-Organizer: Darko Vasić, University of Zagreb, Croatia

**SPS-17: Robotics: Tactile & Proximity Sensing**

Organizer: Stephan Mühlbacher-Karrer, JOANNEUM RESEARCH ROBOTICS (JR), Austria

Co-Organizer: Stefan Escalda Navarro, Inria Lille-Nord Europe, France; Björn Hein Karlsruhe Institute of Technology (KIT), Germany

**SPS-18: Intrabody communication for body area networks**

Organizer: Željka Lučev Vasić, Univ. Of Zagreb, Croatia

Co-Organizer: Yueming Gao, Fuzhou University, China

**TC-1: Nondestructive Evaluation and Industrial Inspection Track - Innovations for Next-Generation of Nondestructive Testing and Evaluation**

Organizer: Helena Maria Geirinhas Ramos, Instituto Superior Técnico, Universidade de Lisboa

Co-Organizer: Dr. Zheng Liu, University of British Columbia Okanagan, Canada

*Papers submitted to Special Sessions that did not reach a minimum of four papers have been included in the regular Sessions.*

## I2MTC 2020 Reviewers

Mohamed Abou-Khousa, Khalifa University of Science and Technology  
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### **Telemonitoring Systems Based on Brain-Computer Interfaces and Augmented Reality in Smart Industry**

Pasquale Arpaia  
Antonio Esposito

### **Uncertainty Evaluation Based on Measurement Modeling**

Giovanni Battista Rossi  
Francesco Crenna

### **Wireless Connectivity for the Industrial IoT**

Emiliano Sisinni  
Mikael Gidlund  
Aamir Mahmood

### **Thermoresistive Sensors, Applications and Electrical Equivalence Principle**

Sebastian Yuri Catunda

### **From Compression to Recovery: An Overview of Compressive Sensing**

Fereshteh Fakhar Firouzeh  
Sreeraman Rajan  
Mohamed Abdelazez

### **Analysis of Broad-Band Signals in Reduced-Inertia Power Systems Using the Hilbert Transform**

Guglielmo Frigo  
Asja Derviskadic  
Mario Paolone

### **Measurements Applications for Autonomous Systems**

Daniele Fontanelli

### **Fiber-Optic Sensors and their Application in Power and Energy Industries**

Pawel Niewczas

### **Young Professionals Best Practices in a Variety of Measures**

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### **Microwave Microscopy for Advanced and Efficient Materials Analysis and Production**

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## 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

## 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 2019-2020 winners.

### 2019 Transaction Outstanding Associate Editors

Mohamed Abou-Khousa, *Khalifa University of Science and Technology, UAE*

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Emanuele Zappa, *Politecnico di Milano, Italy*

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

*For the paper: Design and Evaluation of a Fast, High-Resolution Sensor Evaluation Platform Applied to MEMS Position Sensing*

**Authors: Lisa-Marie Faller; Tobias Mitterer; Juliana Padilha Leitzke; Hubert Zangl**

Alpen-Adria-Universität, Austria

### IEEE Instrumentation and Measurement Society Best Application Award



**Mathias Bonmarin**

Zurich University of Applied Science (ZHAW), Switzerland

*For using lock-in thermal imaging to investigate stimuli-responsive nanoparticles in complex environments.*

## IEEE Instrumentation and Measurement Society Outstanding Young Engineer Award



**Datong Liu**

Harbin Institute of Technology, China

*For intelligent system diagnostic, prognostic, and health management.*

## IEEE Instrumentation and Measurement Society Technical Award



**Ruqiang Yan**

Xi'an Jiaotong University, China

*For significant contributions to energy efficient sensing and advanced data analytics.*

## IEEE Instrumentation and Measurement Society Distinguished Service Award



**Mark Yeary**

University of Oklahoma, United States

*For distinguished service to the I&M Society as TC Chair, VP Publications, VP Conferences, and Chair of the Fellows Coordination Committee. His leadership within and outside our society has been crucial to our success.*

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



**Lijuan Wang**

University of Kent, United Kingdom

*For contributions to the development of soft computing models for multiphase flow measurement.*

## 2019 Instrumentation and Measurement Society Senior Member Elevations

Mohammad Al-Shabi  
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### **Measurements Applications for Autonomous Systems**

Daniele Fontanelli

### **Fiber-Optic Sensors and their Application in Power and Energy Industries**

Pawel Niewczas

### **Young Professionals Best Practices in a Variety of Measures**

Erik Timpson

### **Microwave Microscopy for Advanced and Efficient Materials Analysis and Production**

Kamel Haddadi

# Technical Program

## Circuits and Systems for Instrumentation and Measurement

### T1-1: Circuits and Systems for Instrumentation and Measurement

Session Chair: *Consolatina Liguori (University of Salerno, Italy)*

#### **An Affordable Multichannel Potentiostat with 128 Individual Stimulation and Sensing Channels**

Tom Romain Molderez (KU Leuven & Ghent University, Belgium)

Korneel Rabaey (Ghent University, Belgium)

Marian K. h. Verhelst (University of Leuven (KULeuven), Belgium)

#### **High-speed AWG Exploiting Parallel Time Interleaved DAC Cores**

Mauro D'Arco (University of Naples Federico II, Italy)

Leopoldo Angrisani (University of Naples Federico II, Italy)

Pietro Monsurrò (University of Rome "La Sapienza", Italy)

Alessandro Trifiletti (University of Rome "La Sapienza", Italy)

#### **Development of a Disposable Blood Creatinine Sensor**

Monalisha Debnath (Indian Institute of Technology Kharagpur, India)

Karabi Biswas (Indian Institute of Technology Kharagpur, India)

Jyotirmoy Chatterjee (Indian Institute of Technology Kharagpur, India)

#### **Design of Power Supply System Applied for Electroplastic Effect Research of BMGs with Temperature Control Function**

Yilin Wang (Huazhong University of Science and Technology, China)

Shaozhe Zhang (Huazhong University of Science and Technology, China)

Jiawei Wu (Huazhong University of Science and Technology, China)

Yuyuan Song (Huazhong University of Science and Technology, China)

Qi Chen (Huazhong University of Science and Technology, China)

Jianfeng Xie (Huazhong University of Science and Technology, China)

Xiaotao Han (Huazhong University of Science and Technology, China)

#### **Auto Calibration Method for the Front-end Electronics in Digital Hadron Calorimeter**

Yu Wang (University of Science and Technology of China, China)

Shubin Liu (University of Science and Technology of China, China)

Zhongtao Shen (University of Science and Technology of China, China)

Changqing Feng (University of Science and Technology of China, China)

Yanbin Shui (University of Science and Technology of China, China)

Jianguo Liu (University of Science and Technology of China, China)

#### **Development of Wire-mesh Sensor in Small Bubble Visualization Based on Differential Measurement Mode**

Lusheng Zhai (Tianjin University, China)

Jie Yang (Tianjin University, China)

Zihan Meng (Tianjin University, China)

Ziqiang Cui (Tianjin University, China)

#### **An FPGA-based Multi-frequency EIT System with Reference Signal Measurement**

Zhicheng Yan (School of Electrical and Information Engineering, Tianjin University, China)

Yanbin Xu (Tianjin University, China)

Feng Dong (Tianjin University, China)

#### **FPGA-based Architecture for Identification Algorithms in NILM Techniques**

Juan Barbero (University of Alcalá, Spain)

Alvaro Hernández (University of Alcalá, Spain)

Jesús Ureña Ureña (University of Alcalá, Spain)

### **Modeling of a Suction Chamber based Wall Climbing Robot for Angular Stability**

Florence Gnana Poovathy John (Hindustan Institute of Technology and Science, India)  
Shubhashisa Sahoo (CAIR Bangalore, India)  
Sathish Eswaramoorthy (Hindustan Institute of Technology and Science, India)  
Muthukumaran Gopalan (Hindustan University, India)  
Uppu Ramachandraiah (Hindustan University, India)  
Arun Prakash Rao (CAIR DRDO, India)

### **Design of Indoor Object Searching and Positioning System Based on Ibeacon**

Wenbin Zheng (Harbin Institute of Technology, China)  
Tiancheng Wang (Harbin Institute of Technology, China)  
Ping Fu (Harbin Institute of Technology, China)  
Feng Lei (Harbin Institute of Technology, China)  
JinLong Shi (Harbin Institute of Technology, China)  
Li Wang (Harbin Institute of Technology, China)

## **T1-2: Circuits and Systems for Instrumentation and Measurement**

*Session Chair: Zheng Liu (University of British Columbia Okanagan, Canada)*

### **Conducted Noise Measuring System Using Floating Voltage Measurement Equipment**

Naruto Arai (NTT Corporation, Japan)  
Ken Okamoto (NTT Corporation, Japan)  
Jun Kato (NTT Corporation, Japan)

### **An Op-amp Less Electrochemical Spectroscopy System**

Leila Es Sebar (Politecnico di Torino, Italy)  
Emma Paola Angelini (Politecnico di Torino, Italy)  
Sabrina Grassini (Politecnico di Torino, Italy)  
Leonardo Iannucci (Politecnico di Torino, Italy)  
Marco Parvis (Politecnico di Torino, Italy)

### **Numerical Simulation of Effective Medium Approximation Using Monte Carlo Method and Its Experimental Evaluation**

Qian Zhang (Tianjin University, China)  
Ziqiang Cui (Tianjin University, China)  
Zihan Xia (Tianjin University, China)  
Long Yan (Tianjin University, China)  
Huaxiang Wang (Tianjin University, China)

### **M2S Parameters: A Multi-Tone Multi-Harmonic Measurement Approach for the Characterization of Nonlinear Networks**

Gian Piero Gibiino (University of Bologna, Italy)  
Alberto Maria Angelotti (University of Bologna, Italy)  
Alberto Santarelli (University of Bologna, Italy)  
Fabio Filicori (University of Bologna, Italy)  
Pier Andrea Traverso (University of Bologna, Italy)

### **A Resource-saving Method for Implementation of High-Performance Time-to-Digital Converters in FPGA**

Xiaoguang Kong (University of Science and Technology of China, China)  
Yonggang Wang (University of Science and Technology of China, China)  
Zhengqi Song (University of Science and Technology of China, China)  
Xiaoyu Zhou (University of Science and Technology of China, China)  
Jianming Lin (University of Science and Technology of China, China)  
Jie Kuang (University of Science and Technology of China, China)

### **A Real-Time Non-Volatile Memory Analyzer and its Use on the Evaluation of Storage Devices Based on NAND Flash Memories**

Eleni Bougioukou (University of Patras, Greece)  
Maria Varsamou (University of Patras, Greece)  
Nikolaos Toulgaridis (University of Patras, Greece)  
Theodore A. Antonakopoulos (University of Patras, Greece)

### **Effects of Experimental Conditions on Dynamic Measurement Characteristics of Flowmeters**

Youkun Zhu (Nanjing University of Aeronautics and Astronautics, China)  
Bin Wang (Nanjing University of Aeronautics and Astronautics, China)  
Nanyue Xu (Nanjing University of Aeronautics and Astronautics, China)

### **A Method for Measuring Ionizing Radiation Dose by Analyzing Hybrid- $\pi$ Parameters of Transistors**

David Monte (Universidade Federal de Pernambuco, Brazil)  
Luiz Antonio Santos (CNEN / CRCN-NE & SCIENTS Company, Brazil)

### **Lake Water Level Estimated by a Purely Radiometric Measurement: An Experiment with the SLSTR Radiometer Onboard Sentinel-3 Satellites**

Andrea Scozzari (CNR ISTI, Italy)  
Stefano Vignudelli (CNR IBF, Italy)  
Abdelazim Negm (Zagazig University, Italy)

### **Trapezoidal Current Generator for an Electromagnetic Groundwater Flowmeter**

Bill Heffernan (University of Canterbury, New Zealand)  
Ben Mitchell (University of Canterbury, New Zealand)  
Michael Hayes (University of Canterbury, New Zealand)

## **T1-3: Circuits and Systems for Instrumentation and Measurement**

*Session Chair: Consolatina Liguori (University of Salerno, Italy)*

### **An Engineering Voltage Divider for High Frequency and Wide Ranges of Voltage Measurement**

Xuan Gou (University of Electronic Science and Technology of China, China)  
Kai Chen (University of Electronic Science and Technology of China, China)  
Zengzeng Wang (University of Electronic Science and Technology of China, China)  
Wenqiang Han (University of Electronic Science and Technology of China, China)  
Yifan Wang (University of Electronic Science and Technology of China, China)

### **Electrical Resistance Tomography Using High and Low Conductivity Calibration**

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

### **Improvement in Localization of a Moving Vehicle using K-means Clustering**

Akhilesh Kumar (Indian Institute of Technology Kharagpur, India)  
Anirban Mukherjee (Indian Institute of Technology Kharagpur, India)

### **Self-Powered Wireless Sensor Node Based on Rotational Triboelectric Nanogenerator**

Zrinka Kovačić (Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia)  
Marijan Kuri (Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia)  
Ana Pilipovic (Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb)  
Haitao Zhao (Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA, 02139)  
Hrvoje Džapo (University of Zagreb, Croatia)

### **X- $\gamma$ -Ray Detection Instrument for the HERMES Nano-Satellites Based on SDDs Read-Out by the LYRA Mixed-Signal ASIC Chipset**

Marco Grassi (University of Pavia, Italy)  
Massimo Gandola, Filippo Mele (Politecnico di Milano, Italy)  
Giuseppe Bertuccio (Politecnico di Milano, Italy)  
Piero Malcovati (University of Pavia, Italy)  
Fabio Fuschino (INAF-OAS Bologna, Italy)  
Riccardo Campana (INAF-OAS Bologna, Italy)  
Claudio Labanti (INAF-OAS Bologna, Italy)  
Mauro Fiorini (INAF-IASF Milano, Italy)  
Yuri Evangelista (INAF-IAPS Roma, Italy)  
Raffaele Piazzolla (INAF-IAPS Roma, Italy)  
Marco Feroci (INAF-IAPS Roma, Italy)  
Gianluigi Zampa (Istituto Nazionale di Fisica Nucleare, Italy)  
Zampa Nicola (Istituto Nazionale di Fisica Nucleare, Italy)  
Alexandre Rachevski (Istituto Nazionale di Fisica Nucleare, Italy)  
Pierluigi Bellutti (Fondazione Bruno Kessler, Italy)  
Giacomo Borghi (Fondazione Bruno Kessler, Italy)  
Evgeny Demenev (Fondazione Bruno Kessler, Italy)  
Francesco Ficorella (Fondazione Bruno Kessler, Italy)  
Antonino Picciotto (Fondazione Bruno Kessler, Italy)  
Nicola Zorzi (Fondazione Bruno Kessler (FBK), Italy)  
Irina Rashevskaya (Istituto Nazionale di Fisica Nucleare, Italy)  
Andrea Vacchi (Istituto Nazionale di Fisica Nucleare, Italy)  
Fabrizio Fiore (INAF-OA Trieste, Italy)  
Luciano Burderi (University of Cagliari, Italy)

### **A Digital-to-Resistance Converter with an Automatic Offset Calibration Method for Evaluating Dynamic Performance of Resistive Sensor Readout Circuits**

Shuya Nakagawa (Keio University, Japan)  
Takumi Miyazaki (Keio University, Japan)  
Hiroki Ishikuro (Keio University, Japan)

### **A CMOS Lock-In-based Read-out for Interdigitated Electrodes**

Paulina Maya (Universidad de Zaragoza, Spain)  
Belen Calvo (University of Zaragoza, Spain)  
Maria Teresa Sanz-Pascual (National Institute for Astrophysics, Optics and Electronics, Mexico)  
Nicolas Medrano (University of Zaragoza, Spain)  
Jorge Perez-Bailon (University of Zaragoza & Group of Electronic Design, Spain)

### **Controlling Smart Meter Integrity via Identity Management of Its Components**

Alvaro E Robles Rincón (Universidade Federal do Rio de Janeiro)  
Wilson Melo, Jr. (National Institute of Metrology Quality and Technology, Brazil)  
Luiz Fernando Costa Carmo (National Institute of Metrology Quality and Technology, Brazil)  
Claudio M. Farias (Universidade Federal do Rio de Janeiro, Brazil)

## **T1-4: Circuits and Systems for Instrumentation and Measurement**

*Session Chair: Zheng Liu (University of British Columbia Okanagan, Canada)*

### **Readout Circuit Implemented on PCB-Level for Embedded CNT Sensors**

Quentin Vandier (Université de Sherbrooke, Canada)  
Julien Pezard (Université de Sherbrooke, Canada)  
Helene Fremont (IMS, Bordeaux, Canada)  
Eric Duchesne (IBM Bromont, Canada)  
Dominique Drouin (Université de Sherbrooke, Canada)

### **Low Group Delay Interpolation Filter for Delta-Sigma Converters**

Manouane Caza-Szoka (Universite du Quebec a Trois-Rivieres, Canada) Daniel  
Massicotte (Universite du Quebec a Trois-Rivieres, Canada)

### **A New Method of True Random Number Generation Based on Galois Ring Oscillator with Event Sampling Architecture in FPGA**

Jianming Lin (University of Science and Technology of China, China)  
Yonggang Wang (University of Science and Technology of China, China)  
Zelong Zhao (University of Science and Technology of China, China)  
Cong Hui (University of Science and Technology of China, China)  
Zhengqi Song (University of Science and Technology of China, China)

### **Logic Built-In Self-Test Instrumentation System for Engineering Test Technology Education**

Serge Demidenko (Sunway University, Malaysia)  
Moi Tin Chew (Massey University, New Zealand)  
Ba Tong Nguyen (RMIT University Vietnam, Vietnam)  
Melanie Ooi (University of Waikato, New Zealand)  
Ye Chow Kuang (University of Waikato & Monash University, New Zealand)

### **Using a Digital Timer to Demodulate AM Triangular Signals for Sensor Applications**

Ferran Reverter (Universitat Politècnica de Catalunya, Spain)  
Manel Gasulla (Universitat Politècnica de Catalunya, Spain)

### **Simple and Power Efficient Interface for AC-excited Differential Sensors**

Alessandro Depari (University of Brescia, Italy)  
Alessandra Flammini (University of Brescia, Italy)  
Emiliano Sisinni (University of Brescia, Italy)  
Gianluca Barile (University of L'Aquila, Italy)  
Giuseppe Ferri (University of L'Aquila, Italy)  
Vincenzo Stornelli (University of L'Aquila, Italy)

### **A Simple Direct Microcontroller Interface for Capacitively-Coupled Resistive Sensors**

Lakshmi Areekath (Indian Institute of Technology, Madras, India)  
Boby George (Indian Institute of Technology Madras, India)  
Ferran Reverter (Universitat Politècnica de Catalunya, Spain)

### **Novel Substrate Integrated Waveguide Architectures for Microfluidic Biosensing and Environmental Detection**

Adel Benleulmi (UQTR, Canada)  
Naimi Boubekour (Université du Québec à Trois-Rivières, Canada)  
Daniel Massicotte (Université du Québec à Trois-Rivières, Canada)

# Data Acquisition Systems and Real-time Measurement Systems

## T2-1: Data Acquisition Systems and Real time Measurement Systems

Session Chairs: Ján Šaliga (Technical University of Košice, Slovakia)

Pasquale Daponte (University of Sannio, Italy)

### Fast Calibration Method for Broadband Electromagnetic Prospecting Equipment

Shuangchao Ge (North University of China, China)

Ruifeng Yang (North University of China, China)

Chenxia Guo (North University of China, China)

### Impedance Measurement Solution Based on the High Time Resolution DSP

Olev Martens (Tallinn University of Technology, Estonia)

Raul Land (Tallinn University of Technology, Estonia)

Mart Min (Tallinn University of Technology, Estonia)

Paul Annus (Tallinn University of Technology, Estonia)

Marek Rist (Tallinn University of Technology, Estonia)

### Augmenting an Assisted Living Lab with Non-Intrusive Load Monitoring

Hafsa Bousbiat (University of Klagenfurt, Austria)

Christoph Klemenjak (University of Klagenfurt, Austria)

Gerhard Leitner (University of Klagenfurt, Austria)

Wilfried Elmenreich (University of Klagenfurt, Austria)

### A Wireless Instrumentation Control System Based on Low-Cost Single Board Computers

Daniel Enériz Orta (University of Zaragoza, Spain)

Nicolas Medrano (University of Zaragoza, Spain)

Belen Calvo (University of Zaragoza, Spain)

Jorge Perez-Bailon (University of Zaragoza & Group of Electronic Design, Spain)

### Edge Sensor Signal Processing Algorithms for Earthquake Early Detection

Moise Avoci Ugwiri (University of Salerno, Italy)

Vincenzo Paciello (University of Salerno & DIn Università Degli studi di Salerno, Italy)

António Espírito Santo (University of Beira Interior, Portugal)

Marco Carratù (University of Salerno, Italy)

Gustavo Monte (UTN Facultad Regional Del Neuquen, Argentina)

### Real-time Rehabilitation Exercise Performance Evaluation System Using Deep Learning and Thermal Image

Chien-Hua Huang (Central Taiwan University of Science and Technology, Taiwan)

Chun-Fu Lin (Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan)

Ching-An Chen (Institute of Electrical Control Engineering, NCTU, Taiwan)

Chi-Hung Hwang (Instrument Technology Research Center, Taiwan)

Der-Chen Huang (National Chung Hsing University, Taiwan)

### Uncertainty Issues in Multi-Channel Data Acquisition Systems

Alessio Carullo (Politecnico di Torino, Italy)

Alessio Atzori (Politecnico di Torino, Corso Duca degli Abruzzi 24, Torino, Italy)

Simone Corbellini (Politecnico di Torino, Italy)

Alberto Vallan (Politecnico di Torino, Italy)

## T2-2: Data Acquisition Systems and Real time Measurement Systems

Session Chair: Ján Šaliga (Technical University of Košice, Slovakia)

Amitava Chatterjee (Jadavpur University, India)

### A Simple One-Bit Detector of Parametric Signals for IoT Applications

Guido De Angelis (Regione Umbria, Italy)

Alessio De Angelis (University of Perugia, Italy)

Paolo Carbone (University of Perugia, Italy)



### **Drone Gas Concentration Measurement System for Landfills**

Javier Mendoza Montoya (Universidad Andina Néstor Cáceres Velásquez, Sweden)  
Annakarin Olsson Olsson (University of Gävle, Sweden)  
Stig-Göran Mårtensson (University of Gävle, Sweden)  
Jose Chilo (University of Gavle, Sweden)

### **Energy-Aware Real-Time Scheduling for Energy-Harvesting Sensor Nodes**

Ivan Puri Pavić (Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia)  
Hrvoje Džapo (University of Zagreb, Croatia)

### **A Bandpass Sampling Scheme Based on Asynchronous Time Interleaving**

Eulalia Balestrieri (University of Sannio, Italy)  
Luca De Vito (University of Sannio, Italy)  
Pasquale Daponte (University of Sannio, Italy)  
Francesco Picariello (University of Sannio, Italy)  
Sergio Rapuano (University of Sannio, Italy)  
Ioan Tudosa (University of Sannio, Italy)

### **A Flexibly Reconfigurable Data Acquisition System for Tunable Diode Laser Absorption Spectroscopy**

Fanghao Lu (Beihang University, China)  
Lijun Xu (Beihang University, China)  
Hongyu Zhang (Beihang University, China)  
Chenran Wang (Beihang University, China)  
Zhang Cao (Beihang University, China)

### **Application Research of LoRa Technology in Photovoltaic Monitoring System**

Xiaotao Hu (Beijing Jiaotong University, China)  
Hesheng Zhang (Beijing Jiaotong University, China)  
Yuhang Wang (Beijing Jiaotong University, China)

### **A TDoA-based Measurement Method for RF Emitters Localization by Exploiting Wideband Compressive Sampling**

Eulalia Balestrieri (University of Sannio, Italy)  
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)

# Image Processing for Instrumentation and Measurement

## T3-1: Image Processing for Instrumentation and Measurement

Session Chairs: Tomislav Petković, Jr. (University of Zagreb, Croatia)

Jacob Scharcanski (UFRGS, Brazil)

### Instrument and Method for Measuring Ice Accretion in Mixed-Phase Cloud Conditions

Eero O. Molkoselkä (University of Oulu, Finland)

Ville Kaikkonen (University of Oulu, Finland)

Anssi Mäkynen (University of Oulu, Finland)

### Visual Inspection for Laser Welding Joints of Electrodes in Lithium-ion Battery Packing

Zhong Chen (South China University of Technology, China)

Yuya Hao (South China University of Technology, China)

Zichen Liu (South China University of Technology, China)

Xianmin Zhang (South China University of Technology, China)

### Deep Learning Based Cell Imaging with Electrical Impedance Tomography

Zhou Chen (University of Edinburgh, United Kingdom (Great Britain))

Yunjie Yang (University of Edinburgh, United Kingdom (Great Britain))

Jiabin Jia (University of Edinburgh, United Kingdom (Great Britain))

Pierre Bagnaninchi (The University of Edinburgh, United Kingdom (Great Britain))

### Multi-camera Stereo Vision Based on Weights

Songlin Bi (University of Science and Technology of China, China)

YongGang Gu (University of Science and Technology of China, China)

Zhihong Zhang (University of Science and Technology of China, China)

Honghong Liu (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)

### Low-Rank Matrix Recovery for Electrical Capacitance Tomography

Jiamin Ye (Tianjin University, China)

Wuqiang Yang (The University of Manchester, United Kingdom (Great Britain))

Chao Wang (Tianjin University, China)

### Regularization Parameter Considering Electric Field Attenuation for Electrical Resistance Tomography

Sitong Chen (Tianjin University, China)

Yanbin Xu (Tianjin University, China)

Feng Dong (Tianjin University, China)

### Bone Age Assessment Based on Phalanx Radiograms

Chih-Yen Chen (School of Electronic Engineering and Computer Science, Queen Mary University, United Kingdom (Great Britain))

Lijuan Wang (University of Kent, United Kingdom (Great Britain))

Chi-Wen Hsieh (National Chiayi University, Taiwan)

## T3-2: Image Processing for Instrumentation and Measurement

Session Chairs: Tomislav Petković, Jr. (University of Zagreb, Croatia)

Jacob Scharcanski (UFRGS, Brazil)

### An Ill-posed Optimization Method and Relaxation Strategy of Landweber for EMT System Based on TMR

Qi Guo (Tianjin University, China)

Chao Wang (Tianjin University, China)

Jiamin Ye (Tianjin University, China)

### **Effect of Liquid Temperature on Wave Characteristics in Falling Film Based on PLIF**

Ting Xue (Tianjin University, China)  
Zhili Wang (Tianjin University, China)  
Jinshun Liu (Tianjin University, China)

### **Automated Segmentation of Profiled Fibers in Cross-sectional Micrographs for Quality Control**

Oliver Rippel (RWTH Aachen University, Germany)  
Maximilian Schnabel (RWTH Aachen University, Germany)  
Georg-Philipp Paar (Institut für Textiltechnik der RWTH Aachen University, Germany)  
Thomas Gries (RWTH Aachen University, Germany)  
Dorit Merhof (RWTH Aachen University, Germany)

### **Investigation of Film Bubbles in Annular Flow Based on Planar Laser-induced Fluorescence**

Ting Xue (Tianjin University, China)  
Jinshun Liu (Tianjin University, China)  
Zhili Wang (Tianjin University, China)

### **Image Based Similarity Detection in Mechanical Registers**

Consolatina Liguori (University of Salerno, Italy)  
Marco Carratù (University of Salerno, Italy)  
Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)  
Salvatore Dello Iacono (University of Salerno, Italy)  
Giuseppe Di Leo (University of Salerno, Italy)

### **Object Tracking Scheme Using Part-based Correlation Filters**

Pablo Barcellos (UFRGS, Brazil)  
Jacob Scharcanski (UFRGS, Brazil)

### **Effect of the Exposure Time in Laser Speckle Imaging for Improving Blood Vessels Localization: A Wavelet Approach**

Francisco Lopez-Tiro (INAOE, Mexico)  
Hayde Peregrina-Barreto (Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico)  
Jose J. Rangel-Magdaleno (INAOE, Mexico)  
Julio Cesar Ramirez-San-Juan (INAOE, Mexico)  
Juan M. Ramirez-Cortes (INAOE, Mexico)

# Instrumentation and Measurement in Aerospace Systems

## T4: Instrumentation and Measurement in Aerospace Systems

Session Chair: Marco Pertile (University of Padova, Italy)

### Electrical Conductivity Analysis of CFRP with Boundary Element Method

Qian Zhao (Qufu Normal University, China)

Xiyue Wang (Qufu Normal University, China)

Kaidi Teng (Qufu Normal University, China)

Kai Zhang (Qufu Normal University, China)

Ronghua Zhang (Tianjin Polytechnic University School of Artificial Intelligence, China)

Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))

Zhijie Zhang (North University of China, China)

### Design and Validation of SVOM on Board TT&C System

Yang Liu (Shanghai Engineering Center for Microsatellites, China)

Shunjing YU (Shanghai Engineering Center for Microsatellites, China)

Haiying HU (Shanghai Engineering Center for Microsatellites, China)

Zongde Li (Shanghai Engineering Center for Microsatellites, China)

Yuanyuan Dai (Shanghai Engineering Center for Microsatellites, China)

Xiaofeng Zhang (Shanghai Engineering Center for Microsatellites, China)

### Design and Development of Flexible Baseline-based Distributed Position and Orientation Measurement System

Bo Wang (Beihang University, China)

Jianli Li (Beihang University, China)

Wen Ye (National Institute of Metrology, China)

Yanhong Liu (Beihang University, China)

Chunyu Qu (Beihang University, China)

### Cryogenic Electrical Characterization and Equivalent-Circuit Modeling of SAW Resonators

Giuseppe Campobello (University of Messina, Italy)

Giovanni Crupi (University of Messina, Italy)

Nicola Donato (University of Messina, Italy)

### Measurement and Modeling of SpaceWire Radiation for Electromagnetic Compatibility Assessment

Anargyros T. Baklezos (National Technical University of Athens, Greece)

Christos D. Nikolopoulos (National Technical University of Athens & School of Electrical and Computer Engineering, Greece)

Ilias Sigalas (National & Kapodistrian University of Athens, Greece)

Christos Capsalis (National Technical University of Athens, Greece)

### Fiber Optic Temperature Sensor for Nanosatellites

Ana K. Reascos (Universidad Carlos III de Madrid, Spain)

Dragos A. Poiana (Universidad Carlos III de Madrid, Spain)

Julio E. Posada Roman (Universidad Carlos III de Madrid, Spain)

Jose A. Garcia Souto (Universidad Carlos III de Madrid, Spain)

# Instrumentation and Measurement in Automotive and Transportation Industry

## **T5: Instrumentation and Measurement in Automotive and Transportation Industry**

*Session Chairs: Georg Bresseur (Graz University of Technology, Austria)*

*Mario Hrgetic (University of Zagreb, Croatia)*

### **Comparison of the VLP-16 LiDAR System with an Absolute Interferometer**

Stefano Cattini (University of Modena and Reggio Emilia & Science & Technology Park for Medicine, Mirandola, Modena, Italy)

Luigi Rovati (University of Modena and Reggio Emilia, Italy)

Luca Di Cecilia (CNH Industrial Italia Spa, Italy)

Luca Ferrari (CNH Industrial, Italy)

### **Increased Accuracy for Fast Moving LiDARS: Correction of Distorted Point Clouds**

Tobias Renzler (Graz University of Technology, Austria)

Michael Stolz (Institute of Automation and Control Technical University Graz & Virtual Vehicle Research Center, Austria)

Markus Schratzer (Virtual Vehicle Research Center, Austria)

Daniel Watzenig (Graz University of Technology & Virtual Vehicle Research Center, Austria)

### **Enhancing Structural Health Monitoring with Vehicle Identification and Tracking**

Alessio Burrello (Viale Carlo Pepoli 2 & MICREL lab Università di Bologna, Italy)

Davide Brunelli (University of Trento, Italy)

Marzia Malavisi (Politecnico di Torino, Italy)

Luca Benini (ETH Zurich, Switzerland)

### **Development of a Distributed Electronic System for Low-cost Heavy-duty Engine Test Bench**

Olivier R. Gouveia (Polytechnic Institute of Leiria & Center for Rapid and Sustainable Product Development, Portugal)

Alexandre Borges (Polytechnic Institute of Leiria, Portugal)

Diogo Costa (Polytechnic Institute of Leiria, Portugal)

Diogo Coelho (Diamantino Perpétua e Filhos, Ida, Portugal)

Paulo Lopes (Diamantino Perpétua e Filhos, Ida, Portugal)

Hugo Perpétua (Diamantino Perpétua e Filhos, Ida, Portugal)

Luís Serrano (ADAI - Associação para o Desenvolvimento da Aerodinâmica Industrial & Polytechnic Institute Leiria, Portugal)

Carlos Ferreira (Polytechnic Institute of Leiria, Portugal)

### **Structural Characterization of Complex Lattice Parts by Means of Optical Non-contact Measurements**

Roberto Montanini (University of Messina, Italy)

Gianluca Rossi (University of Perugia, Italy)

Antonino Quattrocchi (University of Messina, Italy)

Damiano Alizzio (University of Messina, Italy)

Lorenzo Capponi (University of Padova, Italy)

Roberto Marsili (University of Perugia, Italy)

Annamaria Di Giacomo (University of Messina, Italy)

Tommaso Tocci (University of Perugia, Italy)

### **Digital Vehicle Radar Sensor Target Simulation**

Jan Sobotka (Czech Technical University in Prague, Czech Republic)

Jiří Novák (Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic)

### **Experimental Analysis of Kalman Filter-Based Vehicle Sideslip Angle Estimation Accuracy and Related Error-Compensation Techniques**

Mario Hrgetic (University of Zagreb, Croatia)

Josko Deur (University of Zagreb, Croatia)

# Instrumentation and Measurement in Energy and Power Industry

## **T6-1: Instrumentation and Measurement in Energy and Power Industry**

*Session Chair: Edoardo Fiorucci (University of L'Aquila, Italy)*

### **Investigation of Even Harmonics in Low-voltage Distribution Networks**

Julio Barros (University of Cantabria, Spain)  
Matilde Apraiz (University of Cantabria, Spain)  
Ramón I. Diego (University of Cantabria, Spain)

### **Characterization of Even Harmonics in Power System Networks**

Julio Barros (University of Cantabria, Spain)  
Matilde Apraiz (University of Cantabria, Spain)  
Ramón I. Diego (University of Cantabria, Spain)

### **Detecting Defects in Photovoltaic Cells and Panels with the Help of Time-Resolved Thermography Under Outdoor Environmental Conditions**

Christian Schuss (University of Oulu & Faculty of Information Technology and Electrical Engineering, Finland)  
Kari Remes (University of Oulu, Finland)  
Kimmo Leppänen (Oy GW Berg & Co Ab, Finland)  
Juha Saarela (University of Oulu, Finland)  
Tapio Fabritius (University of Oulu, Finland)  
Bernd Eichberger (Graz University of Technology, Austria)  
Timo Rahkonen (University of Oulu, Finland)

### **Uncertainty Analysis in the Measurement of Switching Losses in GaN FETs Power Converters**

Marco A. Azpurua (Universitat Politècnica de Catalunya, Spain)  
Marc Pous (Universitat Politècnica de Catalunya, Spain)  
Ferran Silva (Universitat Politècnica de Catalunya, Spain)

### **Energy-efficient Routing of Electric Vehicles with Integrated Photovoltaic Installations**

Christian Schuss (University of Oulu & Faculty of Information Technology and Electrical Engineering, Finland)  
Tapio Fabritius (University of Oulu, Finland)  
Bernd Eichberger (Graz University of Technology, Austria)  
Timo Rahkonen (University of Oulu, Finland)

### **Experimental Investigation of Liquid-solid Two-Phase Flow with Electrical Resistance Tomography and Ultrasound Doppler**

Hanrui Zhang (Tianjin University, China)  
Chao Tan (Tianjin University, China)  
Feng Dong (Tianjin University, China)

### **Procedure for Ratio Error and Phase Displacement Prediction of Inductive Current Transformers at Different Operating Conditions**

Alessandro Mingotti (University of Bologna, Italy)  
Abbas Ghaderi (University of Bologna, Italy)  
Lorenzo Peretto (University of Bologna, Italy)  
Roberto Tinarelli (University of Bologna, Italy)

### **A High Voltage Circuit Breaker Condition Assessment Method using the Vibration Fingerprint Based on VMD-EM Method**

Kerim Obarčanin (DV Power, Sweden)  
Lačević Bakir (University of Sarajevo, Bosnia and Herzegovina)  
Michele Ermidoro (University of Bergamo, Italy)

### **Rapid Fault Diagnosis of Photovoltaic Panels Under Outdoor Environmental Conditions**

Christian Schuss (University of Oulu & Faculty of Information Technology and Electrical Engineering, Finland)  
Kari Remes (University of Oulu, Finland)  
Kimmo Leppänen (Oy GW Berg & Co Ab, Finland)  
Juha Saarela (University of Oulu, Finland)  
Tapio Fabritius (University of Oulu, Finland)  
Bernd Eichberger (Graz University of Technology, Austria)  
Timo Rahkonen (University of Oulu, Finland)

### **Partial Discharges Measurement During Under-damped Steep-fronted Overvoltages**

Juan Manuel Martínez-Tarifa (University Carlos III, Spain)  
Guillermo Robles (Universidad Carlos III de Madrid, Spain)

## **T6-2: Instrumentation and Measurement in Energy and Power Industry**

*Session Chair: Sara Sulis (University of Cagliari, Italy)*

### **Magnetic Energy Harvesting on Overhead High Voltage Lines: Weight Optimized Transformer Design for High Power Output**

Markus Neumayer (Graz University of Technology, Austria)  
Thomas Bretterklieber (Graz University of Technology, Austria)  
Gabriel Gruber (Graz University of Technology, Austria)  
Georg Brasseur (Graz University of Technology, Austria)

### **Load Identification System for Residential Applications Based on the NILM Technique**

Edoardo Fiorucci (University of L'Aquila, Italy)  
Giovanni Bucci (Università Dell' Aquila, Italy)  
Fabrizio Ciancetta (University of L'Aquila, Italy)  
Simone Mari (University of L'Aquila, Italy)

### **Measurement Uncertainty of Harmonic Emission Indicators Based on IEEE Std. 1459-2010**

Giovanni Artale (Università di 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, Italy)  
Salvatore Guaiana (Università di Palermo, Italy)  
Nicola Panzavecchia (National Research Council, Italy)  
Giovanni Tinè (National Research Council, Italy)

### **Impact of Measurement Uncertainties on Compressive Sensing-based Harmonic Source Estimation Algorithms**

Daniele Carta (University of Cagliari, Italy)  
Carlo Muscas (University of Cagliari, Italy)  
Paolo Attilio Pegoraro (University of Cagliari, Italy)  
Antonio Vincenzo Solinas (University of Cagliari, Italy)  
Sara Sulis (University of Cagliari, Italy)

### **Measurement of Dynamic Voltage Variation Effect on Instrument Transformers for Power Grid Applications**

Gabriella Crotti (Istituto Nazionale di Ricerca Metrologia, Italy)  
Domenico Giordano (Istituto Nazionale di Ricerca Metrologica, Italy)  
Giovanni D'Avanzo (University of Campania Luigi Vanvitelli, Italy)  
Antonio Delle Femine (University of Campania Luigi Vanvitelli, Italy)  
Daniele Gallo (University of Campania Luigi Vanvitelli, Italy)  
Carmine Landi (University of Campania Luigi Vanvitelli, Italy)  
Mario Luiso (University of Campania Luigi Vanvitelli, Italy)  
Palma Sara Letizia (INRiM-Istituto Nazionale di Ricerca Metrologica & Politecnico di Torino, Italy)  
Luca Barbieri (RSE S.p.A., Italy)  
Daniele Palladini (Ricerca sul Sistema Energetico - RSE S.p.A., Italy)  
Paolo Mazza (Ricerca sul Sistema Energetico - RSE S.p.A., Italy)

### **Mass Flow Measurement of Pneumatically Conveyed Solids Through Multi-Modal Sensing and Machine Learning**

Faisal Abbas (University of Kent, United Kingdom (Great Britain))

Yong Yan (University of Kent, United Kingdom (Great Britain))

Lijuan Wang (University of Kent, United Kingdom (Great Britain))

### **Electricity Theft Detection Base on Extreme Gradient Boosting in AMI**

Zhongzong Yan (Hunan University, China)

He Wen (Hunan University & College of Electrical and Information Engineering, China)

### **132 kV Optical Voltage Sensor for Wide Area Monitoring, Protection and Control Applications**

Grzegorz Fusiek (University of Strathclyde, United Kingdom (Great Britain))

Pawel Niewczas (University of Strathclyde & Synaptec Ltd, United Kingdom (Great Britain))

Neil Gordon (Synaptec Ltd, United Kingdom (Great Britain))

Philip Orr (Synaptec Ltd, United Kingdom (Great Britain))

Paul Clarkson (National Physical Laboratory, United Kingdom (Great Britain))

### **Dynamic Phasor Estimations By Using Matrix Pencil and Taylor Least Squares Method**

Jian Song (Hunan University & College of Electrical and Information Engineering, China)

He Wen (Hunan University & College of Electrical and Information Engineering, China)

### **Parameter Estimation of Power System Oscillation Signal Under Power Swing based on Clarke-DFT**

Xuansheng Shan (Hunan University, China)

He Wen (Hunan University & College of Electrical and Information Engineering, China)

## **T6-3: Instrumentation and Measurement in Energy and Power Industry**

*Session Chair: Edoardo Fiorucci (University of L'Aquila, Italy)*

### **An FPGA-Based Implementation of High Speed Telemetry Device for Well Logging**

Hongwei Zhao (University of Science and Technology of China, China)

Kezhu Song (University of Science and Technology of China, China)

Kehan Li (University of Science and Technology of China, China)

Chuan Wu (University of Science and Technology of China, China)

Zhuo Chen (University of Science and Technology of China, China)

### **Study of the Aerodynamic Sampling Effects of a Holographic Cloud Droplet Instrument**

Harri Juttula (University of Oulu, Finland)

Ville Kaikkonen (University of Oulu, Finland)

Anssi Mäkynen (University of Oulu, Finland)

### **Continuous Measurement of Charge Distribution in a Single-Jet Fluidized Bed Using an Electrostatic Sensor Array**

Bojian Qi (North China Electric Power University, China)

Wenbiao Zhang (North China Electric Power University, China)

Yong Yan (University of Kent, United Kingdom (Great Britain))

Xinyan Li (North China Electric Power University, China)

### **Combined Impact of Voltage Transformer and Estimation Algorithm on Harmonic Synchrophasors Measurements**

Christian Laurano (Politecnico di Milano, Italy)

Sergio Toscani (Politecnico di Milano, Italy)

Michele Zanoni (Politecnico di Milano, Italy)

Paolo Castello (University of Cagliari, Italy)

Carlo Muscas (University of Cagliari, Italy)

Paolo Attilio Pegoraro (University of Cagliari, Italy)



### **Monitoring a DC Train Supplied by a Reversible Substation**

Giuliano Cipolletta (University of Campania Luigi Vanvitelli, Italy)  
Antonio Delle Femine (University of Campania Luigi Vanvitelli, Italy)  
Daniele Gallo (University of Campania Luigi Vanvitelli, Italy)  
Carmine Landi (University of Campania Luigi Vanvitelli, Italy)  
Mario Luiso (University of Campania Luigi Vanvitelli, Italy)  
Domenico Giordano (Istituto Nazionale di Ricerca Metrologica, Italy)  
Davide Signorino (Istituto Nazionale di Ricerca Metrologica (INRIM), Italy)  
Fabio Balic (Metro de Madrid, Spain)  
Jorge Quintana Fernández (Metro de Madrid, Spain)  
Antonio Gallo (Hitachi Rail, Italy)  
Luigi Pastena (Hitachi Rail, Italy)

### **Measurement of the Moisture Content in Woodchips Through Capacitive Sensing and Data Driven Modelling**

Jing Yan (North China Electric Power University, China)  
Wenbiao Zhang (North China Electric Power University, China)  
Yong Yan (University of Kent, United Kingdom (Great Britain))

### **Filter Transients Onboard DC Rolling Stock and Exploitation for the Estimate of the Line Impedance**

Andrea Mariscotti (ASTM, Switzerland)  
Domenico Giordano (Istituto Nazionale di Ricerca Metrologica, Italy)  
Antonio Delle Femine (University of Campania Luigi Vanvitelli, Italy)  
Davide Signorino (Istituto Nazionale di Ricerca Metrologica (INRIM), Italy)

### **Supervised Non-Intrusive Load Monitoring Algorithm for Electric Vehicle Identification**

Andres F Moreno Jaramillo (Queen's University Belfast, United Kingdom (Great Britain))  
David Laverty (Queen's University Belfast, United Kingdom (Great Britain))  
John Hastings (Queen's University Belfast, United Kingdom (Great Britain))  
Jesus Martinez del Rincon (Queen's University Belfast, United Kingdom (Great Britain))  
John Morrow (Queen's University, Belfast, United Kingdom (Great Britain))

### **Advanced Self-Discharge Measurements of Lithium-Ion Cells and Comparison to Modeling**

Nawfal Al-Zubaidi R-Smith (Johannes Kepler University Linz & Keysight Laboratories Linz, Austria)  
Georg Gramse (Keysight Laboratories Linz, Germany)  
Manuel Moertelmaier (Keysight Laboratories Linz, Austria)  
Manuel Kasper (Keysight Technologies, Austria)  
Ferry Kienberger (Keysight Technologies, Austria)

### **Mass Flow Rate Measurement of Pneumatically Conveyed Particles Through Acoustic Emission Detection and Electrostatic Sensing**

Ge Zheng (North China Electric Power University, China)  
Yong Yan (University of Kent, United Kingdom (Great Britain))  
Yonghui Hu (North China Electric Power University, China)  
Wenbiao Zhang (North China Electric Power University, China)  
Long Yang (North China Electric Power University, China)  
Lanqi Li (North China Electric Power University, China)

## **T6-4: Instrumentation and Measurement in Energy and Power Industry**

*Session Chair: Sara Sulis (University of Cagliari, Italy)*

### **A Compact System for On-line Electrochemical Impedance Spectroscopy on Lithium-Ion Batteries**

Alessio De Angelis (University of Perugia, Italy)  
Marco Crescentini (University of Bologna, Italy)  
Roberta Ramilli (University of Bologna, Italy)  
Guido De Angelis (Regione Umbria, Italy)  
Marco Tartagni (University of Bologna, Italy)  
Antonio Moschitta (University of Perugia, Italy)  
Pier Andrea Traverso (University of Bologna, Italy)  
Paolo Carbone (University of Perugia, Italy)

### **Power Factor Revisited**

Harold Kirkham (Pacific Northwest National Laboratory, USA)  
D. White (Measurement Standards Laboratory of New Zealand, New Zealand)  
Artis Riepnieks (Pacific Northwest National Laboratory, USA)

### **Multimodal Analysis of Gas-oil Intermittent Structures in Co-current Horizontal Flow**

Stian Husevik Stavland (University of Bergen & NORCE, Norway)  
Yessica Arellano (Coventry University, United Kingdom (Great Britain))  
Andrew Hunt (Atout Process Ltd., United Kingdom (Great Britain))  
Rachid Maad (University of Bergen, Norway)  
Bjørn Tore Hjertaker (University of Bergen, Norway)

### **Characterization of a Premixed Flat Combustor Through Plasma Current Measurements**

Luca Pintori (University of Modena and Reggio Emilia, Italy)  
Luigi Rovati (University of Modena and Reggio Emilia, Italy)  
Giovanni Verzellesi (University of Modena and Reggio Emilia, Italy)

### **A Novel PSO-CWA Algorithm for the Estimation of Inter-area Oscillation Parameters**

Leopoldo Angrisani (University of Naples Federico II, Italy)  
Francesco Bonavolontà (Università di Napoli Federico II, Italy)  
Luigi Pio Di Noia (Università di Napoli Federico II, Italy)  
Davide Lauria (University of Naples Federico II, Italy)  
Annalisa Liccardo (University of Naples Federico II, Italy)  
Salvatore Tessitore (University Federico II of Naples, Italy)  
Davide Ruggiero (STMicroelectronics, Italy)

# Instrumentation and Measurement in Environmental Protection, Agriculture and Food Production

## T7-1: Instrumentation and Measurement in Environmental Protection, Agriculture and Food Production

Session Chair: Francesco Lamonaca (University of Sannio, Italy)

### **Kalman Filtering for Accurate and Fast Plant Growth Dynamics Assessment**

Dmitrii Shadrin (Skolkovo Institute of Science and Technology, Russia)

Tatiana Podladchikova (Skolkovo Institute of Science and Technology, Russia)

Georgii Ovchinnikov (Skolkovo Institute of Science and Technology, Russia)

Artem Pavlov (Skolkovo Institute of Science and Technology, Russia)

Mariia Pukalchik (Skoltech, Russia)

Andrey Somov (Skolkovo Institute of Science and Technology, Russia)

### **Impact of Look-Back Period on Soil Temperature Estimation Using Machine Learning Models**

Tomislav Kovačević (University of Zagreb, Croatia)

Lovre Mrčela (University of Zagreb, Croatia)

Andro Merćep (University of Zagreb, Croatia)

Zvonko Kostanjčar (University of Zagreb, Croatia)

### **Effect of Frozen-thaw Injury on Cell Membrane and Bio-impedance**

Jiawei Tang (The University of Manchester, United Kingdom (Great Britain))

Mingyang Lu (The University of Manchester, United Kingdom (Great Britain))

Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))

Yuedong Xie (Beihang University, China)

Zhijie Zhang (North University of China, China)

Qian Zhao (Qufu Normal University, China)

### **Classifying Cannabis Sativa Flowers, Stems and Leaves using Statistical Machine Learning with Near-Infrared Hyperspectral Reflectance Imaging**

Wayne Holmes (Unitec Institute of Technology, New Zealand)

Melanie Ooi (University of Waikato, New Zealand)

Ye Chow Kuang (University of Waikato & Monash University, New Zealand)

Ray Simpkin (Callaghan Innovation, New Zealand)

Dan Blanchon (Unitec Institute of Technology, New Zealand)

Serge Demidenko (Sunway University, Malaysia)

Gourab Sen Gupta (Massey University, New Zealand)

### **Sedimentation Monitoring of the Active Biomass in Bioreactors by Electrical Impedance Spectroscopy**

Ernesto Serrano (Universitat Politècnica de Catalunya, Spain)

Núria Mata (KU Leuven, Belgium)

Míriam Cerrillo (IRTA - Institute of Agrifood Research and Technology, Spain)

### **A Portable Automated Bioanalyzer Based on Enzymatic Biosensors for Food Analysis**

Francisco Ferrero Martín (University of Oviedo, Spain)

Alberto Lopez (University of Oviedo, Spain)

Marta Valledor (University of Oviedo, Spain)

Juan Carlos Campo (University of Oviedo, Spain)

Julio Reviego (Complutense University of Madrid, Spain)

Jose Maria Pingarron (Complutense University of Madrid, Spain)

### **Handheld Device for Rapid Detection of miRNA Based on a Ratiometric Transmittance Scheme**

Francisco Ferrero Martín (University of Oviedo, Spain)  
Jorge Losada Matias (University of Oviedo, Spain)  
Adrian Sanchez Visedo (University of Oviedo, Spain)  
Marta Valledor (University of Oviedo, Spain)  
Jose J. Costa-Fernandez (University of Oviedo, Spain)  
M.T. Fernandez-Arguelles (University of Oviedo, Spain)  
Juan Carlos Campo (University of Oviedo, Spain)  
Ana Soldado Cabezuelo (Regional Institute for Research and Agro-Food Development, Spain)

### **Assessment of Frying Oil Degradation using Laser Direct Writing Interdigital Sensors**

Donyau Chiang (Taiwan Instrument Research Institute, Taiwan)  
Chien-Fang Ding (Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan)  
Yu-Ting Li (National Applied Research Laboratories, Taiwan)  
Yi-Cheng Lin (ITRC, Narlabs, Taiwan)  
Po-Kai Chiu (National Applied Research Laboratories, Taiwan)  
Hsin-Yi Tsai (Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan)

## **T7-2: Instrumentation and Measurement in Environmental Protection, Agriculture and Food Production** *Session Chair: Dinko Oletic (University of Zagreb & Faculty of Electrical Engineering and Computing, Croatia)*

### **Bumble Bee Traffic Monitoring Using Acoustics**

David Heise (Lincoln University, USA)  
Zachary Miller (University of Missouri, USA)  
Mackenzie Wallace (University of Missouri, USA)  
Candace Galen (University of Missouri, USA)

### **Vision Based Crop Row Detection for Low Cost UAV Imagery in Organic Agriculture**

Vitali Czymmek (West Coast University of Applied Sciences, Germany)  
Riko Schramm (West Coast University of Applied Science, Germany)  
Stephan Hussmann (West Coast University of Applied Sciences, Germany)

### **Three-dimensional Reconstruction and Measurement of Avian Eggs through Digital Imaging**

Wasif Shafaet Chowdhury,  
Gang Lu (University of Kent, United Kingdom (Great Britain))  
Md Moinul Hossain (University of Kent, United Kingdom (Great Britain))

### **Electrical Bioimpedance Scanning in Bacterial Diagnosis and Mastitis Detection**

Rodrigo W Porto (IFSUL, Brazil)  
Luciano Carvalho Ayres (Universidade Católica de Pelotas, Brazil)  
Renato Neuenfeld (IFSUL, Brazil)  
Claudia Carvalho (IFSUL, Brazil)  
Ana Geller (IFSUL, Brazil)  
Wemerson Oliveira (IFSUL, Brazil)

### **A Measurement System for the Evaluation of Efficiency of Enzyme Accelerated CO<sub>2</sub> Capture Systems Based on Modeling**

Lorenzo Parri (University of Siena, Italy)  
Ada Fort (University of Siena, Italy)  
Valerio Vignoli (University of Siena, Italy)  
Marco Mugnaini (University of Siena, Italy)  
Anna Lo Grasso (University of Siena, Italy)  
Clemente Capasso (CNR Institute of Biosciences and Bioresources, Italy)  
Sonia Del Prete (CNR Institute of Biosciences and Bioresources (IBBR-CNR), Italy)  
Maria Novella Romanelli (University of Florence, Italy)  
Claudiu Supuran (University of Florence, Italy)

**Assessment of Indoor Air Quality of Educational Facilities Using an IoT Solution for a Healthy Learning Environment**

Tamás Kovácsházy (Budapest University of Technology and Economics, Hungary)

Attila Kanál (Budapest University of Technology and Economics, Hungary)

**Embedded Front-End for Xylem Sap Velocity Measurement with Single Pulse-Heated NTC Probe**

Dinko Oletic (University of Zagreb & Faculty of Electrical Engineering and Computing, Croatia)

Boris Snajder (University of Zagreb, Croatia)

Vedran Bilas (University of Zagreb, Croatia)

# Instrumentation and Measurement in Medical, Biomedical and Healthcare Systems

## T8-1: Instrumentation and Measurement in Medical, Biomedical and Healthcare Systems

Session Chair: Sabrina Grassini (Politecnico di Torino, Italy)

### **Towards Realisation of a Non-Invasive Blood Glucose Sensor Using Microstripline**

Samuel Zeising (University of Erlangen-Nuremberg, Germany)  
Jens Kirchner (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany)  
Hossein Fazeli Khalili (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany)  
Doaa Ahmed (Friedrich Alexander Universität Erlangen Nürnberg (FAU), Germany)  
Maximilian Lübke (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany)  
Angelika Thalmayer (Friedrich-Alexander-University Erlangen-Nürnberg, Germany)  
Georg Fischer (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany)

### **Preliminary Results for Novel Shear Force Sensor using Force Sensitive Resistors**

Steven Cramp (Carleton University, Canada)  
Cam Maccoll (Carleton University, Canada)  
Bruce Wallace (AGE-WELL NIH SAM3 & Carleton University, Canada)

### **Multi-Stage Detection of Atrial Fibrillation in Compressively Sensed Electrocardiogram**

Mohamed Abdelazez (Carleton University, Canada)  
Fereshteh Fakhar Firouzeh (Carleton University, Canada)  
Sreeraman Rajan (Carleton University, Canada)  
Adrian D.C. Chan (Carleton University, Canada)

### **Microphone Based Smartphone Enabled Spirometry Data Augmentation using Information Maximizing Generative Adversarial Network**

Sudipto Trivedy (Indian Institute of Technology Kharagpur, India)  
Manish Goyal (All India Institute of Medical Sciences, India)  
Anirban Mukherjee (Indian Institute of Technology Kharagpur, India)

### **Hemorrhage Detection by Multi-frequency Magnetic Induction Tomography with Focusing Coil**

Yixuan Chen (Tianjin University, China)  
Zhili Xiao (Tianjin University, China)  
Chao Tan (Tianjin University, China)  
Feng Dong (Tianjin University, China)

### **Correlation Between Electrical Bioimpedance and Pressure Waveform in Radial Artery and in Mechanical Pulsating Pipe System**

Margus Metshein (Tallinn University of Technology, Estonia)  
Paul Annus (Tallinn University of Technology, Estonia)  
Raul Land (Tallinn University of Technology, Estonia)  
Marek Rist (Tallinn University of Technology, Estonia)  
Mart Min (Tallinn University of Technology, Estonia)  
Olev Martens (Tallinn University of Technology, Estonia)

### **Electrical Impedance and Ultrasound Dual-Mode Tomography for Human Abdomen**

Jiaqi Han (Tianjin University, China)  
Shu Zhao (Chinese Academy of Medical Sciences and Peking Union Medical College, China)  
Shangjie Ren (Tianjin University, China)  
Feng Dong (Tianjin University, China)

### **Image Reconstruction for Multi-frequency Electromagnetic Tomography Based on Multiple Measurement Vector Model**

Jinxi Xiang (Tsinghua University, China & University of Edinburgh, United Kingdom (Great Britain))  
Zhou Chen (University of Edinburgh, United Kingdom (Great Britain))  
Yonggui Dong (Tsinghua University, China)  
Yunjie Yang (University of Edinburgh, United Kingdom (Great Britain))

### **The Possibility to Have 1 mm Positioning Accuracy of Intracardiac Catheter via Electrical Measurement**

Enkang Liu (Shanghai Jiao Tong University, China)  
Yixin Ma (Shanghai Jiao Tong University, China)  
Mingzhu Zhang (Shanghai Jiao Tong University, China)  
Hao Ge (Shanghai Jiao Tong University, China)

### **Analyses of IR Stimulation Influence on EEG**

Sasa Vlahinic (University of Rijeka, Croatia)  
Zoran Sverko (University of Rijeka, Croatia)  
David Bacnar (University of Rijeka, Croatia)  
Lovro Bebic (University of Rijeka, Croatia)

## **T8-2: Instrumentation and Measurement in Medical, Biomedical and Healthcare Systems**

*Session Chair: Ratko Magjarevic (University of Zagreb, Croatia)*

### **High-Definition Transcranial Direct Current Stimulation Device for Targeting Cerebral Cortex**

Gaurav Sharma (Indian Institute of Technology Mandi, India)  
Rakshit Raj (Indian Institute of Technology Mandi, India)  
Shubhajit Roy Chowdhury (School of Computing and Electrical Engineering, IIT Mandi, India)

### **Design and Verification of Finite-element Simulation Modeling for Vibro-acoustic Effect**

Dongdong Zheng (School of Electrical and Information Engineering, Tianjin University, China)  
Yanbin Xu (Tianjin University, China)  
Feng Dong (Tianjin University, China)

### **Wearable Medical Device for Remote Monitoring the Health of Elderly People at Home**

Diego Barrettino (Lucerne University of Applied Sciences and Arts (HSLU) & Swiss Federal Institute of Technology Lausanne (EPFL), Switzerland)  
Thomas Gisler (Lucerne University of Applied Sciences and Arts (HSLU), Switzerland)  
Christoph Zumbühl (Lucerne University of Applied Sciences and Arts (HSLU), Switzerland)  
Christian Di Battista (Lucerne University of Applied Sciences and Arts (HSLU), Switzerland)  
Raphael Kummer (Lucerne University of Applied Sciences and Arts (HSLU), Switzerland)  
Markus Thalmann (Lucerne University of Applied Sciences and Arts (HSLU), Switzerland)

### **Lifetime Improvement of Digital Microfluidic Biochips Based on the Improved Whale Optimization Algorithm for Protein Analysis Instrument System**

JinLong Shi (Harbin Institute of Technology, China)  
Ping Fu (Harbin Institute of Technology, China)  
Wenbin Zheng (Harbin Institute of Technology, China)  
Hongtao Yin (Harbin Institute of Technology, China)  
Qiao Jiaqing (Harbin Institute of Technology, China)  
Bing Liu (Harbin Institute of Technology, China)

### **Microwave Materials Characterization of Biodegradable Glass**

Katelyn R Brinker (Iowa State University & Center for Nondestructive Evaluation, USA)  
Devdatt Chattopadhyay (Missouri University of Science and Technology, USA)  
Logan Wilcox (Missouri University of Science and Technology, USA)  
Kristen M Donnell (Missouri University of Science and Technology, USA)

### **An Integrated 9x9 SPAD Array with a 10-channel TDC and a CMOS Laser Diode Driver for a Wearable Time-domain Diffuse Optics Optode**

Jussi-Pekka Jansson (University of Oulu, Finland)  
Sahba Jahromi (University of Oulu, Finland)  
Kalle Haapalainen (University of Oulu, Finland)  
Harri Juttula (University of Oulu, Finland)  
Anssi Mäkynen (University of Oulu, Finland)  
Jan Nissinen (University of Oulu, Finland)

### **Measurement Uncertainty Evaluation in Biomechanical Inverse Dynamics Analysis**

Francesco Crenna (University of Genova, Italy)  
Giovanni Battista Rossi (University of Genova, Italy)

### **Embedded System for Bimodal Biometrics with Fiducial Feature Extraction on ECG and PPG Signals**

Denisse Mancilla-Palestina (INAOE Mexico, Mexico)  
Jose Jimenez-Duarte (INAOE Mexico, Mexico)  
Juan M. Ramirez-Cortes (INAOE, Mexico)  
Álvaro Hernández Alonso (University of Alcala, Spain)  
Pilar Gomez-Gil (National Institute of Astrophysics, Optics and Electronics, Mexico)  
Jose J. Rangel-Magdaleno (INAOE, Mexico)

### **Individual Recognition by Gaussian ECG Features**

Alessandra Galli (University of Padova, Italy)  
Giada Giorgi (University of Padova, Italy)  
Claudio Narduzzi (Universita' di Padova, Italy)

### **Instrumentation for Motor Imagery-based Brain Computer Interfaces Relying on Dry Electrodes: A Functional Analysis**

Leopoldo Angrisani (University of Naples Federico II, Italy)  
Pasquale Arpaia (University of Naples Federico II, Italy)  
Francesco Donnarumma (National Research Council, Italy)  
Antonio Esposito (Politecnico di Torino & Augmented Reality for Health Monitoring Laboratory (ARHEMIlab), Italy)  
Mirco Frosolone (Università degli Studi di Napoli Federico II, Italy)  
Giovanni Improta (University of Naples, Federico II, Italy)  
Nicola Moccaldi (University of Naples Federico II, Italy)  
Angela Natalizio (CRdC Tecnologie Scarl, Italy)  
Marco Parvis (Politecnico di Torino, Italy)

### **T8-3: Instrumentation and Measurement in Medical, Biomedical and Healthcare Systems**

*Session Chair: Octavian Adrian Postolache (Instituto de Telecomunicações, Lisboa/IT & Instituto Universitario de Lisboa, ISCTE-IUL, Portugal)*

### **A Markerless System for Gait Analysis Based on OpenPose Library**

Erika D'Antonio (Università degli Studi Niccolò Cusano, Italy)  
Juri Taborri (University of Tuscia, Viterbo, Italy)  
Eduardo Palermo (Sapienza University of Rome, Italy)  
Stefano Rossi (University of Tuscia, Italy)  
Fabrizio Patanè (Niccolò Cusano University, Italy)

### **Comfort Assessment in the Use of Shotgun for Skeet Shooting: An EMG Based Approach**

Edoardo Della Santa (Marche Polytechnic University, Italy)  
Lorenzo Scalise (Università Politecnica delle Marche, Italy)  
Milena Martarelli (Marche Polytechnic University, Italy)  
Barbara Lonzi (Benelli Armi spa, Italy)  
Loredana Banci (Benelli Armi spa, Italy)  
Riccardo Monzoni (University of Urbino Carlo Bo, Italy)



### **Artificial Classification System for Urothelial Carcinoma**

Yu-Chieh Chen (The Institute of Electrical Engineering, National Tsing-Hua University & Taiwan Instrument Research Institute, NARL, Taiwan)  
Chih-Chieh Huang (Taiwan Instrument Research Institute, NARL, Taiwan)  
Da-Ren Liu (Instrument Technology Research Center, National Applied Research Laboratories, Taiwan)  
Chi-Hung Hwang (Instrument Technology Research Center, Taiwan)  
Wei-Chen Lin (E-DA Hospital, Taiwan)  
Chao-Tian Hsu (E-DA Hospital, Taiwan)

### **Model-Based Filtering of EEG Alpha Waves for Enhanced Accuracy in Dynamic Conditions and Artifact Detection**

Valentina Casadei (University of Liverpool, United Kingdom (Great Britain))  
Roberto Ferrero (University of Liverpool, United Kingdom (Great Britain))  
Christopher Brown (University of Liverpool, United Kingdom (Great Britain))

### **Employment of Nb2O5 Thin-films for Ethanol Sensing**

Alessio Gullino (Politecnico di Torino, Italy)  
Nicola Donato (University of Messina, Italy)  
Sabrina Grassini (Politecnico di Torino, Italy)  
Marco Parvis (Politecnico di Torino, Italy)  
Kaveh Moulaei (University of Messina, Italy)  
Giovanni Neri (University of Messina, Italy)  
Luca Lombardo (Politecnico di Torino, Italy)

### **A Customized Bioimpedance Meter for Monitoring Insulin Bioavailability**

Giovanni Annuzzi (Università Federico II, Italy)  
Pasquale Arpaia (University of Naples Federico II, Italy)  
Umberto Cesaro (University of Naples Federico II, Italy)  
Ornella Cuomo (Università degli studi di Napoli Federico II, Italy)  
Mirco Frosolone (Università degli Studi di Napoli Federico II, Italy)  
Sabrina Grassini (Politecnico di Torino, Italy)  
Nicola Moccaldi (University of Naples Federico II, Italy)  
Isabella Sannino (Polytechnic of Turin, Italy)

### **Monitoring Diabetic Ketoacidosis by Urine Ketones Tracing Using an E- Nose**

Jorge Javier Mendoza Montoya (Andina Néstor Cáceres Velásquez University, Peru)  
Germán Torregrosa-Penalva (Universidad Miguel Hernández, Spain)  
Ernesto Ávila Navarro (Miguel Hernández University, Spain)  
Jose Chilo (University of Gavle, Sweden)

### **ECG Baseline Wander Removal via a Signal-Piloted Filtering**

Saeed Mian Qaisar (Effat University, Jeddah, KSA & INPG, ENSEIRB, France)  
Dominique Dallet (IMS Laboratory - Bordeaux INP - University Bordeaux, France)

### **Smart Ballistocardiography Front-end**

Guillaume Cathelain (Ecole Pratique des Hautes Etudes - PSL, France)  
Bertrand Rivet (Grenoble INP, France)  
Sophie Achard (Grenoble INP, France)  
Jean Bergounioux (Assistance Publique des Hôpitaux de Paris, France)  
François Jouen (Ecole Pratique des Hautes Etudes - PSL, France)

### **Energy Detection for Spectrum Sensing in Medical Telemetry Networks using Modified NLMS Algorithm**

Aime' Lay-Ekuakille (University of Salento, Italy)  
S. Surekha (K L University, India)  
Mohammad Zia Ur Rahman (K L University, India)  
Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)  
Moise Avoci Ugwiri (University of Salerno, Italy)

#### **T8-4: Instrumentation and Measurement in Medical, Biomedical and Healthcare Systems**

*Session Chairs: Sabrina Grassini (Politecnico di Torino, Italy)*

*Ratko Magjarevic (University of Zagreb, Croatia)*

##### **Blood Dilution Measurement by a Dual Laser Fluorimeter**

Bahareh Madadkhahsalmassi (New Zealand & University of Auckland, New Zealand)

James McKeage (Auckland Bioengineering Institute, New Zealand)

Bryan P. Ruddy (University of Auckland, New Zealand)

Andrew Taberner (University of Auckland, New Zealand)

##### **Evaluation of Position RMS Error from Magnetic Field Gradient for Surgical EM Tracking Systems**

Mattia Alessandro Ragolia (Politecnico di Bari, Italy)

Filippo Attivissimo (Politecnico of Bari, Italy)

Attilio Di Nisio (Politecnico di Bari, Italy)

Anna Maria Lucia Lanzolla (Polytechnic of Bari, Italy)

##### **Fast Single Tracking Location Shear Wave Elasticity Imaging**

Yang Xiao (Harbin Institute of Technology, China)

Jing Jin (Harbin institute of Technology, China)

Yue Zhao (Harbin Institute of Technology, China)

Yu Yuan (Harbin Institute of Technology, China)

Shen Yi (Harbin Institute of Technology, China)

Naizhang Feng (Harbin Institute of Technology, China)

##### **A Modified Ray Tracing Method for Ultrasound Computed Tomography in Breast Imaging**

Yu Yuan (Harbin Institute of Technology, China)

Shen Yi (Harbin Institute of Technology, China)

Yue Zhao (Harbin Institute of Technology, China)

Yang Xiao (Harbin Institute of Technology, China)

Jing Jin (Harbin institute of Technology, China)

Naizhang Feng (Harbin Institute of Technology, China)

##### **Gamma Camera Motion Parameters Estimation Using Binocular Camera for Accurate Radioactive Source Image Reconstruction**

Yueer Li (Beijing Institute of Technology, China)

Zhibiao Cheng (Beijing Institute of Technology, China)

Junhai Wen (Beijing Institute of Technology, China)

Fengfu Wei (China Academy of Engineering Physics, China)

Chen Yang (Beijing Institute of Technology, China)

##### **High Intensity Focused Ultrasound (HIFU) Pressure Field Characterization**

Baki Karaböce (TÜBİTAK UME & National Metrology Institute of Turkey, Turkey)

Süreyya Yıldız (Mustafa Kemal University, Turkey)

Ali Şahin (Lecturer at İnönü University, Malatya, Turkey)

##### **Temperature Effect of HIFU with Thermal Dose Estimation**

Emel Çetin (National Metrology Institute, Turkey)

Oya Orun (Marmara University School of Medicine, Turkey)

Baki Karaböce (TÜBİTAK UME & National Metrology Institute of Turkey, Turkey)

Olca Kilinc (Marmara University, School of Medicine, Turkey)

Hüseyin Okan Durmuş (National Metrology Institute, Turkey)

##### **Ultrasonic Power Calculation by Linear Regression Method**

Baki Karaböce (TÜBİTAK UME & National Metrology Institute of Turkey, Turkey)

Mithat Özdingiş (National Metrology Institute, Turkey)

# Non-Destructive Testing and Evaluation

## T9-1: Non- Destructive Testing and Evaluation

Session Chair: Davorin Ambruš (University of Zagreb, Croatia)

### **A Kalman-based Phase-locked Demodulation for Electromagnetic Acoustic Transducer**

Yong Li (Beijing Jiaotong University, China)  
Ze Liu (Beijing Jiaotong University, China)  
Wei Yuan (Beijing Jiaotong University, China)  
Yuanli Yue (Beijing Jiaotong University, China)  
Zheliang Liu (Beijing Jiaotong University, China)

### **Active Microwave Thermographic Measurement of In-Plane Thermal Diffusivity**

Ali Mirala (Missouri University of Science and Technology, USA)  
Kristen M Donnell (Missouri University of Science and Technology, USA)

### **Online Quality Assurance of Microchannels in Roll-to-Roll by Optical Coherence Tomography**

Janne Lauri (Optoelectronics and Measurement Techniques Research Unit University of Oulu, Finland)  
Christina Liedert (VTT, Technical Research Centre of Finland, Finland)  
Ralph Liedert (VTT, Technical Research Centre of Finland, Finland)  
Tapio Fabritius (Optoelectronics and Measurement Techniques Research Unit University of Oulu, Finland)

### **Real-time Measurement of Electrical Conductivity for Aluminium Wires Using a Novel Calibration Method**

Shuang Zhu (University of Manchester, United Kingdom (Great Britain))  
Jorge Ricardo Salas Avila (University of Manchester, United Kingdom (Great Britain))  
Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))  
Anthony Peyton (University of Manchester, United Kingdom (Great Britain))  
Stewart Williams (Cranfield University, United Kingdom (Great Britain))  
Jialuo Ding (Cranfield University, United Kingdom (Great Britain))

### **Identifying Surface Defect Opening Profiles Based on the Uniform Magnetic Field Distortion**

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

### **Measuring and Modelling the Thermal Behavior of LEDs in Structural Electronics**

Esa Hannila (Optoelectronics and Measurement Techniques Research Unit, Finland)  
Noora Heinilehto (Technical Research Centre of Finland Ltd, VTT, Finland)  
Janne Lauri (Optoelectronics and Measurement Techniques Research Unit, Finland)  
Kimmo Keränen (Technical Research Centre of Finland Ltd, VTT, Finland)  
Tapio Fabritius (University of Oulu, Finland)

### **An Element-Combination Method for Arbitrary Defect Reconstruction from MFL Signals**

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

## **T9-2: Non- Destructive Testing and Evaluation**

*Session Chair: Marco Ricci (Università della Calabria & Polo Scientifico Didattico di Terni, Italy)*

### **A Trustable 3D Photogrammetry Approach for Cultural Heritage**

Leila Es Sebar (Politecnico di Torino, Italy)  
Emma Paola Angelini (Politecnico di Torino, Italy)  
Sabrina Grassini (Politecnico di Torino, Italy)  
Marco Parvis (Politecnico di Torino, Italy)  
Luca Lombardo (Politecnico di Torino, Italy)

### **IC Discrimination via Novel S-Parameter Measurement Technique**

Derek Johnston (Texas Tech University, USA)  
Brian Nutter (Texas Tech University, USA)  
Richard Gale (Texas Tech, USA)

### **Characterization of Magnetic Steels for the FCC-ee Magnet Prototypes**

Jaime Anglada (CERN, Switzerland)  
Pasquale Arpaia (University of Naples Federico II, Italy)  
Marco Buzio (CERN, Switzerland)  
Mariano Pentella (Politecnico di Torino & CERN, Italy)  
Carlo Petrone (CERN, Switzerland)

### **Acoustic Resonance Recognition of Coins**

Ivan Kraljeviski (Fraunhofer IKTS, Germany)  
Frank Duckhorn (Fraunhofer IKTS, Germany)  
Yong Chul Ju (Fraunhofer IKTS, Germany)  
Constanze Tschoepe (Fraunhofer IKTS, Germany)  
Christian Richter (BTU Cottbus-Senftenberg, Germany)  
Matthias Wolff (BTU Cottbus-Senftenberg, Germany)

### **Measurement and Characterization of Nano-Electro-Mechanical Systems Using Laser Interferometry**

Valentina Bello (University of Pavia, Italy)  
Atakan B. Ari (Boston University, USA)  
M. Selim Hanay (Bilkent University, Turkey)  
Kamil L. Ekinici (Boston University, USA)

### **A New Microwave Method for On-Site Integrity Monitoring of Pipelines**

Leopoldo Angrisani (University of Naples Federico II, Italy)  
Giuseppe Cannazza (University of Salento, Italy)  
Egidio De Benedetto (University of Naples, Italy)  
Andrea Cataldo (University of Salento, Italy)  
Emanuele Piuze (Sapienza University of Rome, Italy)

### **A New Dual Magnetic Sensor Probe for Lift-off Compensation in Magnetic Flux Leakage Detection**

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

## **T9-3: Non- Destructive Testing and Evaluation**

*Session Chair: Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))*

### **Separation of Overlapping Reflected Signals in Stepped-Frequency Waveform Reflectometry**

Nicola Giaquinto (Politecnico di Bari, Italy)  
Marco Scarpetta (Polytechnic University of Bari, Italy)  
Maurizio Spadavecchia (Polytechnic University of Bari, Italy)

### **Magnetic Moment Direction Estimation Based on Magnetic Anomaly Signature Analysis**

Jiazeng Wang (HEU, China)

Ying Shen (NONE, China)

Junqi Gao (HEU, China)

Lingsi Sun (HEU, China)

### **NDTNet: Optical Nondestructive Evaluation with Compact Convolutional Neural Network**

Raunak Borwankar (Worcester Polytechnic Institute, USA)

Reinhold Ludwig (Worcester Polytechnic Institute, USA)

### **A Linear Temperature Extraction Method from Voigt Lineshape Profile in Laser Absorption Spectroscopy**

Shuang Qiu (Beihang University, China)

Zhang Cao (Beihang University, China)

Lijun Xu (Beihang University, China)

### **Assessment of Pressure Vessel Based on Variational Bayesian**

Chun Yin (University of Electronic Science and Technology of China & School of Automation Engineering, China)

Hao-Nan Zhang (University of Electronic Science and Technology of China, China)

Yuhua Cheng (University of Electronic Science and Technology of China & School of Automation Engineering, China)

Xuegang Huang (China Aerodynamics Research & Development Center, China)

Kai Chen (University of Electronic Science and Technology of China, China)

Anhua Shi (China Aerodynamics Research & Development Center, China)

Xuan Gou (University of Electronic Science and Technology of China, China)

### **Eddy Current Phase Gradient and Its Identification of Conductive Material Defects**

Xiaoxiao Ma (Tiangong University, China)

Hongli Li (Tiangong University, China)

Song Ye (Tanjin University, China)

Qian Zhao (Qufu Normal University, China)

Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))

# Measurement Theory and Metrology

## **T10: Measurement Theory and Metrology**

*Session Chair: Marco Parvis (Politecnico di Torino, Italy)*

### **Compound-oriented Measurement Processes: Elements, Molecules, Structures**

Heidi Fleischer (University of Rostock, Germany)

Kerstin Thurow (Center for Life Science Automation - CELISCA, Germany)

### **Research on the Characteristics of Graphene-metal Contact**

Chunyu Pan (School of Automation Science and Electrical Engineering, Beihang University, Beijing, China)

Jing Wu (Beihang University, China)

Jingwen Zhang (BUAA, China)

Songling Huang (Tsinghua university, China)

Yue Long (Tsinghua University, China)

### **Dynamic Compensation for a Second Order Measuring Device**

Giovanni Battista Rossi (University of Genova, Italy)

Francesco Crenna (University of Genova, Italy)

### **Calibration of Burdens for Instrument Transformers**

Karel Draxler (Czech Technical University in Prague, Czech Republic)

Michal Ulvr (Czech Metrology Institute, Czech Republic)

Renata Styblikova (Czech Metrology Institute, Czech Republic)

Jan Hlavacek (Czech Technical University in Prague, Czech Republic)

### **Progress Toward an Atomic Clock Based on a Continuous Cold Rubidium Beam**

Zhixin Meng (Tsinghua University, China)

Peiqiang Yan (Tsinghua University, China)

Xiaojie Li (Tsinghua University, China)

Yanying Feng (Tsinghua University, China)

### **Automatic Uncertainty Propagation Based on the Unscented Transform**

Dailys Arronde Perez (University of Klagenfurt, Austria)

Harald Gietler (University of Klagenfurt, Austria)

Hubert Zangl (Alpen-Adria Universität, Austria)

# Signal Processing for Instrumentation and Measurement

## T11-1: Signal Processing for Instrumentation and Measurement

Session Chair: Luca De Vito (University of Sannio, Italy)

### Nonlinear Compensation for High Speed Analog to Digital Converter

Karen Hovakimyan (Tektronix, USA)  
Norayr Yengibaryan (Institute of Mathematics)  
Tigran Hovakimyan (Yerevan State University, Armenia)  
Hungming Chang (Tektronix, USA)

### A Dual Synchronous Demodulator for Phase Sensitive Detection Applications

Alejandro Marquez (University of Zaragoza, Spain)  
Nicolas Medrano (University of Zaragoza, Spain)  
Belen Calvo (University of Zaragoza, Spain)  
Jorge Perez-Bailon (University of Zaragoza & Group of Electronic Design, Spain)

### A 1.8 V Gm-C Highly Tunable Low Pass Filter for Sensing Applications

Jorge Perez-Bailon (University of Zaragoza & Group of Electronic Design, Spain)  
Belen Calvo (University of Zaragoza, Spain)  
Nicolas Medrano (University of Zaragoza, Spain)  
Jaime Ramirez-Angulo (New Mexico State University, USA)

### Ultrasound Tomography Using Limited Rays in Transmission Field

Nan Wu (Tianjin University, China)  
Shu Zhao (Chinese Academy of Medical Sciences and Peking Union Medical College, China)  
Feng Dong (Tianjin University, China)

### Effect of Frequency Uncertainty on the Sine-wave Amplitude Estimator Returned by Linear Least-Squares Fitting

Daniel Belega (University of Timisoara, Romania)  
Dario Petri (University of Trento, Italy)

### FFT-based Identification of Gilbert-Elliott Data Loss Models

András Palkó (Budapest University of Technology and Economics, Hungary)  
László Sujbert (Budapest University of Technology and Economics, Hungary)

### Measurement of Cardiac Parameters by Motion Artifacts Free Photoplethysmography Signals

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

### Bearing Fault detection on IM using MCSA and Sparse Representation

Carlos Morales-Perez (National Institute for Astrophysics, Optics and Electronics, Mexico)  
Jose J. Rangel-Magdaleno (INAOE, Mexico)  
Hayde Peregrina-Barreto (Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico)  
Juan M. Ramirez-Cortes (INAOE, Mexico)

## T11-2: Signal Processing for Instrumentation and Measurement

Session Chair: Kurt Barbé (Vrije Universiteit Brussel & Faculty of Sciences, Belgium)

### Classification Reliability of 3D Shapes using Neural Networks in Case of Partial and Noisy Models

Simone Paganoni (Politecnico di Milano, Italy)  
Emanuele Zappa (Politecnico di Milano, Italy)  
Simone Turrise (Politecnico di Milano, Italy)

### **Hybrid Neural Network Based on Feature Fusion for Vehicle Type Identification**

Haoze Chen (North University of China, China)  
Zhijie Zhang (North University of China, China)  
Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))  
Mingquan Wang (North University of China, China)  
Meng Lifan (North University of China, China)  
Xiaojian Hao (North University of China, China)

### **Bandwidth Based Design Methodology for Wiener Filters for Online Signal Denoising**

Markus Neumayer (Graz University of Technology, Austria)  
Thomas Bretterklier (Graz University of Technology, Austria)

### **Evaluation of MAI Effect in Encoding Techniques for an Infrared Positioning System**

Elena Aparicio-Esteve (University of Alcalá, Spain)  
Alvaro Hernández (University of Alcalá, Spain)  
Jesús Ureña Ureña (University of Alcalá, Spain)

### **Single Node Detection on Direction of Approach**

Sungyoun Seo (Sungkyunkwan University, Korea)  
Seunghyun Yeo (Dankook University, Korea (South))  
Heejae Han (Purdue University, USA)  
Youlim Ko (Purdue University, USA)  
Kar Ee Ho (Purdue University, USA)  
Eric Matson (Purdue University, USA)

### **Polarization Angle Detection Method of High Stability Light Based on Faraday Modulation**

Wen Ye (National Institute of Metrology, China)  
Bo Wang (Beihang University, China)  
Chenguang Cai (National Institute of Metrology, China)

### **Indoor Silent Object Localization Using Ambient Acoustic Noise Fingerprinting**

Meng Jiang (Mid Sweden University, Sweden)  
Jan Lundgren (Mid Sweden University, Sweden)  
Shahab Pasha (Mid Sweden University, Sweden)  
Marco Carratù (University of Salerno, Italy)  
Consolatina Liguori (University of Salerno, Italy)  
Goran Thungstrom (Mid Sweden University, Sweden)

### **Application of Manifold Learning Algorithms to Improve the Classification Performance of an Electronic Nose**

Jersson X Leon-Medina (Universidad Nacional de Colombia sede Bogotá, Colombia)  
Maribel Anaya (Universidad Santo Tomás Bogotá, Colombia)  
Francesc Pozo (Universitat Politècnica de Catalunya (UPC), Spain)  
Diego Tibaduiza (Universidad Nacional de Colombia sede Bogotá, Colombia)

## **T11-3: Signal Processing for Instrumentation and Measurement**

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

### **Performance Comparison of FIR Low-Pass Digital Differentiators for Measurement Applications**

David Macii (University of Trento, Italy)  
Dario Petri (University of Trento, Italy)

### **Large Structures Natural Frequencies Estimation Using a Limited Number of Sensors**

Simone Turrisi (Politecnico di Milano, Italy)  
Emanuele Zappa (Politecnico di Milano, Italy)  
Alfredo Cigada (Politecnico di Milano, Italy)  
Tobias Hötzer (Politecnico di Milano, Italy)



### **An Enhanced Oscillator Model for Clock Synchronization Protocols**

Balázs Renczes (Budapest University of Technology and Economics & Faculty of Electrical Engineering and Informatics, Hungary)

Tamás Kovácsházy (Budapest University of Technology and Economics, Hungary)

### **A Novel IVS Procedure for Handling Big Data with Artificial Neural Networks**

Marco Carratù (University of Salerno, Italy)

Consolatina Liguori (University of Salerno, Italy)

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Mattias O'Nils (Mid Sweden University, Sweden)

Jan Lundgren (Mid Sweden University, Sweden)

### **A Weak Magnetic Field Sensor with InSb-Magnetometers and Lock-in Amplifier**

Oussama Ferhi (Ostfalia University of Applied Sciences, Germany)

Marvin Sandner (Ostfalia Hochschule für Angewandte Wissenschaften, Germany)

Kris Rohrmann (Ostfalia University of Applied Sciences, Germany)

Phil Meier (Ostfalia University of Applied Sciences, Germany)

Marcus Prochaska (Ostfalia University of Applied Sciences, Germany)

### **Improved Recovery of Compressively Sensed Speech**

Fereshteh Fakhar Firouzeh (Carleton University, Canada)

Mohamed Abdelazez (Carleton University, Canada)

Sina Salsabili (Carleton University, Canada)

Sreeraman Rajan (Carleton University, Canada)

### **Defining Thresholds for Leak Detection Parameters Through Statistical Analysis of the Noise in Water/Gas Pipelines**

Dimitrios Kappelopoulos (Aristotle University of Thessaloniki, Greece)

George-Napoleon Papastavrou (Aristotle University of Thessaloniki, Greece)

Georgios - Panagiotis Kousiopoulos (Aristotle University of Thessaloniki, Greece)

Nikolaos Karagiorgos (Aristotle University of Thessaloniki, Greece)

Dimitrios Porlidas (Hellenic Petroleum)

Spiros Nikolaidis (Aristotle University of Thessaloniki, Greece)

### **Compressive Sensing Based Data Acquisition Architecture for Transient Stellar Events in Crowded Star Fields**

Asmita Korde-Patel (NASA Goddard Space Flight Center, USA)

Richard Barry (NASA/GSFC, USA)

Tinoosh Mohsenin (University of Maryland Baltimore County, USA)

## **T11-4: Signal Processing for Instrumentation and Measurement**

*Session Chair: Luca De Vito (University of Sannio, Italy)*

### **One-Bit Measurement of the Parameters of Multiple Sinusoids with Unknown Frequency**

Paolo Carbone (University of Perugia, Italy)

Alessio De Angelis (University of Perugia, Italy)

Antonio Moschitta (University of Perugia, Italy)

### **A Pruning Technique for Volterra Models: Exploiting Knowledge About Input Spectrum**

Marco Faifer (Politecnico di Milano, Italy)

Christian Laurano (Politecnico di Milano, Italy)

Roberto Ottoboni (Politecnico di Milano, Italy)

Sergio Toscani (Politecnico di Milano, Italy)

Michele Zanoni (Politecnico di Milano, Italy)

### **A Measurement Fault Elimination Method in One-dimensional Fourier Phase Retrieval**

Pinjun Zheng (Harbin Institute of Technology, China)

Ying Liu (Aerospace DaDao Co. Ltd., China)

Ning Fu (Harbin Institute of Technology, China)

Liyan Qiao (Harbin Institute of Technology, China)

### **Dual Measurement Mode Rotational Viscometer**

Tapio Fabritiu (University of Oulu, Finland)  
Päivö Kinnunen (University of Oulu, Finland)  
Jakub Czajkowski (Microsoft, Finland)

### **A Low-cost TDoA-based Ultrasonic Positioning System**

Antonella Comuniello (University of Perugia, Italy)  
Alessio De Angelis (University of Perugia, Italy)  
Antonio Moschitta (University of Perugia, Italy)

### **Simultaneous Amplitude Measurement of Multiple Chirp Spread Spectrum Signals**

Antonio Moschitta (University of Perugia, Italy)  
Antonella Comuniello (University of Perugia, Italy)  
Francesco Santoni (University of Perugia, Italy)  
Alessio De Angelis (University of Perugia, Italy)  
Paolo Carbone (University of Perugia, Italy)  
Mario Luca Fravolini (University of Perugia, Italy)

### **Using Trajectory Features for Tai Chi Action Recognition**

Leiyang Xu (Harbin Institute of Technology, China)  
Qiang Wang (Harbin Institute of Technology, China)  
Lin Yuan (Harbin Institute of Technology, China)  
Xiang Ma (Harbin Institute of Technology, China)

### **Sign Language Recognition Based on Concept Learning**

Xiang Ma (Harbin Institute of Technology, China)  
Lin Yuan (Harbin Institute of Technology, China)  
Ruoshi Wen (Harbin Institute of Technology, China)  
Qiang Wang (Harbin Institute of Technology, China)

## **T11-5: Signal Processing for Instrumentation and Measurement**

*Session Chair: Kurt Barbé (Vrije Universiteit Brussel & Faculty of Sciences, Belgium)*

### **Acoustic Cavitation Detection Produced by Ultrasound in an Agarose-gel Phantom Analyzed with Frequencies Spectrogram**

Jorge Alberto Rodríguez (Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional, Mexico)  
Lorenzo LEija (Cinvestav IPN, Mexico)  
Arturo Vera (Centro de Investigación y de Estudios Avanzados del IPN, Mexico)  
Mario Gutierrez (Instituto Nacional de Rehabilitacion & CONACYT, Mexico)  
Carlos Negreira (Universidad de la República, Uruguay)  
Antonio Ramos Fernandez (CSIC, Mexico)

### **A New Frequency Estimation Algorithm for IIoT Applications and Low-cost Instrumentation**

Giuseppe Campobello (University of Messina, Italy)  
Antonino Segreto (University of Messina, Italy)  
Nicola Donato (University of Messina, Italy)

### **Applicability of Multiple Impulse-radar Sensors for Estimation of Person's Three-dimensional Position**

Pawel Mazurek (Warsaw University of Technology, Poland)

### **Modified Multisine Fitting Algorithm for the Estimation of Time-Varying Carrier Frequency Signal Parameters**

Domenico Luca Carni (University of Calabria, Italy)  
Francesco Lamonaca (University of Sannio, Italy)

### **Parallelized Sequential Indexing Tables for Fast High-Volume Data Processing**

Balazs Tusor (Óbuda University, Hungary & J Selye University (Researcher), Slovakia)  
János Tóth (J. Selye University, Slovakia)  
Annamária R. Várkonyi-Kóczy (Óbuda University, Hungary)

### **FPGA Realization of Hardware-Flexible Parallel Structure FIR Filters Using Combined Systolic Arrays**

Dai Xuefeng (UESTC, China)

Gu Jun (UESTC, China)

Ye Peng (University of Electronic Science and Technology of China, China)

Yu Zhao (University of Electronic Science and Technology of China, China)

Kuojun Yang (University of Electronic Science and Technology of China, China)

### **A Kernel-Based Nonlinear Blind Source Separation Algorithm with Reference and Its Application in Satellite Micro-vibration System**

Xin Luo (Xi'an Jiaotong University, China)

Zhousuo Zhang (Xi'an Jiaotong University, China)

Teng Gong (Xi'an Jiaotong University, China)

Yuheng Yang (Xi'an Jiaotong University, China)

Yongjie Li (Xi'an Jiaotong University, China)

### **Nonlinear System Identification 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)

## **T11-6: Signal Processing for Instrumentation and Measurement**

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

### **A Linearity Testing of Cascaded Analog Mixed-Signal Blocks Using SEIR Method**

Tatsuya Ishikawa (Keio University, Japan)

Chia-Wei Pai (Keio University, Japan)

Hiroki Ishikuro (Keio University, Japan)

### **Feasibility of Utilizing Smart-phone Cameras for Seismic Structural Damage Detection**

Ahmed Alzughabi (University of California, Irvine, USA)

Ahmed M. Ibrahim (University of California, Irvine, USA)

Yunsu Na (University of Michigan, USA)

Sherif El-Tawil (University of Michigan, USA)

Ahmed M. Eltawil (King Abdullah University of Science and Technology, Saudi Arabia)

### **Research on Bearing Fault Diagnosis Method Based on Two-Dimensional Convolutional Neural Network**

Yuhang Wang (Beijing Jiaotong University, China)

Hesheng Zhang (Beijing Jiaotong University, China)

Xiaotao Hu (Beijing Jiaotong University, China)

### **All-ConvNet: A Lightweight All CNN for Neuromuscular Activity Recognition Using Instantaneous High-Density Surface EMG Images**

Rabiul Islam (Universite du Quebec a Trois-Rivieres, Canada)

Daniel Massicotte (Universite du Quebec a Trois-Rivieres, Canada)

Wei-Ping Zhu (Concordia University, Canada)

### **Estimation of Instantaneous Frequency in the Presence of Interfering Trajectories**

Leopoldo Angrisani (University of Naples Federico II, Italy)

Rosario Schiano Lo Moriello (Università degli Studi di Napoli Federico II, Italy)

Alessandro Tocchi (Università di Napoli Federico II, Italy)

Giorgio de Alteriis (Università degli Studi di Bergamo, Italy)

Davide Ruggiero (STMicroelectronics, Italy)

Francesco Capasso (Università degli Studi Di Napoli Federico II, Italy)

## **A Novel CS-based Measurement Method for Impairments Identification in Wireline Channels**

Eulalia Balestrieri (University of Sannio, Italy)

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)

# Instrumentation and Measurement in Robotics

## **T12: Instrumentation and Measurement in Robotics**

*Session Chairs: Valner Brusamarello (UFRGS, Brazil)*

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

### **Angular Measurement of High Precision Reducer for Industrial Robot**

Jie Xue (Tianjin University, China)

Zurong Qiu (Tianjin University, China)

Lin Fang (Tianjin University, China)

Yaohuan Lu (Tianjin University, China)

Wenchuan Hu (Tianjin University of Technology and Education, China)

### **A Positioning Filter Based on Uncertainty and Observability Analyses for Nonholonomic Robots**

Luigi Palopoli (Universita` di Trento, Italy)

David Macii (University of Trento, Italy)

Daniele Fontanelli (University of Trento, Italy)

### **Majority Effect in Cooperative Localisation of Mobile Agents using Ranging Measurements**

Sebastiano Dal Ben (University of Trento, Italy)

Daniele Fontanelli (University of Trento, Italy)

### **Collaborative Localization Sensor for Mobile Robots in Feature-Free Environments**

Shengsong Yang (University of Ottawa, Canada)

Pierre Payeur (University of Ottawa, Canada)

### **Scalable Retrofit Angular Position Sensor System**

Harald Gietler (University of Klagenfurt)

Christian Stetco (University of Klagenfurt)

Hubert Zangl (University of Klagenfurt)

### **When Measurements Fail: Using an Interactive SLAM Solution to Fight Bad Odometry**

Robert Milijaš (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia)

Juraj Oršulić (University of Zagreb, Faculty of Electrical Engineering and Computing, Croatia)

Stjepan Bogdan (University of Zagreb, Croatia)

### **Training Musculoskeletal Arm Play Taichi with Deep Reinforcement Learning**

Haoran Xu (Harbin Institute of Technology, China)

Xiang Ma (Harbin Institute of Technology, China)

Leiyang Xu (Harbin Institute of Technology, China)

Qiang Wang (Harbin Institute of Technology, China)

# Micro and Nanotechnology in Instrumentation and Measurement

## **T13: Micro and Nanotechnology in Instrumentation and Measurement**

*Session Chairs: Salvatore Graziani (University of Catania, Italy)*

*Emile Martincic (University of Paris Sud, France)*

### **Integrated Silicon Nitride Horizontal Long Period Grating for Refractometric Gas Sensing Applications**

Clement Deleau (LAAS-CNRS, France)

Olivier Daniel Bernal (LAAS-CNRS, Université de Toulouse, France)

Frederic Surre (City University London, United Kingdom (Great Britain))

Han Cheng Seat (LAAS-CNRS, France)

Hélène Tap (LAAS-CNRS, Université de Toulouse, France)

### **Efficient Demodulation for Measuring the Amplitude of Mechanical Oscillations**

Mathias Poik (TU Wien, Austria)

Dominik Kohl (TU Wien, Austria)

Mario Mayr (TU Wien, Austria)

Christoph Kerschner (TU Wien, Austria)

Georg Schitter (Vienna University of Technology, Austria)

### **Design of 2D Plasmonic Diffraction Gratings for Sensing and Super-Resolution Imaging Applications**

Aran Warren (University Of Canterbury, New Zealand)

Maan Alkaisi (University Of Canterbury, New Zealand)

Ciaran Moore (University of Canterbury, New Zealand)

### **Fluxgate Configuration for Obtaining Magnetic Properties of Catalytic Nanoparticles: A Feasibility Study**

Nikolaos Tsakoumis (Norges Teknisk-Naturvitenskapelige Universitet, Norway)

Anargyros T. Baklezos (National Technical University of Athens, Greece)

Ioannis Vardiambasis (Hellenic Mediterranean University, Greece)

Theodoros Kapetanakis (Hellenic Mediterranean University, Greece)

Christos D. Nikolopoulos (National Technical University of Athens & School of Electrical and Computer Engineering, Greece)

# Networked Embedded Systems and Communication Systems

## **T14: Networked Embedded Systems and Communication Systems**

*Session Chairs: Domenico Capriglione (University of Salerno, Italy)*

*Michele Magno (ETH Zurich, Switzerland)*

### **Measurement of Internal Self-Interference of USRP Family of Devices in Full-Duplex Operations**

Arul Mathi Maran Chandran (Missouri University of Science and Technology, USA)

Maciej Zawodniok (Missouri University of Science and Technology, USA)

### **Blockchain-Based Infrastructure to Enable Trust in IoT Environment**

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Laura De Santis (University of Salerno, Italy)

Vincenzo Paciello (University of Salerno & DIIIn Università Degli studi di Salerno, Italy)

### **Experimental Test of ECDSA Digital Signature Robustness from Timing-lattice Attack**

Leopoldo Angrisani (University of Naples Federico II, Italy)

Pasquale Arpaia (University of Naples Federico II, Italy)

Francesco Bonavolontà (Università di Napoli Federico II, Italy)

Antonella Cioffi (University of Naples Federico II, Italy)

### **Unconventional Communication Channels for Smart Sensors Networking**

Domenico Di Caro (University of Salerno, Italy)

Giuseppe Di Leo (University of Salerno, Italy)

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Vincenzo Paciello (University of Salerno & DIIIn Università Degli studi di Salerno, Italy)

### **Measurements of 3G and 4G Signal Attenuation in Adobe Buildings Structures**

Julio R Lopez, H (Universidad Nacional de San Agustín de Arequipa & Telefónica del Perú SAA, Peru)

Mauricio Postigo-Malaga (Universidad Nacional de San Agustín, Peru)

Pablo Yanyachi (Universidad Nacional de San Agustín, Peru)

Jose Chilo (University of Gavle, Sweden)

### **Evaluation of the Applicability of BLE-Based Wireless Sensor Networks for Operational Modal Analysis**

Alvaro Julian Torres Di Zeo (ASML, The Netherlands)

Reza Taherkhani (Delft University of Technology, The Netherlands)

Stoyan Nihtianov (Technical University - Delft, The Netherlands)

### **Short-range Wirelessly Powered Sensor Network: Concept and Initial Measurement**

Stanislav Drozd (Czech Technical University in Prague & Faculty of Electrical Engineering, Czech Republic)

Radislav Smid (Czech Technical University in Prague, Czech Republic)

### **A Comparative Approach of Unsupervised Machine Learning Techniques for LTE Network Parameter Clustering**

Nicola Pasquino (University of Naples Federico II, Italy)

Stefania Zinno (University Federico II of Naples, Italy)

Federica Cotugno (Università degli Studi di Napoli Federico II, Italy)

Sofia Petrocelli (University of Naples Federico II, Italy)

### **Improved Measurement System for the Evaluation of GNSS Receivers for Timing Applications**

Tamás Kovács házy (Budapest University of Technology and Economics, Hungary)

Ádám Hollós (Budapest University of Technology and Economics, Hungary)

# Sensors and Transducers

## T15-1: Sensors and Transducers

Session Chair: Bruno Andò (University of Catania, Italy)

### **Analysis of Fiber-Optic Coil SHUPE Effect for Different Fiber Coil Winding Structure and Winding Processes Optimization**

Ruifeng Yang (North University of China, China)  
Shuangchao Ge (North University of China, China)  
Bin Li (Taiyuan Satellite Launch Center, China)  
Chenxia Guo (North University of China, China)

### **Meanderline Coil Arrangement of Ultrasonic Wave Line-Focusing Electromagnetic Acoustic Transducers**

Hongyu Sun (Tsinghua University, China)  
Songling Huang (Tsinghua University, China)  
Shen Wang (Tsinghua University, China)  
Wei Zhao (Tsinghua University, China)

### **Characterisation of Zinc Oxide Thin-Film Solidly Mounted Resonators for Particle Sensing in Air**

Jan P Specht (University of Warwick, United Kingdom (Great Britain))  
Siavash Esfahani (University of Warwick, United Kingdom (Great Britain))  
Yuxin Xing (Warwick University, United Kingdom (Great Britain))  
Marina Cole (Warwick University, United Kingdom (Great Britain))  
Julian Gardner (University of Warwick, United Kingdom (Great Britain))

### **Liquid Level Measurement through Capacitive Pressure Sensor**

Parisa Esmaili (Politecnico di Milano, Italy)  
Federico Cavedo (Politecnico di Milano, Italy)  
Alessandro Pesatori (Politecnico di Milano, Italy)  
Michele Norgia (Politecnico di Milano, Italy)

### **Analysis of Ratio and Phase Errors Over Time for Low Power Voltage Transformers**

Alessandro Mingotti (University of Bologna, Italy)  
Marco Pau (RWTH Aachen University, Germany)  
Ferdinanda Ponci (RWTH Aachen University, Germany)  
Lorenzo Peretto (University of Bologna, Italy)  
Andrea Nalli (G&W Altea Srl, Italy)

### **Development of a Clark Microsensor for Low Concentration Dissolved Oxygen Monitoring**

Mehdi Nosrati (McGill University, Canada)  
Daniela Vieira (McGill University, Canada)  
Edward J. Harvey (McGill University, Canada)  
Geraldine E. Merle (McGill University, Canada)  
Sharmistha Bhadra (McGill University, Canada)

### **Doppler Shift Compensation Technique for Ultrasonic DSSS Ranging System**

Toru Ishii (Kobe University, Japan)  
Yukiko Yoshikawa (Kobe University, Japan)  
Shintaro Izumi (Kobe University, Japan)  
Hiroshi Kawaguchi (Kobe University, Japan)

### **Measurement of Vortex Flowmeter Using Tri-axis Acceleration Probe Based on Multi-parameter Adjustable Mist Flow Loop**

Hongjun Sun (Tianjin University, China)  
Wenqiang Zhang (Tianjin University, China)  
Hongbing Ding (Tianjin University, China)  
Jinxia Li (Tianjin University, China)



**Multi-Frequency Ultrasonic Measurements of Phase Fraction for Liquid-Solid Dispersions**

Han Yu (Tianjin University, China)  
Chao Tan (Tianjin University, China)  
Feng Dong (Tianjin University, China)

**An Improved Vertical Seismometer with Build-in Retroreflector**

Meiyong Guo (Tsinghua University, China)  
Kang Wu (Tutor, China)  
Jiamin Yao (Coworker, China)  
Lijun Wang (Supervisor, China)

**Feasibility Analysis of Oil-water Two-phase Flow Testing Based on Ultrasound Array Scanning**

Sheng Tian (Tianjin University, China)  
Chao Tan (Tianjin University, China)  
Feng Dong (Tianjin University, China)

**Double-sided Environmental Sensor for High-efficiency Particulate Air Filter**

Pauliina Vilmi (University of Oulu, Finland)  
Rafal Sliz (University of Oulu, Finland)  
Tapio Fabritius (University of Oulu, Finland)

**A Frequency Characteristics Modelling Method for Current Sensors Based on the Electromagnetic Induction Principle**

Yang Jiao (Huazhong University of Science and Technology, China)  
Hongbin Li (Huazhong University of Science and Technology, China)  
Hui Gong (Huazhong University of Science and Technology, China)

**Optical H2S Sensor Base on Cu<sub>2</sub>-xO-Functionalized FBG**

Meysam Keley (Federal University of Rio de Janeiro & Electrical Engineering Program, Brazil)  
Fabricio Borghi (Universidade Federal do Rio de Janeiro, Brazil)  
Alexandre Silva Allil (Federal University of Rio de Janeiro & COPPETEC Foundation, Brazil)  
Fábio Dutra (Petrobras S.A., Brazil)  
Cesar Carvalho (LIF/COPPE/UFRJ, Brazil)  
Regina Allil (Brazilian Army, Brazil)  
Marcelo Werneck (Universidade Federal do Rio de Janeiro, Brazil)

**Design and Test of Capacitive Micro-machined Ultrasonic Transducer Array for The Air-coupled Ultrasound Imaging Applications**

Dongmei Liang (Tianjin University, China)  
Lei Ye (Tianjin University, China)  
Zhuochen Wang (Tianjin University, China)  
Lu Yu (Tianjin University, China)  
Hui Zhang (Tianjin University, China)  
Hao Feng (Tianjin University, China)

**An Eddy Current Based Non-Contact Displacement Sensor**

A. S. Anil Kumar (Indian Institute of Technology Madras, India)  
Boby George (Indian Institute of Technology Madras, India)  
Subhas Mukhopadhyay (Macquarie University, Australia)

**Bearing Estimation Using Planar Circular Photodiode Arrays**

Gergely Zachár (Pázmány Péter Catholic University)  
Gergely Vakulya (Pázmány Péter Catholic University)  
Gyula Simon (Óbuda University)

**Sensitivity Enhancement of Silver-based SPR Sensors using Ultrathin Gold Film and Graphene Overlay**

Igor J. Carvalho de Lima Queiroz (Federal Institute of Paraíba, Brazil)  
Arthur Aprígio de Melo (Federal University of Campina Grande, Brazil)  
Filipe P. M. Fernandes (Universidade Federal da Paraíba, Brazil)  
Fabiana Fim (University of Paraíba, Brazil)  
Yunshan Wang (University of Utah, USA)  
Steve Blair (University of Utah, USA)  
Rossana Moreno Santa Cruz (Instituto Federal da Paraíba, Brazil)  
Cleumar da Silva Moreira (Instituto Federal da Paraíba & Campus Joao Pessoa, Brazil)

**Radial Gas Holdup Distribution and its Prediction Model for the Gas-liquid Bubble Column Reactor by Using Conductivity Probe Array**

Chao Wang (Tianjin University, China)  
Lin Zhang (Tian Jin University, China)  
Hongbing Ding (Tianjin University, China)  
Ruifeng Bai (Tianjin University, China)  
Jiamin Ye (Tianjin University, China)

**Theoretical Study of Optical Fiber-based SPR Sensors Application for Colorectal Cancer Diagnosis Through Histological Analysis**

Arthur Aprígio de Melo (Federal University of Campina Grande, Brazil)  
Talita Silva (Instituto Federal da Paraíba, Brazil)  
Cleumar da Silva Moreira (Instituto Federal da Paraíba & Campus Joao Pessoa, Brazil)  
Rossana Moreno Santa Cruz (Instituto Federal da Paraíba, Brazil)

**Lower Detection Limit of the Acousto-optic Effect using Optical Feedback Interferometry**

Einar Knudsen (LAAS - CNRS, Institut National Polytechnique de Toulouse, France)  
Julien Perchoux (Institut National Polytechnique de Toulouse, France)  
Thierry Mazoyer (ACOEM, France)  
Francis Jayat (LAAS-CNRS, University of Toulouse, INP ENSEEIHT, France)  
Clement Tronche (Institut National Polytechnique de Toulouse, France)  
Thierry Bosch (CNRS, France)

**Quantitative Shape Measurement of An Inflatable Rubber Dam Using Inertial Sensors**

Yonghui Hu (North China Electric Power University, China)  
Yong Yan (University of Kent, United Kingdom (Great Britain))  
Christos Efstratiou (University of Kent, United Kingdom (Great Britain))  
David Vela-Orte (Dyrhoff Limited, United Kingdom (Great Britain))

**Movable Nozzle Device Design for Moist Gas Condensation in Sonic Nozzle**

Hongbing Ding (Tianjin University, China)  
Yuhe Tian (Tianjin University, China)  
Chao Wang (Tianjin University, China)  
Zhenxin Liang (Tianjin University, China)  
Peijuan Cao (Tianjin University & National Institute of Metrology, China)

## **T15-4: Sensors and Transducers**

*Session Chair: Alessandra Flammini (University of Brescia, Italy)*

### **Research on Droplet Properties in Atomization using Optical Imaging Measurements**

Hongjun Sun (Tianjin University, China)

Yikun Luo (Tianjin University, China)

Hongbing Ding (Tianjin University, China)

Jinxia Li (Tianjin University, China)

### **Experimental Assessment of a Broadband Current Sensor Based on the X-Hall Architecture**

Marco Crescentini (University of Bologna, Italy)

Roberta Ramilli (University of Bologna, Italy)

Gian Piero Gibiino (University of Bologna, Italy)

Marco Marchesi (STMicroelectronics, Italy)

Roberto Canegallo (ST Microelectronics, Italy)

Aldo Romani (University of Bologna, Italy)

Marco Tartagni (University of Bologna, Italy)

Pier Andrea Traverso (University of Bologna, Italy)

### **Resistive Temperature Sensor Based on a Syndiotactic Polystyrene/MWCNT Composite Material as Sensitive NIR Bolometer**

Heinz-Christoph Neitzert (Salerno University, Italy)

Giovanni Landi (Salerno University, Italy)

Andrea Sorrentino (Institute for Polymers, Composites and Biomaterials (IPCB-CNR), Italy)

### **Non-Uniform Sampling Theory Applied to Optical Feedback Interferometry for Displacement Sensors**

Olivier Daniel Bernal (LAAS-CNRS, Université de Toulouse, France)

Usman Zabit (NUST, Pakistan)

Thierry Bosch (Université de Toulouse, France)

Francis Jayat (LAAS-CNRS, University of Toulouse, INP ENSEEIHT, France)

Tara Niakan (INP ENSEEIHT, France)

Ankit Raghubanshi (INP ENSEEIHT, France)

### **Design and Development of a Mobile e-nose Platform for Real Time Victim Localization in Confined Spaces During USaR Operations**

Antonios Anyfantis (University of the Peloponnese, Greece)

Spyridon Blionas (University of the Peloponnese, Greece)

### **EMAT Design for Defect Inspection in Pipe-like Structure Using Helical Lamb Wave**

Zhe Wang (Tsinghua University, China)

Songling Huang (Tsinghua University, China)

Shen Wang (Tsinghua University, China)

Qing Wang (Durham University, United Kingdom (Great Britain))

Wei Zhao (Tsinghua University, China)

# Late Results

## T16: Late Results

Session Chair: *Boby George (Indian Institute of Technology Madras, India)*

### **A Novel Real-time Detection System of Breakages in the Rail Based on Ultrasonic Guided Waves**

Xiaoyuan Wei (Xi'an University of Technology, China)

Yuan Yang (Xi'an University of Technology, China)

Jesús Ureña Ureña (University of Alcalá, Spain)

### **Improving Energy Expenditure Estimation in Wearables Using a Heat Flux Sensor: First Observations**

Saku Levikari (LUT University, Finland)

Antti Immonen (LUT University, Finland)

Mikko P. J. Kuisma (LUT University, Finland)

Heikki Peltonen (University of Jyväskylä, Finland)

Mika Silvennoinen (University of Jyväskylä, Finland)

Heikki Kyröläinen (University of Jyväskylä, Finland)

Pertti Silventoinen (LUT University, Finland)

### **MEMS Heat Flux Sensor**

Antti Immonen (LUT University, Finland)

Saku Levikari (LUT University, Finland)

Feng Gao (VTT Technical Research Centre of Finland, Finland)

Mikko P. J. Kuisma (LUT University, Finland)

Pertti Silventoinen (LUT University, Finland)

### **In-situ Correction of Impedance Mismatch of a Microwave Radio Thermometer**

Dawei Xu (University of Applied Sciences Ruhr West, Germany)

Fabian Ströder (University of Applied Sciences Ruhr West, Germany)

Joerg Himmel (University of Applied Sciences Ruhr West, Muelheim an der Ruhr, Germany)

Daniel Erni (University of Duisburg-Essen, Germany)

Klaus Thelen (University of Applied Science, Germany)

### **Extending the Input Common-Mode Voltage Range of Single-Supply OP Amps**

Marko Petkovsek (University of Ljubljana, Faculty of Electrical Engineering, Slovenia)

Peter Zajec (University of Ljubljana, Faculty of Electrical Engineering, Slovenia)

### **Plastic-optical-fiber-based Solar Tracker Development Applied for Ambiences Illumination**

Alexandre Silva Allil (Federal University of Rio de Janeiro & COPPETEC Foundation, Brazil)

Yan Cirto (UFRJ, Brazil)

Saullo Cardoso (UFRJ, Brazil)

Meysam Keley (Federal University of Rio de Janeiro & Electrical Engineering Program, Brazil)

Regina Allil (Brazilian Army, Brazil)

Marcelo Werneck (Federal University of Rio de Janeiro (UFRJ), Brazil)

# Special Sessions #1-8

## SPS1-1: Advanced Measurement and Data Analytics for Industrial Equipment Health Monitoring

Session Chair: Weihua Li (South China University of Technology, China)

### The Sparse and Low-rank Interpretation of SVD-based Denoising for Vibration Signals

Zhao Zhibin (Xi'an Jiaotong University, China)

Shibin Wang (The State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, China)

David Wong (University of Manchester, United Kingdom (Great Britain))

Yanjie Guo (Xi'an Jiaotong University, China)

Xuefeng Chen (Xian Jiaotong University, China)

### A Two-Order Transfer Model for Gearbox Fault Diagnosis

Fei Shen (Southeast University, China)

Chao Chen (Southeast University, China)

Jiawen Xu (Southeast University, China)

Robert X. Gao (Case Western Reserve University, USA)

Ruqiang Yan (Xi'an Jiaotong University, China)

### Satellite Telemetry Data Anomaly Detection Using Bi-LSTM Prediction Based Model

Pan Dawei (Harbin Engineering University, China)

Zhe Song (Harbin Engineering University, China)

Longqiang Nie (Harbin Engineering University, China)

BenKuan Wang (Harbin Institute of Technology, China)

### Unsupervised Flight Phase Recognition with Flight Data Clustering Based on GMM

Datong Liu (Harbin Institute of Technology, China)

Ning Xiao (Harbin Institute of Technology, China)

Yujie Zhang (Harbin Institute of Technology, China)

Xiyuan Peng (Harbin Institute of Technology, China)

### Accelerated Degradation Wiener Model for Lithium Battery Considering Individual Difference

Yandong Hou (Harbin Institute of Technology, China)

Datong Liu (Harbin Institute of Technology, China)

Peng Yu (Harbin Institute of Technology, China)

### A Transferable Capsule Network for Decoupling Compound Fault of Machinery

Ruyi Huang (South China University of Technology, China)

Zhen Wang (South China University of Technology, China)

Jipu Li (South China University of Technology, China)

Junbin Chen (South China University of Technology, China)

Weihua Li (South China University of Technology, China)

### State Recognition of Bolted Structures Based on Quasi-analytic Wavelet Packet Transform and Generalized Gegenbauer Support Vector Machine

Wenzhan Yang (Xi'an Jiaotong University, China)

Zhousuo Zhang (Xi'an Jiaotong University, China)

Yujie Hong (Xi'an Jiaotong University, China)

## SPS1-2: Advanced Measurement and Data Analytics for Industrial Equipment Health Monitoring

Session Chair: Shibin Wang (The State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, China)

### Feature Ranking Under Industrial Constraints in Continuous Monitoring Applications Based on Machine Learning Techniques

Roberto Bodo (Università degli Studi di Padova, Italy)

Matteo Bertocco (University of Padova, Italy)

Alberto Bianchi (Carel Industries SpA, Italy)

### **Impact of Noise on Machine Learning-based Condition Monitoring Applications: A Case Study**

Roberto Bodo (Università degli Studi di Padova, Italy)

Matteo Bertocco (University of Padova, Italy)

Alberto Bianchi (Carel Industries SpA, Italy)

### **A Feature Transferring Fault Diagnosis Based on WPDR, FSWT and GoogLeNet**

Guannan Cao (Huazhong University of Science and Technology, China)

Kaifeng Zhang (Huazhong University of Science and Technology, China)

Kaibo Zhou (Huazhong University of Science and Technology, China)

Hao Pan (Huazhong University of Science and Technology, Wuhan, China)

Yanhe Xu (Huazhong University of Science and Technology, China)

Jie Liu (Huazhong University of Science and Technology, China)

### **An OPR-free Blade Tip Timing Method Based on Blade Spacing Change**

Zengkun Wang (Xi'an Jiaotong University, China)

Zhibo Yang (Xi'an Jiaotong University, China)

Shuming Wu (Xi'an JiaoTong University & State Key Laboratory for Manufacturing and Systems Engineering, China)

Haoqi Li (Xi'an Jiaotong University, China)

Ruqiang Yan (Xi'an Jiaotong University, China)

Shaohua Tian (Xi'an Jiaotong University, China)

Xingwu Zhang (State Key Laboratory for Manufacturing System Engineering, China)

Xuefeng Chen (Xian Jiaotong University, China)

### **Generalized Gaussian Noise Distribution Enabled Sparse Representation Model for Bearing Fault Diagnosis**

Botao An (Xi'an Jiaotong University, China)

Shibin Wang (The State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, China)

Ruqiang Yan (Xi'an Jiaotong University, China)

Weihua Li (South China University of Technology, China)

Xuefeng Chen (Xian Jiaotong University, China)

### **A Hybrid Fault Diagnosis Approach for Blade Crack Detection Using Blade Tip Timing**

Shuming Wu (Xi'an JiaoTong University & State Key Laboratory for Manufacturing and Systems Engineering, China)

Zengkun Wang (Xi'an Jiaotong University, China)

Haoqi Li (Xi'an Jiaotong University, China)

Zhibo Yang (Xi'an Jiaotong University, China)

Shaohua Tian (Xi'an Jiaotong University, China)

Ruqiang Yan (Xi'an Jiaotong University, China)

Shibin Wang (The State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, China)

Xuefeng Chen (Xian Jiaotong University, China)

## **SPS2: Smart Sensors in the Context of Industry 4.0**

*Session Chair: Vincenzo Paciello (University of Salerno & DIIIn Università Degli studi di Salerno, Italy)*

### **Structural Modeling and Implementation of Smart Sensor and Actuator Networks using IEEE 1451**

Reza Abrishambaf (Miami University, USA)

### **Pre-Processing Technique for Compass-less Madgwick in Heading Estimation for Industry 4.0**

Minh Long Hoang (Salerno University, Italy)

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Salvatore Dello Iacono (University of Salerno, Italy)

Vincenzo Paciello (University of Salerno & DIIIn Università Degli studi di Salerno, Italy)

### **Non-Intrusive Operation Status Tracking for Legacy Machines via Sound Recognition**

Boon Yaik Ooi (UTAR, Malaysia)

Shervin Shirmohammadi (University of Ottawa, Canada)

Wai Kong Lee (Universiti Tunku Abdul Rahman, Malaysia)

Jason Jing Wei Lim (UTAR, Malaysia)

### **On a finite Domain Magnetic Localization by Means of TMR Triaxial Sensors**

Gianni Cerro (University of Molise, Italy)  
Luigi Ferrigno (University of Cassino, Italy)  
Marco Laracca (University of Cassino and Southern Lazio, Italy)  
Filippo Milano (University of Cassino and Southern Lazio, Italy)  
Paolo Bellitti (Università degli Studi di Brescia, Italy)  
Mauro Serpelloni (University of Brescia, Italy)  
Oscar Casas (Universitat Politècnica de Catalunya, Spain)

### **Multi-Frequency Signal for Saturation Detection of a Pollution Filter Based on Graphene Nanoplatelets**

Luigi Ferrigno (University of Cassino, Italy)  
Antonio Maffucci (University of Cassino and Southern Lazio & National Institute of Nuclear Physics, INFN-LNF, Italy)  
Gianfranco Miele (University of Cassino and Southern Lazio, Italy)  
Sarah Sibilia (University of Cassino and Southern Lazio, Italy)  
Stefano Bellucci (Istituto Nazionale di Fisica Nucleare (INFN), Italy)  
Antonino Cataldo (National Institute of Nuclear Physics, Frascati National Laboratories, Italy)

### **Improving Soft Sensors Performance in the Presence of Small Datasets by Data Selection**

Salvatore Graziani (University of Catania, Italy)  
Maria Gabriella Xibilia (University of Messina, Italy)

### **Towards Data Aggregation on Multi-Sensor Low Power Wireless Transducer with ISO/IEC/IEEE 21450 Transducer Electronic Datasheets**

Tobias Mitterer (Alpen-Adria Universität, Austria)  
Hubert Zangl (Alpen-Adria Universität, Austria)

### **A Platform for IEEE 1451 Standard's Education, Development and Validation for Industry 4.0**

João Pereira (University Of Beira Interior, Portugal)  
Helbert da Rocha (University of Beira Interior, Portugal)  
António Espírito Santo (University of Beira Interior, Portugal)

### **An IEEE 1451 Vehicular Sensor Network Development**

Rita Pinto (University of Beira Interior, Portugal)  
Joel Bonifácio (University of Beira Interior, Portugal)  
Marcelo Moreira (University of Beira Interior, Portugal)  
António Espírito Santo (University of Beira Interior, Portugal)

### **SPS4: Measurements for Demanding Communications: Broadband and Industrial Networking**

*Session Chairs: Gianfranco Miele (University of Cassino and Southern Lazio, Italy)  
Emiliano Sisinni (University of Brescia, Italy)*

### **Evaluation of the Impact of Cloud Database Services on Industrial IoT Applications**

Paolo Ferrari (University of Brescia, Italy)  
Emiliano Sisinni (University of Brescia, Italy)  
Alessandro Depari (University of Brescia, Italy)  
Alessandra Flammini (University of Brescia, Italy)  
Stefano Rinaldi (University of Brescia, Italy)  
Paolo Bellagente (University of Brescia, Italy)  
Marco Pasetti (University of Brescia, Italy)

### **Design and Implementation of FC-AE Fault Simulation Instrument**

Qiao Jiaqing (Harbin Institute of Technology, China)  
Zhenyu Wang (Harbin Institute of Technology, China)  
Ping Fu (Harbin Institute of Technology, China)  
Wenbo Li (Harbin Institute of Technology, China)  
Zhihao Guo (Harbin Institute of Technology, China)  
Feng Lei (Harbin Institute of Technology, China)  
Wenbin Zheng (Harbin Institute of Technology, China)  
Shengwei Meng (Harbin Institute of Technology, China)  
Li Wang (Harbin Institute of Technology, China)

### **LoRaWAN Performances for Underground to Aboveground Data Transmission**

Alessandro Pozzebon (University of Siena, Italy)  
Stefano Parrino (University of Siena, Italy)  
Giacomo Peruzzi (University of Siena, Italy)  
Matteo Gineprini (University of Siena, Italy)

### **A LoRaWAN Network Infrastructure for the Remote Monitoring of Offshore Sea Farms**

Alessandro Pozzebon (University of Siena, Italy)  
Giacomo Peruzzi (University of Siena, Italy)  
Lorenzo Parri (University of Siena, Italy)  
Stefano Parrino (University of Siena, Italy)

### **Assessment of Different OPC UA Industrial IoT Solutions for Distributed Measurement Applications**

Alberto Morato (University of Padova, Italy)  
Stefano Vitturi (CNR, Italy)  
Angelo Cenedese (University of Padova, Italy)  
Federico Tramarin (University of Padova, Italy)

### **Evaluation of LoRaWAN for Sensor Data Collection in an IIoT-based Additive Manufacturing Project**

Stefano Vitturi (CNR, Italy)  
Luca Trevisan (University of Padova, Italy)  
Alberto Morato (University of Padova, Italy)  
Guglielmo Frigo (École Polytechnique Fédérale de Lausanne (EPFL), Switzerland)  
Federico Tramarin (University of Padova, Italy)

### **On the Reliability of Extrapolation Techniques for Verifying the Compliance of LTE Cellular Systems with RF Human Exposure Limits**

Giovanni Betta (University of Cassino, Italy)  
Gianni Cerro (University of Molise, Italy)  
Gianfranco Miele (University of Cassino and Southern Lazio, Italy)  
Marzia Salone D'Amata (University of Cassino and Southern Lazio, Italy)  
Domenico Capriglione (University of Salerno, Italy)

### **Practical EVM Optimization of 802.11ac Wi-Fi Transmitters via Load-Pull Measurements**

Wei Gao (Broadcom Limited, USA & Northwest University, China)  
Tao Jing (Northwest University, China)



## **SPS5: Unobtrusive Systems and Wearable Technologies for Medical Applications**

*Session Chairs: Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)*

*Emiliano Schena (University Campus Bio-Medico of Rome, Italy)*

### **Evaluation of Thoraco-abdominal Asynchrony Using Conductive Textiles**

Joshua Di Tocco (Università Campus Bio-Medico di Roma, Italy)

Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

Marco Bravi (Università Campus Bio-Medico di Roma, Italy)

Sandra Miccinilli (Università Campus Bio-Medico di Roma, Italy)

Silvia Sterzi (Università Campus Bio-Medico di Roma, Italy)

Domenico Formica (Università Campus Bio-Medico di Roma, Italy)

Emiliano Schena (University Campus Bio-Medico of Rome, Italy)

### **Noninvasive Arterial Blood Pressure Estimation using ABPNet and VITAL-ECG**

Annunziata Paviglianiti (Politecnico di Torino, Italy)

Vincenzo Randazzo (Politecnico di Torino, Italy)

Eros G Pasero (Politecnico di Torino, Italy)

Alberto Vallan (Politecnico di Torino, Italy)

### **Influence of Torso Movements on a Multi-sensor Garment for Respiratory Monitoring During Walking and Running Activities**

Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

Joshua Di Tocco (Università Campus Bio-Medico di Roma, Italy)

Luigi Raiano (Università Campus Bio-Medico di Roma, Italy)

Arianna Carnevale (Università Campus Bio-Medico di Roma, Italy)

Riccardo Sabbadini (Università Campus Bio-Medico di Roma, Italy)

Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy)

Marco Bravi (Università Campus Bio-Medico di Roma, Italy)

Sandra Miccinilli (Università Campus Bio-Medico di Roma, Italy)

Silvia Sterzi (Università Campus Bio-Medico di Roma, Italy)

Domenico Formica (Università Campus Bio-Medico di Roma, Italy)

Emiliano Schena (University Campus Bio-Medico of Rome, Italy)

### **Feasibility Assessment of an FBG-based Wearable System for Monitoring Back Dorsal Flexion-Extension in Video Terminal Workers**

Martina Zaltieri (Università Campus Bio-Medico di Roma, Italy)

Daniela Lo Presti (Università Campus Bio-Medico di Roma, Italy)

Carlo Massaroni (Università Campus Bio-Medico di Roma, Italy)

Jessica D'Abbraccio (Scuola Superiore Sant'Anna, Italy)

Luca Massari (Scuola Superiore Sant'Anna, Italy)

Marco Bravi (Università Campus Bio-Medico di Roma, Italy)

Sandra Miccinilli (Università Campus Bio-Medico di Roma, Italy)

Michele Arturo Caponero (ENEA Frascati Research Centre, Italy)

Silvia Sterzi (Università Campus Bio-Medico di Roma, Italy)

Domenico Formica (Università Campus Bio-Medico di Roma, Italy)

Calogero Maria Oddo (Scuola Superiore Sant'Anna, Italy)

Emiliano Schena (University Campus Bio-Medico of Rome, Italy)

### **Heart Rate Variability Analysis in Healthy Subjects Under Different Colored Lighting Conditions**

John Araujo (UFRN, Brazil)

Mariana Catela Jacob Rodrigues (ISCTE-IUL & Instituto de Telecomunicações, Portugal)

Octavian Adrian Postolache (Instituto de Telecomunicações, Lisboa/IT & Instituto Universitario de Lisboa, ISCTE-IUL, Portugal)

Francisco Cercas (ISCTE-IUL & Instituto de Telecomunicações, Portugal)

Francisco Ferrero Martín (University of Oviedo, Spain)

Alberto López Martínez (University of Oviedo, Spain)

### **Fiber Bragg Gratings Solution for Gait Assessment**

João Pedro Duarte Monge (ISCTE-IUL, Portugal)

Octavian Adrian Postolache (Instituto de Telecomunicações, Lisboa/IT & Instituto Universitario de Lisboa, ISCTE-IUL, Portugal)

Ricardo Alexandre (ISCTE-IUL, Portugal)

Maria de Fatima Domingues (Instituto de Telecomunicações & University of Aveiro, Portugal)

Paulo Antunes (Instituto de Telecomunicações, Portugal)

Vítor Viegas (Portuguese Naval Academy & CINAV, Portugal)

### **A Health 4.0 Integrated System for Monitoring and Predicting Patient's Health During Surgical Procedures**

Pasquale Arpaia (University of Naples Federico II, Italy)

Melania Cicatiello (University of Naples Federico II, Italy)

Egidio De Benedetto (University of Naples, Italy)

Concetta Dodaro (University of Naples Federico II, Italy)

Luigi Duraccio (University of Naples Federico II, Italy)

Giuseppe Servillo (University of Naples Federico II, Italy)

Maria Vargas (University of Naples Federico II, Italy)

### **Embedded Learning for Smart Functional Electrical Stimulation**

Sebastian Marzetti (Université de Toulon, France)

Valentin Gies (Université de Toulon & IM2NP, France)

Valentin Barchasz (SMIOT & Université de Toulon, France)

Herve Barthelemy (Ecole Polytechnique Universitaire de Marseille, France)

Hervé Glotin (Université du Sud Toulon-Var / LSIS, France)

Edith Kussener (IM2NP/ISEN Toulon, France)

Remy Vauche (Aix-Marseille University, IM2NP, France)

### **SPS6-1: Instrumentation and Measurement for Improving Quality, Reliability and Safety: New Perspectives for Research and Industry**

*Session Chair: Lorenzo Ciani (University of Florence, Italy)*

### **Reliability and Availability Evaluation of Linear LoRaWAN Sensor Network Architectures for Pipeline Monitoring**

Enza Panzardi (University of Siena, Italy)

Tommaso Addabbo (University of Siena, Italy)

Ada Fort (University of Siena, Italy)

Elia Landi (University of Siena, Italy)

Marco Mugnaini (University of Siena, Italy)

Alessandro Pozzebon (University of Siena, Italy)

Valerio Vignoli (University of Siena, Italy)

### **Corrosion Prediction in Oil and Gas Pipelines: A Machine Learning Approach**

Giuseppe Canonaco (Politecnico di Milano, Italy)

### **A Fault Prediction Method of Quartz Flexible Accelerometers Based on AGO-RVM**

Jingli Yang (Harbin Institute of Technology, China)

Yongqi Chang (Harbin Institute of Technology, China)

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

Yang Liu (Shanghai Engineering Center for Microsatellites, China)

### **Signal-to-Noise Ratio Contributors and Effects in Proximal Near-Infrared Spectral Reflectance Measurement on Plant Leaves**

Wayne Holmes (Unitec Institute of Technology, New Zealand)

Melanie Ooi (University of Waikato, New Zealand)

Ye Chow Kuang (University of Waikato & Monash University, New Zealand)

Ray Simpkin (Callaghan Innovation, New Zealand)

Dan Blanchon (Unitec Institute of Technology, New Zealand)

Gourab Sen Gupta (Massey University, New Zealand)

Serge Demidenko (Sunway University, Malaysia)

### **FPGA-based Implementation of Lithium-ion Battery SOH Estimator Using Particle Filter**

Yuchen Song (Harbin Institute of Technology, China)

Datong Liu (Harbin Institute of Technology, China)

Yu Peng (Harbin Institute of Technology, HIT, China)

### **Characterization of Inertial Measurement Units Under Environmental Stress Screening**

Marco Carratù (University of Salerno, Italy)

Domenico Capriglione (University of Salerno, Italy)

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Paolo Sommella (University of Salerno, Italy)

Marcantonio Catelani (University of Florence, Italy)

Lorenzo Ciani (University of Florence, Italy)

Gabriele Patrizi (University of Florence, Italy)

Roberto Singuaroli (University of Florence, Italy)

Lorenzo Signorini (Analytical srl - Laboratorio CETACE, Italy)

### **Vibrations Measurement and Current Signatures for Fault Detection in Asynchronous Motor**

Moise Avoci Ugwiri (University of Salerno, Italy)

Marco Carratù (University of Salerno, Italy)

Antonio Pietrosanto (University of Salerno & CEO of Metering Research srl, Italy)

Vincenzo Paciello (University of Salerno & DIn Università Degli studi di Salerno, Italy)

Aime' Lay-Ekuakille (University of Salento, Italy)

### **Characterization of a Low-cost and Low-power Environmental Monitoring System**

Marcantonio Catelani (University of Florence, Italy)

Lorenzo Ciani (University of Florence, Italy)

Alessandro Bartolini (University of Florence, Italy)

Giulia Guidi (University of Florence, Italy)

Gabriele Patrizi (University of Florence, Italy)

## **SPS6-2: Instrumentation and Measurement for Improving Quality, Reliability and Safety: New Perspectives for Research and Industry**

*Session Chair: Giulio D'Emilia (University of L'Aquila, Italy)*

### **Measuring Worker's Performance in Augmented Reality-assisted Industry 4.0 Procedures**

Francesco Bonavolontà (Università di Napoli Federico II, Italy)

Dominique Dallet (IMS Laboratory - Bordeaux INP - University Bordeaux, France)

Ernesto Erra (Università di Napoli Federico II, Italy)

Andrea Grassi (University of Naples Federico II, Italy)

Valentina Popolo (University of Naples Federico II, Italy)

Annarita Tedesco (University of Naples, Federico II, Italy)

Silvestro Vespoli (Università degli Studi di Napoli Federico II, Italy)

### **Optically Scanned Laser Line Sensor**

Johannes Schlarp (Vienna University of Technology, Austria)

Ernst Csencsics (TU Wien, Austria)

Georg Schitter (Vienna University of Technology, Austria)

### **Application of Uncertainty Analysis to Experimental Reliability of Sensors by Thermal Shock Test**

Antonella Gaspari (University of L'Aquila, Italy)

Giulio D'Emilia (University of L'Aquila, Italy)

Emanuela Natale (University of L'Aquila, Italy)

David Delaux (Valeo, France)

Thomas Illing (Valeo, Germany)

David Di Gasbarro (University of L'Aquila, Italy)

## **Accuracy Improvement of Measurement Management Systems: Requirements for Reliability of Data and Practical Examples**

Antonella Gaspari (University of L'Aquila, Italy)  
Giulio D'Emilia (University of L'Aquila, Italy)  
Emanuela Natale (University of L'Aquila, Italy)

## **Optical Instrument for Thickness Measurement**

Alessandro Pesatori (Politecnico di Milano, Italy)  
Michele Norgia (Politecnico di Milano, Italy)  
Federico Cavedo (Politecnico di Milano, Italy)

## **Feasibility Evaluation of Optoelectronic Strain Measurement for Flywheel Rotors**

Matthias Rath (Graz University of Technology, Austria)  
Rupert Preßmair (Graz University of Technology, Austria)  
Bernhard Schweighofer (Graz University of Technology, Austria)  
Georg Brasseur (Graz University of Technology, Austria)

## **End of Life Estimation for Storage System Used in Photovoltaic Residential Installation**

Loredana Cristaldi (Politecnico di Milano, Italy)  
Giancarlo Bernasconi (Politecnico di Milano, Italy)  
Sergio C. Brofferio (Politecnico Di Milano, Italy)  
Sergio Toscani (Politecnico di Milano, Italy)  
Mattia Sapone (Politecnico di Milano, Italy)

## **Self-Aligning Scanning Shack-Hartmann Sensor for Automatic Wavefront Measurements of High-NA Optics**

Martin E Fuerst (TU Wien, Austria)  
Nikolaus Berlakovich (TU Wien, Austria)  
Ernst Csencsics (TU Wien, Austria)  
Georg Schitter (Vienna University of Technology, Austria)

## **SPS7: Green Sensors: Sensing Systems and Transducers for the Implementation of a Sustainable Economy**

*Session Chairs: Salvatore Graziani (University of Catania, Italy)  
Carlo Trigona (University of Catania, Italy)*

## **Battery Less HF RFID Sensor Tag for Humidity Measurements Based on TiO<sub>2</sub> Nanoparticles**

Enza Panzardi (University of Siena, Italy)  
Irene Cappelli (University of Siena, Italy)  
Ada Fort (University of Siena, Italy)  
Marco Mugnaini (University of Siena, Italy)  
Alessandro Pozzebon (University of Siena, Italy)  
Marco Tani (University of Siena, Italy)  
Valerio Vignoli (University of Siena, Italy)

## **Detection of Formaldehyde by A RGO/PMMA Coated Sensor**

Suman Biswas (IIT Kharagpur, India)  
Moupali Chakraborty (Indian Institute of Technology, Kharagpur, India)  
Karabi Biswas (I.I.T. Kharagpur, India)

## **An LSPR Sensor Based on a Thin Slab Waveguide of Bacterial Cellulose**

Nunzio Cennamo (University of Campania Luigi Vanvitelli, Italy)  
Luigi Zeni (University of Campania Luigi Vanvitelli, Italy)  
Francesco Arcadio (University of Campania Luigi Vanvitelli, Italy)  
Carlo Trigona (University of Catania, Italy)  
Salvatore Graziani (University of Catania, Italy)  
Giovanna Di Pasquale (Università degli Studi di Catania, Italy)  
Antonio Pollicino (University of Catania, Italy)

### **Green Fractional Order Elements Based on Bacterial Cellulose and Ionic Liquids**

Riccardo Caponetto (University of Catania, Italy)  
Giovanna Di Pasquale (Università degli Studi di Catania, Italy)  
Salvatore Graziani, Emanuele Murgano and Carlo Trigona (University of Catania, Italy)  
Antonino Pollicino (Università di Catania, Italy)

### **A Vibrational Energy Harvester Based on Soft Nonlinearity for Truly Random Excitation**

Carlo Trigona (University of Catania, Italy)  
Jaakko Palosaari (University of Oulu, Finland)  
Yang Bai (University of Oulu, Finland)

### **Exploitation of Temperature Effect in 100um Ferromagnetic Wire**

Carlo Trigona (University of Catania, Italy)  
Gianluca Caposciutti (University of Pisa, Italy)  
Mirko Marracci (University of Pisa, Italy)  
Salvatore Baglio (University of Catania, Italy)  
Bernardo Tellini (University of Pisa, Italy)

## **SPS8: Sensors and Sensing System for Assistive Technology**

*Session Chair: Vincenzo Marletta (University of Catania, Italy)*

### **Force-Feedback Tablet: A New ICT Device for 2D Data Display (*Invited Presentation*)**

Edwige E. Pissaloux (UPMC-Paris 6 University, France)

### **Multi Sensors Platform for Stress Monitoring of Workers in Smart Manufacturing Context**

Alessandro Leone (CNR, Italy)  
Gabriele Rescio (CNR, Italy)  
Pietro Siciliano (UOS di Lecce, Germany)  
Alessandra Papetti (Università Politecnica delle Marche, Italy)  
Agnese Brunzini (Università Politecnica delle Marche, Italy)  
Michele Germani (Università Politecnica delle Marche, Italy)

### **Measurement of Activities of Daily Living: A Simulation Tool for the Optimisation of a Passive Infrared Sensor Network in a Smart Home Environment**

Sara Casaccia (Università Politecnica delle Marche, Italy)  
Riccardo Rosati (Università Politecnica delle Marche, Italy)  
Lorenzo Scalise (Università Politecnica delle Marche, Italy)  
Gian Marco Revel (Università Politecnica delle Marche, Italy)

### **Comparative Study of Time Series-based Human Activity Recognition using Convolutional Neural Networks**

Heba Nematallah (Carleton University, Canada)  
Sreeraman Rajan (Carleton University, Canada)

# Special Session #9-18 & TC-1

## **SPS9: Innovative Measurement Systems for Applications in Harsh Environments**

*Session Chair: Georg Brasseur (Graz University of Technology, Austria)*

### **Online Calibration of Accelerometers for Monitoring of Wind Turbine Blade Movement**

Theresa Loss (Technical University of Graz, Austria)  
Oliver Gerler (eologix sensor technology gmbh, Austria)  
Alexander Bergmann (Graz University of Technology, Austria)

### **Model Based Compensation of Thermal Drifts for Multi Electrode Capacitive Sensing**

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)

### **AMR Magnetometer with Digital Feedback for Space Applications**

David Novotny (Czech Technical University in Prague, Czech Republic)  
Vojtech Petrucha (Czech Technical University in Prague & Faculty of Electrical Engineering, Czech Republic)  
Michal Dressler (Czech Technical University in Prague, Czech Republic)  
Antonin Platil (Czech Technical University, Czech Republic)

### **A Compact Noise-Immune TDLAS Temperature Sensor using Intensity Modulation**

Lijun Xu (Beihang University, China)  
Guangyu Hou (Beihang University, China)  
Yuanqing Li (Beihang University, China)  
Shuang Qiu (Beihang University, China)  
Zhenyuan Song (Beihang University, China)  
Zhang Cao (Beihang University, China)

### **Water Holdup Prediction of Oil-water Two-phase Flow in Horizontal Well Using a 12-probe Conductance Array**

Xiaokai Zhang (Beihang University, China)  
Lijun Xu (Beihang University, China)  
Jiangtao Sun (Beihang University, China)  
Shijie Sun (Beihang University, China)  
Wenbin Tian (Beihang University, China)  
Yuedong Xie (Beihang University, China)

## **SPS10: Multichannel Imaging for Scientific and Industrial Application**

*Session Chair: Maik Rosenberger (Ilmenau University of Technology, Germany)*

### **Dual-modality Tomography for Gas-Liquid-Solid Three Phase Flow Imaging: A Simulation Study**

Zihan Xia (Tianjin University, China)  
Ziqiang Cui (Tianjin University, China)  
Lusheng Zhai (Tianjin University, China)  
Huaxiang Wang (Tianjin University, China)

### **Image Reconstruction for Ultrasonic Tomography with a U-net Convolutional Neural Network**

Jiashuo Lyu (Tianjin University, China)  
Chao Tan (Tianjin University, China)  
Hao Liu (Tianjin University, China)  
Feng Dong (Tianjin University, China)

### **6D Object Pose Estimation Algorithm Using Preprocessing of Segmentation and Keypoint Extraction**

Yan Zhang (Ilmenau University of Technology, Germany)  
Chen Zhang (Ilmenau University of Technology, Germany)  
Maik Rosenberger (Ilmenau University of Technology, Germany)  
Gunther Notni (Ilmenau University of Technology, Germany)

### **Measurement of Magnetic Microstructures with a Faraday Rotation Magnetometer**

Ruben G Piepgras (Johannes Kepler University Linz, Austria)  
Bernhard G. Zagar (University of Linz, Austria)  
Sebastian Michlmayr (Johannes Kepler University Linz, Austria)  
Johannes Egger (Johannes Kepler University Linz, Austria)

### **Investigations on Industrial Water Detection on Surfaces Using Multichannel Imaging Techniques**

Maik Rosenberger (Ilmenau University of Technology, Germany)  
Gunther Notni (Ilmenau University of Technology, Germany)  
David Rebhan (Technische Universitaet Ilmenau, Germany)  
Raik Illmann (Technische Universitaet Ilmenau, Germany)  
Paul-Gerald Dittrich (Technische Universität Ilmenau & SpectroNet c/o Technologie- und Innovationspark Jena GmbH, Germany)  
Alexander Wemhoff (Technische Universität Ilmenau, Germany)

### **Multi-channel Supported Surveying of Industrial Floor Tiles**

Raik Illmann (Technische Universitaet Ilmenau, Germany)  
Maik Rosenberger (Ilmenau University of Technology, Germany)  
Gunther Notni (Ilmenau University of Technology, Germany)

## **SPS11: Recent Advances in Fiber Optic Sensing: Sensors, Instrumentations, Measurements and Applications**

*Session Chair: Tuan Guo (Institute of Photonics Technology, Jinan University, China)*

### **Measurement Signal Analysis at Each Pulsation Point of Living Body by FBG Sensor**

Shouhei Koyama (Division of Smart Textiles, Institute of Fiber Engineering, Shinshu University, Japan)

### **Compact System of Dispersion Spectroscopy for Interrogating Fiber Bragg Grating Sensors Using Multi-wavelength Phase Shift Interferometry**

Dragos A. Poiana (Universidad Carlos III de Madrid, Spain)  
Julio E. Posada Roman (University Carlos III de Madrid, Spain)  
Jose A. Garcia Souto (Universidad Carlos III de Madrid, Spain)

### **Plastic Optical Fiber Sensors and Magnetic Fluids: Plasmonic Tunability and Sensing Properties for Measurements**

Nunzio Cennamo (University of Campania Luigi Vanvitelli, Italy)  
Luigi Zeni (University of Campania Luigi Vanvitelli, Italy)  
Francesco Arcadio (University of Campania Luigi Vanvitelli, Italy)  
Salvatore Baglio, Vincenzo Marletta and Bruno Ando (University of Catania, Italy)

### **The Highest Fluorescence Signal-to-noise Ratio is Achieved by Optimizing the Light Acquisition Direction and Tube Diameter of the QPCR System**

Chia-Lien Ma (Instrument Technology Research Center, Taiwan)  
Hsin-Yi Tsai (Instrument Technology Research Center, National Applied Research Laboratories, Taiwan)  
Dar-Bin Shieh (National Cheng Kung University & NCKU Hospital, Taiwan)  
Kuo-Cheng Huang (Instrument Technology Research center, National Applied Research Laboratories, Taiwan)  
Chih-Chung Yang (Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan)  
Yu-Hsuan Lin (Taiwan Instrument Research Institute, National Applied Research Laboratories, Taiwan)  
Chun-Han Chou (Instrument Technology Research Center, National Applied Research Laboratories, Taiwan)

### **Fibre Optical Ice Sensing: Sensor Model and Icing Experiments for Different Ice Types**

Alexander Siegl (Graz University of Technology, Austria)  
Markus Neumayer (Graz University of Technology, Austria)  
Thomas Bretterkieber (Graz University of Technology, Austria)

### **Phase Detection of the NIR Optical Resonances of Rectangular Glass Micro-capillaries**

Valentina Bello (University of Pavia, Italy)  
Sabina Merlo (University of Pavia, Italy)

## **SPS14: From Low-Energy to Energy-Autonomous Sensor and Measurement Systems**

*Session Chair: Sebastian Bader (Mid Sweden University, Sweden)*

### **Towards Autonomous Smart Sensing Systems**

Brendan O'Flynn (Tyndall National Institute, Ireland)

Michael Hayes (Tyndall National Institute, Ireland)

Peter Haigh (Tyndall National Institute, Ireland)

Dinesh Gawade (Tyndall National Institute, Ireland)

### **Characterization and Comparison of Envelope Detectors for Wake-up Sensor Interfaces at Audio Frequencies**

Marko Gazivoda (Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia)

Dinko Oletic (University of Zagreb & Faculty of Electrical Engineering and Computing, Croatia)

Vedran Bilas (University of Zagreb, Croatia)

### **A Solar-Radiation-Powered Thermoelectric Energy Harvester Based on Quasicrystal**

Vinicius Silva Oliveira (Federal University of Paraíba, Brazil)

Marcelo Camboim (Federal University of Paraíba, Brazil)

Bruno Alessandro Silva Guedes de Lima (UFPB, Brazil)

Cleonilson Protasio de Souza (Federal University of Paraíba, Brazil)

Orlando Baiocchi (University of Washington, USA)

### **On Measuring Power Efficiency in DC-DC Converters at Light Load Currents**

Manel Gasulla (Universitat Politècnica de Catalunya, Spain)

Ferran Reverter (Universitat Politècnica de Catalunya, Spain)

### **Experimental Validation of a Piezoelectric Measuring Chain for Monitoring Structural Dynamics**

Favour Okosun (University College Dublin, Ireland)

Vikram Pakrashi (Contact Us University College Dublin, Ireland)

## **SPS15: Near Field Electromagnetic Sensing and Imaging**

*Session Chairs: Guiyun Tian (Newcastle University & University of Electronic Science and Technology of China, United Kingdom (Great Britain))*

*Darko Vasić (University of Zagreb, Croatia)*

### **Comparison on Pipeline Welds and Integrity through Different Electromagnetic NDT Techniques**

Qiuping Ma (University of Electronic Science and Technology of China, China)

Guiyun Tian (Newcastle University & University of Electronic Science and Technology of China, United Kingdom (Great Britain))

Bin Gao (University of Electronic Science and Technology, China)

Darko Bajić (University of Montenegro, Montenegro)

Stefan Culafic (University of Montenegro, China)

Tongle Wu (University of Electronic Science and Technology of China, China)

Jia Liu (University of Electronic Science and Technology of China, China)

Kun Zeng (University of Electronic Science and Technology of China, China)

Zewei Liu (University of Electronic Science and Technology of China, China)

Qianhang Liu (University of Electronic Science and Technology of China, China)

Changrong Yang (University of Electronic Science and Technology of China, China)

Dong Liu (University of Electronic Science and Technology of China, China)

### **Underground Metal Target Detection Method Based on Rectangular Planar Coil and EM Instrument**

Zhijie Zhang (North University of China, China)

Ning Han (North University of China, China)

Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))

Mingquan Wang (North University of China, China)

Xiaojian Hao (North University of China, China)

Meng Lifan (North University of China, China)



### **A Portable Planar Coil Array for Frequency-Domain Inductive Sensing of Metallic Objects**

Davorin Ambruš (University of Zagreb, Croatia)

Darko Vasić (University of Zagreb, Croatia)

Vedran Bilas (University of Zagreb, Croatia)

### **Towards High Frequency Electromagnetic Induction Sensing of Soil Apparent Electrical Conductivity**

Dorijan Špikić (University of Zagreb, Croatia)

Darko Vasić (University of Zagreb, Croatia)

Davorin Ambruš (University of Zagreb, Croatia)

Ivan Rep (University of Zagreb, Croatia)

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### **Investigation of Layer Interface Model of Multi-layer Structure Using Semi-analytical and FEM Analysis for Eddy Current Pulsed Thermography**

Qiuji Yi (Newcastle University, United Kingdom (Great Britain))

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*Session Chairs: Stefan Escalda Navarro (Inria, France)*

*Stephan Mühlbacher-Karrer (Joanneum Research, Austria)*

### **Multisensory-based Safety Concept for Human-Robot Collaboration in Robotized Warehouses**

**(Invited Presentation)**

Ivan Marković (University of Zagreb, Croatia)

Ivan Petrović (University of Zagreb, Croatia)

### **Teleoperation with Tactile Feedback based on a Capacitive Proximity Sensor Array**

Hosam Alagi (Researcher, Germany)

Stefan Escalda Navarro (Inria, France)

Jan Hergenhan (Karl Storz SE & Co. KG, Germany)

Selma Music (Technical University of Munich, Germany)

Björn Hein (Karlsruhe Institute of Technology (KIT), Germany)

### **Gesture-based Contactless Control of Mobile Manipulators using Capacitive Sensing**

Christian Stetco (Alpen-Adria Universität, Austria)

Stephan Mühlbacher-Karrer (Joanneum Research, Austria)

Matteo Lucchi (Joanneum Research, Austria)

Matthias Weyrer (Joanneum Research, Austria)

Lisa-Marie Faller (Carinthia University of Applied Sciences, Austria)

Hubert Zangl (Alpen-Adria Universität, Austria)

### **0-3 Barium Titanate-PDMS Flexible Film for Tactile Sensing**

Kiran kumar Sappati (McGill University, Canada)

Sharmistha Bhadra (McGill University, Canada)

### **SPS18: Intrabody Communication for Body Area Networks**

*Session Chairs: Yueming Gao (Fuzhou University, China)*

*Željka Lučev Vasić (University of Zagreb, Croatia)*

### **A Differential Analog Receiver Front-End for Galvanic-Coupled Human Body Communication**

Dongming Li (Fuzhou University, China)

Jiahui Wu (Fuzhou University, China)

Yueming Gao (Fuzhou University, China)

Min Du (Fuzhou University, China)

Željka Lučev Vasić (University of Zagreb, Croatia)

Mario Cifrek (University of Zagreb, Croatia)

### **Design and Implementation of Galvanic Coupling Intra-Body Communication Transceivers using Differential Phase Shift Keying**

Ziliang Wei (Fuzhou University, China)  
Weikun Chen (Fuzhou University, China)  
Mingjing Yang (Fuzhou University, China)  
Yueming Gao (Fuzhou University, China)  
Željka Lučev Vasić (University of Zagreb, Croatia)  
Mario Cifrek (University of Zagreb, Croatia)

### **A Data-Fusion Algorithm for Respiration Rate Extraction Based on UWB Transversal Propagation Method**

Ivana Čuljak (University of Zagreb, Croatia)  
Hrvoje Mihaldinec (University of Zagreb, Croatia)  
Hrvoje Džapo (University of Zagreb, Croatia)  
Mario Cifrek (University of Zagreb, Croatia)

### **Preliminary Characterization of Capacitive Intrabody Communication Channel under Implantable-Like Conditions**

Željka Lučev Vasić (University of Zagreb, Croatia)  
Mario Cifrek (University of Zagreb, Croatia)  
Yueming Gao (Fuzhou University, China)  
Min Du (Fuzhou University, China)

### **Smart Infant-Monitoring System with Machine Learning Model to Detect Physiological Activities and Ambient Conditions**

Samira Shamsir (University of Missouri-Columbia, USA)  
Omiya Hassan (University of Missouri-Columbia, USA)  
Syed Islam (University of Missouri-Columbia, USA)

## **TC-1: Innovations for Next-Generation of Nondestructive Testing and Evaluation**

*Session Chair: Helena G. Ramos (Instituto de Telecomunicacoes, Instituto Superior Tecnico, Portugal)*

### **Microwave Nondestructive Detection of Influence of Alkali-Silica Reaction (ASR) in Materials Properties of Concrete Specimens**

John Gallion (Missouri University of Science and Technology, USA)  
Reza Zoughi (Iowa State University, USA)  
Nolan Hayes (The University of Tennessee, USA)

### **Multi-Bit Chipless RFID Sensing Methodology for Rotation Determination**

Katelyn R Brinker (Iowa State University & Center for Nondestructive Evaluation, USA)  
Reza Zoughi (Iowa State University, USA)

### **Crack Sizing Using Dual-Polarized Microwave SAR Imaging**

Matthew Dvorsky (Missouri University of Science and Technology, USA)  
Mohammad Tayeb Al Qaseer (Iowa State University, USA)  
Reza Zoughi (Missouri University of Science and Technology, USA)

### **Influence of the Material on the Measurement of Surface Roughness Using Eddy Current Technology**

Lara Vivian Fricke (Leibniz Universität Hannover & Institut für Werkstoffkunde, Germany)  
Bela Lehnhardt (Leibniz Universität Hannover, Germany)  
Sebastian Barton (Leibniz Universität Hannover, Germany)  
Hai Nam Nguyen (Leibniz Universität Hannover, Germany)  
Bernd Breidenstein (Leibniz Universität Hannover, Germany)  
David Zaremba (Leibniz Universität Hannover, Germany)  
Hans Jürgen Maier (Leibniz Universität Hannover, Germany)

**Research on Block Modeling and Electromagnetic Nondestructive Testing Method for Plain Weave CFRP**

Shuo Li (Tiangong University, China)

Ronghua Zhang (Tianjin Polytechnic University School of Artificial Intelligence, China)

Keyu Shi (Tiangong University, China)

Qian Zhao (Qufu Normal University, China)

Wuliang Yin (The University of Manchester, United Kingdom (Great Britain))

## **An Ultra-low-frequency Active Vertical Vibration Isolator with Geometric Anti-spring Structure for Absolute Gravimetry**

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Kang Wu (Tutor, China)

Meiyang Guo (Tsinghua University, China)

Guan Wang (Tsinghua University, China)

Lijun Wang (Supervisor, China)

**Abstract:** The absolute gravimeter plays an important role in metrology, geophysics, and geological exploration. Seismic and environmental vibration has been one of the most serious factors limiting its performance. Consequently, an ultra-low-frequency vertical vibration isolator is required to significantly improve its measurement precision. A novel active vertical vibration isolator employing geometric anti-spring (GAS) structure is proposed in this paper. The payload is supported by a GAS structure fixed on an inner frame, and the inner frame is hung by coil springs from the base. The relative movement of the payload with respect to the inner frame is detected, and the inner frame is driven by a voice coil actuator controlled by a feedback circuit to track the payload's motion. The new isolator has a compact size, and it can be used for different load ranges by tuning the GAS structure. The practical closed-loop system has a resonance period of 19.2 s, compared with the period of 0.74 s in an open-loop system. Experiments showed that the new isolator has great performance in a homemade T-1 absolute gravimeter, reducing the measurement deviation by a factor of 32. It is expected to be used in both free-falling and atomic-interference absolute gravimeters. Future improvements may include optimizing the mechanical structure and integrating a temperature control subsystem. Digital Object Identifier: 10.1109/TIM.2019.2927545

## **Statistical Evaluation of the Behavior of 5 GHz Radio LAN Devices**

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Ramy Gohary (Carleton University, Canada)

Ioannis Lambadaris (Carleton University, Canada)

**Abstract:** The goal of this paper is to develop an experimental hardware testbed for verifying the compliance of the medium access mechanism of commercially available Wi-Fi(TM) certified units with the 802.11 standard. The core of this testbed is based on a Universal Software Radio Peripheral (USRP), which is used to capture and down-convert the Wi-Fi frames to the baseband. The data captured by the USRP is used to extract the key medium access parameters of the commercial Unit Under Test (UUT). Our measurement methodology involves a novel compliance metric based on the Kullback-Leibler distance between probability distributions. This metric is in the form of a single scalar, which will hence enable us to rank the UUTs based on their level of compliance. Furthermore, we develop a method based on the Harmonized European standard ETSI EN 301 893 to identify UUTs with non-compliant access mechanisms that tend to monopolize the wireless medium, and UUTs for which compliance is an option that deviates from default settings. <https://doi.org/10.1109/TIM.2019.2910344>

## **Visible Light Positioning System Based on a Quadrant Photodiode and Encoding Techniques**

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**Abstract:** Visible Light Positioning Systems (VLPS) are a feasible alternative to local positioning systems thanks to the technology improvement and massive use of Light Emitting Diodes (LED). Compared to other technologies, VLPSs can provide significant advantages, such as the achieved accuracy, although they still present some issues, mainly related to the reduced coverage area or the high computational load. This work proposes the design of a VLPS based on four LED lamps as transmitters and a Quadrant Photodiode Angular Diversity Aperture (QADA) as a receiver. As the shape of the QADA is circular and the aperture to be installed over it is square, we derive the corresponding general equations to obtain the currents through the different pads of the QADA, regarding the angle of incidence of the light (and, inversely, how to estimate the angle of incidence from the measured currents). An encoding scheme based on 1023-bit Kasami sequences is proposed for every transmission from the LED lamps, thus providing multiple access capability and robustness against low signal-noise ratios and harsh conditions, such as multipath and near-far effect. A triangulation technique has been applied to estimate the receiver's position, by means of the Least Squares Estimator (LSE), together with some geometrical considerations. The proposal has been validated by simulation and by experimental tests, obtaining 3D positioning average errors below 13 cm and 5.5 cm for separations between the transmitters' plane and the receiver of 2 m and 1 m, respectively. (10.1109/TIM.2019.2962563)

## **Design and Evaluation of a Fast, High-Resolution Sensor Evaluation Platform Applied to MEMS Position Sensing**

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Juliana Leitzke (Alpen-Adria Universität, Austria)

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**Abstract:** We present the design and implementation of an adaptable field-programmable gate array (FPGA)-based sensor evaluation platform. This platform is developed to benchmark a capacitive position sensor for a resonant micromirror system. The sensor is developed in a smart packaging solution as a multilayer inkjet-printed electrode structure on a 3-D-printed metal housing. Very high required resolutions of  $res < 50 \text{ nm}$ , together with a wide measurement range of  $rm = 1000 \text{ }\mu\text{m}$  at an offset of  $d0 = 1000 \text{ }\mu\text{m}$ , motivate the development of such a platform. Yet, it is fully adaptable to other sensing principles (e.g., inductive). The suggested platform provides high sampling rates (up to  $\approx 10 \text{ ns}$ ) and enables generation of trigger signals, i.e., the mirror control signal, without time lag (as could result from high-order filters). The online configurable FPGA block structure in combination with host software blocks enables flexible and individual design. The sensor read-out circuitry is designed as a carrier frequency system. Such a carrier frequency system enables flexible choices of bandwidth and measurement signal frequency. It thus allows for separation in frequency from coupling parasitics, i.e., other frequencies present in the device under test (e.g., actuation frequency in case of the micromirror systems). DOI: 10.1109/TIM.2017.2771955

## **Non-Invasive Estimation of Plasma Sodium Concentration During Hemodialysis via Capacitively-Coupled Electrical Impedance Spectroscopy**

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**Abstract:** This paper presents a compact, low-cost, and non-invasive system for real-time estimation of plasma sodium concentration (NaPI) during a hemodialysis (HD) session with state-of-the-art accuracy. It is based on electrical impedance spectroscopy (EIS) performed with a capacitively-coupled impedance sensing cell and a high-frequency measurement device, both custom-built. The EIS data are processed to infer the resistance of the liquid inside the cell, which is used together with an optical hemoglobin sensor to estimate the NaPI. Validation of the EIS was performed by estimating the conductivity of blood-mimicking fluid (BMF). The complete method was validated using whole bovine blood, comparing the results to those obtained with standard instruments. The system was able to estimate the NaPI with sufficient accuracy (RMS error of  $3.0 \text{ mol/m}^3$  with respect to reference data) to provide clinically useful information. The proof-of-concept hardware can be converted to a cheap and compact circuit board for integration into an HD machine. DOI: 10.1109/TIM.2019.2913612

## **Electromagnetic Tracking Using Modular, Tiled Field Generators**

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**Abstract:** Electromagnetic tracking (EMT) systems play an important role in medicine, robotics, and virtual reality applications by providing accurate position and orientation referencing within a fixed volume around a magnetic field generator. Advances in sensor technology provide increasingly small, lightweight sensors capable of being integrated into hand-held devices for medical simulation, gaming, and image-guided surgery. The need for customizable tracking volumes becomes of interest as the uptake of EMT technology increases. This paper proposes a new method of creating custom tracking volumes from multiple planar field generators. A monolithic, low-cost printed circuit board design allows for tiling of multiple generators to create a larger tracking volume. Experiments were performed with two generators at different angles. Successful tracking is demonstrated with increased positional accuracy observed when transmitters are inclined with respect to one another. Horizontal tiling configurations are most accurate when a common edge is shared between adjacent field generators. (10.1109/TIM.2019.2900884)

### **Electromagnetic Measurement of Molten Metal Level in Pyrometallurgical Furnaces**

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**Abstract:** Accurate control of molten metal levels during pyrometallurgical smelting operations is critical to improving process decision-making and maximizing production efficiency, such as when to commence tapping and the duration of the tapping operation. In addition, molten metal level control is important for long term structural integrity of the furnace. Current methods to measure molten metal levels have limited accuracy and are intermittent, as they require manual measurement from above the furnace. In the present study, a continuous measurement system was designed to improve molten metal level measurement in pyrometallurgical furnaces. This paper describes tests of an electromagnetic sensing system consisting of eddy current drive and pickup coils that could be embedded in the wall of a furnace. As part of the development, portions of the system were simulated using COMSOL and a prototype of the key hardware components was built and tested in the laboratory to validate the simulation results. Differential coil hookup provided a low noise and high-resolution response. The system obtained a molten metal level detection resolution of five millimetres at liftoff distances approximately 300 mm from the simulated metal bath. Projection to latent structures (or Partial least square) and regression analyses were applied to signal response to predict metal height and good agreement between predicted and measured laboratory metal height was obtained. Initial results of the prototype system demonstrate its potential to accurately and continuously measure molten metal level, thereby improving safety and control of furnace operations. DOI 10.1109/TIM.2019.2929613

### **Multichannel QCM-based System for Continuous Monitoring of Bacterial Biofilm Growth**

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**Abstract:** Quartz crystal microbalance (QCM) sensors are becoming a good alternative to analytical methods for the measurement of bacterial growth in liquid media culture. For this purpose, two essential resonance parameters allow monitoring of biofilm formation: the series resonance frequency shift and the change of the resistance at this frequency. Nevertheless, several problems arise in determining these parameters, as their relative variation is very small. This means that an accurate procedure must be implemented for the measurement of the QCM resonance parameters, including the automatic calibration of the frequency response effects of the measurement circuits and the automatic compensation of the static electrical capacitance of the QCM. In this paper, a novel multichannel system for on-line monitoring of biofilm formation based on QCM sensors is proposed. QCM resonance parameters are determined from the electrical impedance analysis by means of an auto-balanced impedance bridge. This configuration has allowed the implementation of an affordable multichannel measurement instrument. Obtained results, based on binary mixtures of water-glycerol measurements and real microorganism experiments, are in good agreement with the theoretical behavior. These results show the great potential of this instrument to be used for monitoring microbial growth and biofilm formation. DOI: 10.1109/TIM.2019.2929280

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