

# **2016 IEEE Sensors Applications Symposium (SAS 2016)**

**Catania, Italy  
20 – 22 April 2016**



**IEEE Catalog Number: CFP16SAS-POD**  
**ISBN: 978-1-4799-7251-7**

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\*This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16SAS-POD
ISBN (Print-On-Demand):	978-1-4799-7251-7
ISBN (Online):	978-1-4799-7250-0

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## Wednesday, April 20

11:00 - 12:20

### SPECIAL SESSION: Magnetic sensors and applications 1

Chair: Claire Baraduc (Spintec (CEA/CNRS), France)

- Modelling the inductance of a novel eddy-current position sensor for high-precision applications ..... 1**  
*Johan Vogel (Delft University of Technology, The Netherlands)*  
*Stoyan Nihtianov (Delft University of Technology, The Netherlands)*
- A spinning current circuit for nanotesla range resolution in Hall measurements ..... 7**  
*Vincent Mosser (Issy Technology Center & Itron France, France)*  
*Nicolas Matringe (Alciom, France)*
- A Particle Filter for 2D Indoor Localization Relying on Magnetic Disturbances and Magnetic-Inertial Measurement Units ..... 13**  
*Gabriele Ligorio (Scuola Superiore Sant'Anna, Italy)*  
*Angelo Sabatini (Scuola Superiore Sant'Anna, Italy)*
- Noise Study of Open-loop Direct Current-Current Transformer using Magneto-Resistance Sensors ..... 19**  
*Eman Soliman (German University in Cairo, Egypt, Germany)*  
*Klaus Hofmann (TU Darmstadt, Germany)*  
*Hansjörg Reeg (GSI, Germany)*  
*Marcus Schwickert (GSI, Germany)*
- 11:00 - 12:20
- SPECIAL SESSION: Ultra Low power sensing for Internet of Things**
- Chairs: Davide Brunelli (University of Trento, Italy) & Michele Magno (ETH Zurich and University of Bologna, Switzerland)
- A wake-up receiver with ad-hoc antenna co-design for wearable applications ..... 24**  
*Tommaso Polonelli (University of Bologna, Italy)*  
*Trinh Le Huy (LEAT, Sophia Antipolis University of Nice, France)*  
*Leonardo Lizzi (University Nice-Sophia Antipolis, CNRS, LEAT, France)*  
*Fabien Ferrero (University Nice Sophia Antipolis, CNRS, LEAT & CREMANT, France)*  
*Michele Magno (ETH Zurich and University of Bologna, Switzerland)*
- Energy neutral 32-channels embedded readout system for IoT-ready fitness equipments ..... 30**  
*Maurizio Rossi (University of Trento, Italy)*  
*Aziz Khouia (University of Trento, Italy)*  
*Leandro Lorenzelli (FBK-Center for Materials and Microsystems, Italy)*  
*Davide Brunelli (University of Trento, Italy)*
- Experimental Validation of Opportunistic Direct Interconnection between different Wireless Sensor Networks ..... 36**  
*Krongboon Singhanat (University of Southampton, United Kingdom)*  
*Nick Harris (University of Southampton, United Kingdom)*  
*Geoff V Merrett (University of Southampton, United Kingdom)*
- A Smart Sensor for Precision Agriculture Powered by Microbial Fuel Cells ..... 42**  
*Davide Sartori (University of Trento, Italy)*  
*Davide Brunelli (University of Trento, Italy)*

14:00 - 15:20

**Energy harvesting and low power sensing**

**Chair:** Carlo Trigona (University of Catania, Italy)

**A Low Threshold Bistable Device for Energy Scavenging from Vibrations.....48**

*Bruno Andò (University of Catania, Italy)*

*Salvatore Baglio (University of Catania, Italy)*

*Vincenzo Marletta (University of Catania, Italy)*

*Antonio Pistorio (University of Catania, Italy)*

*Adi R. Bulsara (Space and Naval Warfare Center (San Diego), USA)*

**Vibration-based Transducer for Zero Energy standby applications.....53**

*Carlo Trigona (University of Catania, Italy)*

*Roberto La Rosa (ST Microelectronics, Italy)*

*Giulio Zoppi (STMicroelectronics, Italy)*

*Bruno Andò (University of Catania, Italy)*

*Salvatore Baglio (University of Catania, Italy)*

**A self-powered WSN for energy efficient heat distribution .....57**

*Alfredo D'Elia (University of Bologna, Italy)*

*Luca Perilli (University of Bologna, Italy)*

*Fabio Viola (University of Bologna, Italy)*

*Luca Roffia (University of Bologna, Italy)*

*Francesco Antoniazzi (University of Bologna, Italy)*

*Roberto Canegallo (ST Microelectronics, Italy)*

*Tullio Salmon Cinotti (University of Bologna, Italy)*

**An All-Digital Voltage Sensor for Static Voltage Drop Measurements .....63**

*Ching-Che Chung (National Chung Cheng University, Taiwan)*

*Mei-I Sun (National Chung Cheng University, Taiwan)*

14:00 - 15:20

**Sensors for Medical, Biomedical, and Healthcare Systems 1**

**Chair:** Alessandro Depari (University of Brescia, Italy)

**Functional characterization of developing heart in embryos using Electric Potential Sensors.....67**

*Elizabeth Rendon-Morales (University of Sussex & Sensor Technology Research Center, United Kingdom)*

*Robert Prance (University of Sussex, United Kingdom)*

*Helen Prance (University of Sussex, United Kingdom)*

*Rodrigo Aviles-Espinosa (Institute of Photonic Sciences, Spain)*

**Glucose sensing electrode system based on polymeric microneedles .....73**

*Principia Dardano (IMM-CNR, IMAST scarl, Italy)*

*Alessandro Calì (IMM-CNR, IMAST scarl, University of Naples "Federico II" Italy)*

*Vincenza Di Palma (IMAST scarl, ST Microelectronics, Italy)*

*Maria Fortuna Bevilacqua (IMAST scarl, STMicroelectronics, Italy)*

*Andrea Di Matteo (IMAST scarl, ST Microelectronics, Italy)*

*Luca De Stefano (IMM-CNR, IMAST scarl, Italy)*

**High-Sensitivity Polymer Fibre Bragg Grating Sensor for Biomedical Applications.....78**

*Kishore Bhowmik (University of New South Wales, Australia)*

*Eliathamby Ambikairajah (University of New South Wales, Australia)*

*Gang-Ding Peng (University of New South Wales, Australia)*

*Yanhua Luo (University of New South Wales, Australia)*

*Ginu Rajan (University of Wollongong, Australia)*

**Finding Features for Premature Ventricular Contraction Classification Using Wavelet Transform .....N/A**  
*Haolin Chong (Sensors Network and Applications Research Center, UCAS, P.R. China)*  
*Yingfei Sun (Sensors Network and Applications Research Center, UCAS, P.R. China)*  
*Lianying Ji (Sensors Network and Applications Research Center, UCAS, P.R. China)*  
*Jiakang Wu (Sensors Network and Applications Research Center, UCAS, P.R. China)*

**16:00 - 17:20**

**New Sensing and Transduction Methodologies and Devices**

**Chair:** Vedran Bilas (University of Zagreb, Croatia)

**Analog current-mode interfaces for differential capacitance sensing .....88**  
*Giuseppe Ferri (University of L'Aquila, Italy)*  
*Francesca Romana Parente (University of L'Aquila, Italy)*  
*Vincenzo Stornelli (University of L'Aquila, Italy)*

**A Modified RDC with an Auto-Adjustable SC Source Enabled Auto-Calibration Scheme .....94**  
*Rohit Gupta (Indian Institute of Technology Madras, India)*  
*Vijayakumar Sreenath (Indian Institute of Technology Madras, India)*  
*Boby George (Indian Institute of Technology Madras India)*

**A Precise Converter for Resolvers and Sinusoidal Encoders Based on a Novel Ratiometric Technique .....100**  
*Asem Khattab (Qatar University, Qatar)*  
*Sharief Saleh (Qatar University, Qatar)*  
*Mohieddine Benammar (Qatar University, Qatar)*  
*Faycal Bensaali (Qatar University, Qatar)*

**A Single Magnetic Nanocomposite Cilia Force Sensor .....106**  
*Ahmed Alfadhel (King Abdullah University of Science and Technology (KAUST), Saudi Arabia)*  
*Mohammed Asadullah Khan (King Abdullah University of Science and Technology, Saudi Arabia)*  
*Susana Cardoso (INESC-Microsystems and Nanotechnologies (INESC-MN), Universidade de Lisboa, Lisbon, Saudi Arabia)*  
*Jürgen Kosel (King Abdullah University of Science and Technology, Saudi Arabia)*

**16:00 - 17:20**

**Ultrasound sensors and fluid characterisation**

**Chair:** Vincenzo Marletta (University of Catania, Italy)

**Ultrasonic Level Sensors for Flowmetering of non-Newtonian Fluids in Open Venturi Channels .....110**  
*Khim Chhantyal (University College of Southeast Norway, Norway)*  
*Håkon Viumdal (University College of Southeast Norway, Norway)*  
*Saba Mylvaganam (University College of Southeast Norway, Norway)*  
*Geir Elseth (Statoil, Norway)*

**Automated Detection of Compressed Air Leaks Using a Scanning Ultrasonic Sensor System .....116**  
*Thomas Guenther (University of Kassel, Germany)*  
*Andreas Kroll (University of Kassel, Germany)*

**Ultrasonic Transducer Positioning System for Clamp-on Flowmeter Applications .....122**  
*Anett Bailleu (HTW Berlin & University of Applied Science, Germany)*

**Flow-Viz - An integrated digital in-line fluid characterization system for industrial applications ..... 128**

*Valentino Meacci (University of Florence, Italy)*

*Stefano Ricci (University of Florence, Italy)*

*Beat Birkhofer (Sika Services AG, Switzerland)*

*Reinhardt Kotzé (FPRC, Cape Peninsula University of Technology, South Africa)*

*Johan Wiklund (SP-Technical Research Institute of Sweden, Sweden)*

## Thursday, April 21

10:00 - 11:20

### **SPECIAL SESSION: Magnetic sensors and applications 2**

**Chair:** Vincent Mosser (Issy Technology Center, France)

- Hybrid magnetic composite (HMC) materials for sensor applications ..... 134**  
*Luca Ferraris (Politecnico di Torino, Italy)*  
*Fausto Franchini (Politecnico di Torino, Italy)*  
*Emir Pošković (Politecnico di Torino, Italy)*
- Low-cost dual-axes fluxgate sensor with a flat field-annealed magnetic core ..... 140**  
*Vojtech Petrucha (Czech Technical University in Prague & Faculty of Electrical Engineering, Czech Republic)*
- Towards digital fundamental mode orthogonal fluxgate ..... 144**  
*Mattia Butta (Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic)*
- High sensitivity magnetic field sensor for spatial applications ..... 149**  
*Claire Baraduc (Spintec (CEA/CNRS), France)*  
*Amandine Bocheux (LPC2E, CNRS, France)*  
*Claude Cavoit (LPC2E, CNRS - Université D'Orléans, France)*  
*Myckael Mouchel (Crocus Technology, France)*  
*Clarisse Ducruet (Crocus Technology, France)*  
*Romain Fons (Spintec, France)*  
*Philippe Sabon (Spintec, France)*  
*Ioan-Lucian Prejbeanu (Spintec, France)*
- 10:00 - 11:20
- SPECIAL SESSION: Sensors and sensing system for Assistive Technology**
- Chair:** Vincenzo Marletta (University of Catania, Italy)
- Contactless Fever Measurement based on Thermal Imagery Analysis..... 154**  
*Jörg Güttler (Technische Universität München, Faculty of Architecture, Germany)*  
*Christos Georgoulas (Technische Universität München & Chair for Building Realization and Robotics, Germany)*  
*Thomas Bock (Technische Universität München, Germany)*
- The Application of Security Adaptive Framework for Sensor in Industrial Systems ..... 160**  
*Bruno A. Mozzaquatro (Universidade Nova de Lisboa, Portugal)*  
*Raquel Melo (UNINOVA, Portugal)*  
*Carlos Agostinho (UNINOVA, Portugal)*  
*Ricardo J Goncalves (Universidade Nova de Lisboa, Portugal)*
- A Multisensor Approach to Perform Instrumented Postural Instability Tests for Patient with Parkinson Disease ..... 166**  
*Bruno Andò (University of Catania, Italy)*  
*Salvatore Baglio (University of Catania, Italy)*  
*Cristian O. Lombardo (University of Catania, Italy)*  
*Vincenzo Marletta (University of Catania, Italy)*  
*Valeria Dibilio (AOU Policlinico Vittorio Emanuele of Catania, Italy)*  
*G. Mostile (AOU Policlinico Vittorio Emanuele of Catania, Italy)*  
*Alessandra Nicoletti (AOU Policlinico Vittorio Emanuele of Catania, Italy)*  
*Mario Zappia (AOU Policlinico Vittorio Emanuele of Catania, Italy)*

**IPv6 WSN Solution for Integration and Interoperation Between Smart Home and AAL Systems ..... 171**

*Lorenzo Palma (Università Politecnica delle Marche, Italy)*  
*Luca Pernini (Università Politecnica delle Marche, Italy)*  
*Alberto Belli (Università Politecnica delle Marche, Italy)*  
*Simone Valenti (Università Politecnica delle Marche, Italy)*  
*Lorenzo Maurizi (Università Politecnica delle Marche, Italy)*  
*Paola Pierleoni (Università Politecnica delle Marche, Italy)*

**11:20 - 12:40**

**Capacitive and inductive sensing**

**Chair:** Mattia Butta (Czech Technical University in Prague, Faculty of Electrical Engineering, Czech Republic)

**Finite Element Analysis of Differential Capacitive PUF Sensors ..... 176**

*Cyril Baby K (Technische Universität München, Germany)*  
*Sithu Aung (Technische Universität München, Germany)*  
*Norbert Schwesinger (Technische Universität München, Germany)*

**Application of Capacitive-Based Contact Sensing for a new Medical Instrument ..... 182**

*Nazir Kamaldin (National University of Singapore, Singapore)*  
*Kok Kiong Tan (National University of Singapore, Singapore)*  
*Wenyu Liang (National University of Singapore, Singapore)*  
*Chee Wee Gan (Yong Loo Lin School of Medicine, National University of Singapore, Singapore)*  
*Hsueh Yee Lim (Yong Loo Lin School of Medicine, National University of Singapore, Singapore)*

**Evaluation of the Thin-Skin Approximation Boundary Element Method for Electromagnetic Induction Scattering Problems ..... 188**

*Michael O'Toole (University of Manchester, United Kingdom)*  
*John Davidson (University of Manchester, United Kingdom)*  
*Liam Marsh (University of Manchester, United Kingdom)*  
*Wuliang Yin (The University of Manchester, United Kingdom)*  
*Anthony Peyton (University of Manchester, United Kingdom)*

**Estimating Directional Magnetic Polarizabilities of Metallic Objects Using Planar Time-Domain Electromagnetic Induction Sensor ..... 194**

*Davorin Ambruš (University of Zagreb, Croatia)*  
*Darko Vasić (University of Zagreb, Croatia)*  
*Vedran Bilas (University of Zagreb, Croatia)*

**11:20 - 12:40**

**Sensors for Medical, Biomedical, and Healthcare Systems 2**

**Chair:** Gourab Sen Gupta (Massey University, New Zealand)

**Detection of Allergen-IgE interaction in Allergic Children Through Impedance Measurements ..... 199**

*Simona Barni (Meyer, Italy)*  
*Ada Fort (University of Siena, Italy)*  
*Marco Mugnaini (University of Siena, Italy)*  
*Neri Pucci (Meyer, Italy)*  
*Valerio Vignoli (University of Siena, Italy)*  
*Marco Tani (University of Siena, Italy)*  
*Elio Novembre (University of Florence, Italy)*

**Efficient R-peak Detection Algorithm for Real-time Analysis of ECG in Portable Devices ..... 205**

*Alessandro Depari (University of Brescia, Italy)*  
*Claudio Crema (University of Brescia, Italy)*  
*Angelo Vezzoli (University of Brescia, Italy)*  
*Alessandra Flammioni (University of Brescia, Italy)*

<b>IoT-based Remote Facial Expression Monitoring System with sEMG Signal.....</b>	<b>211</b>
<i>Mingzhe Jiang (University of Turku, Finland)</i>	
<i>Tuan Nguyen Gia (University of Turku, Finland)</i>	
<i>Arman Anzanpour (University of Turku, Finland)</i>	
<i>Amir-Mohammad Rahmani (University of Turku &amp; KTH Royal Institute of Technology, Finland)</i>	
<i>Tomi Westerlund (University of Turku, Finland)</i>	
<i>Sanna Salanterä (University of Turku, Finland)</i>	
<i>Pasi Liljeberg (University of Turku, Finland)</i>	
<i>Hannu Tenhunen (University of Turku &amp; Royal Institute of Technology, Sweden)</i>	
<b>Towards A Personalised Rehabilitation System for Post Stroke Treatment.....</b>	<b>217</b>
<i>Nick Harris (University of Southampton, United Kingdom)</i>	
<i>Dinesh Sthapit (University of Southampton, United Kingdom)</i>	
<b>14:00 - 14:30</b>	
<b>"Late Results" Poster Session</b>	
<b>Chair:</b> Lorenzo Scalise (Università Politecnica delle Marche, Italy) & Vincenzo Marletta (University of Catania, Italy)	
<b>Modeling and design of micro piezoresistive pressure sensor to detect pore water pressure for landslide monitoring.....</b>	<b>N/A</b>
<i>Muthusamy Shanmugavalli (MAM College of Engineering, India)</i>	
<i>K. A. Unnikrishna Menon (Amrita School of Engineering, India)</i>	
<i>Maneesha V. Ramesh (Amrita School of Engineering, India)</i>	
<i>Nithin P S (Amrita School of Engineering, India)</i>	
<b>Bioluminescent Sensing Technologies.Review.....</b>	<b>N/A</b>
<i>Iryna Dzieciuch (SPAWAR, USA)</i>	
<b>Sensors for Precision, Navigation, and Timing (PNT) of AUV Formations.....</b>	<b>N/A</b>
<i>Vladimir Djapic (SPAWAR Systems Center Pacific, USA)</i>	
<i>Andrew Sabater (SPAWAR Systems Center Pacific, USA)</i>	
<i>Adi Bulsara (SPAWAR Systems Center Pacific, USA)</i>	
<b>MEMS Tunable Aperture Driven by Electro-thermal Actuators.....</b>	<b>N/A</b>
<i>Kyuhyun Kwack (Seoul National University, Korea)</i>	
<i>Kukjin Chun (Seoul National University, Korea)</i>	
<b>INTMARSIS: A Real Time Seafloor Seismic Observatory.....</b>	<b>N/A</b>
<i>Enric Trullols (Universitat Politècnica de Catalunya, Spain)</i>	
<i>Xavier Roset (Universitat Politècnica de Catalunya, Spain)</i>	
<b>Flexible microwire RTD-Fluxgate magnetometers.....</b>	<b>N/A</b>
<i>Carlo Trigona (University of Catania, Italy)</i>	
<i>A. Beninato (University of Catania, Italy)</i>	
<i>Salvatore Baglio (University of Catania, Italy)</i>	
<i>Bruno Andò (University of Catania, Italy)</i>	
<i>Valentina Sinatra (University of Catania, Italy)</i>	
<i>A.R. Bulsara (Space and Naval Warfare Systems Center Pacific, USA)</i>	

**NeXOS A1 Smart Hydrophone Integration into the Sensor Web Enablement Framework.....N/A**

*Enoc Martinez (Universitat Politècnica de Catalunya, Spain)*  
*Daniel M Toma (Technical University of Catalonia, Spain)*  
*Enric Trullols (Universitat Politècnica de Catalunya, Spain)*  
*Joaquin del Rio (Universitat Politècnica de Catalunya, Spain)*  
*Eric Delory (Oceanic Platform of the Canary Islands, Spain)*  
*Diego Pinzani (SMID Technology)*  
*Simon Jirka (52°North GmbH, Germany)*  
*Jay (IEEE France Section, France)*

**Obstacle detection and avoidance system for Guanayll AUV.....N/A**

*Cesar Galarza, C (Universitat Politècnica de Catalunya (UPC), Spain)*  
*Ivan Masmitja (Universitat Politècnica de Catalunya (UPC), Spain)*  
*Jordi Prat (Universitat Politècnica de Catalunya (UPC), Spain)*  
*Enric Trullols (Universitat Politècnica de Catalunya (UPC), Spain)*  
*Spartacus Gomariz (Universitat Politècnica de Catalunya (UPC), Spain)*

**16:00 - 17:20**

**Fiber optic sensors**

**Chair:** Carlo Trigona (University of Catania, Italy)

**Optical fiber Bragg grating sensors for process monitoring in advanced composites .....222**

*Ebrahim Oromiehie (University of New South Wales, Australia)*  
*Gangadhara Prusty (University of New South Wales, Australia)*  
*Paul Compston (Australian National University, Australia)*  
*Ginu Rajan (University of Wollongong, Australia)*

**Surface plasmon resonance in a D-shaped plastic optical fibre: influence of gold layer thickness in monitoring molecularly imprinted polymers .....227**

*Nunzio Cennamo (Second University of Naples, Italy)*  
*Letizia De Maria (RSE Research on Energetic System SpA, Italy)*  
*Maria Pesavento (University of Pavia, Italy)*  
*Antonella Profumo (University of Pavia, Italy)*  
*Cristina Chemelli (RSE Research on Energetic System SpA, Italy)*  
*Luigi Zeni (Second University of Naples, Italy)*

**Fibre Optic Acoustic Emission Measurement Technique for Crack Activity Monitoring in Civil Engineering Applications .....232**

*Ginu Rajan (University of Wollongong, Australia)*  
*Sagar Jinachandran (University of Wollongong, Australia)*  
*Jiangtao Xi (University of Wollongong, Australia)*  
*Jayan S. Vinod (University of Wollongong, Australia)*  
*Shivakumar Karekal Karekal (University of Wollongong, Australia)*  
*Huijun Li (University of Wollongong, Australia)*  
*Gangadhara Prusty (UNSW Australia, Australia)*

**Augmented workplace for SPR sensor application .....238**

*Ramona V. Galatus (Technical University of Cluj-Napoca, Romania)*  
*Nunzio Cennamo (Second University of Naples, Italy)*  
*Luigi Luongo (Second University of Naples, Italy)*  
*Emil Voiculescu (Technical University of Cluj Napoca, Romania)*  
*Luigi Zeni (Second University of Naples, Italy)*

16:00 - 17:20

**Sensors for Industrial Applications and Processes Monitoring 1**

**Chair:** Shreekanth Mandayam (Rowan University, USA)

**A Software-Defined Coherent Fiber Optic Sensor for Manufacturing Machine Diagnostic ..... 242**

*Maddalena Ferrario (Politecnico di Milano & Coherentia - start up of the Politecnico di Milano, Italy)*

*Marco Mattarei (Politecnico di Milano & Coherentia - start up of the Politecnico di Milano, Italy)*

*Pierpaolo Boffi (Politecnico di Milano, Italy)*

*Mario Martinelli (Politecnico di Milano, Italy)*

**Supervision of the Rotor Bars Breakage Evolution through the Output Voltage of Coil Sensors Placed Outside Induction Motors ..... 247**

*Virgiliu Fireteanu (Politehnica University of Bucharest, Romania)*

*Alexandru-Ionel Constantin (Politehnica University of Bucharest, Romania)*

**Sensors applications within the research framework of the PACMAN Project on metrology for particle accelerators at CERN ..... 253**

*Pasquale Arpaia (University of Naples Federico II, Italy)*

*K. Artoos (CERN, Switzerland)*

*M. Buzio (CERN, Switzerland)*

*D. Caiazza (CERN, Switzerland & University of Sannio, Italy)*

*N. Catalan Lasheras (CERN, Switzerland)*

*A. Cherif (CERN, Switzerland)*

*I. Doytchinov (CERN, Switzerland)*

*J.F. Fuchs (CERN, Switzerland)*

*A. Gaddi (CERN, Switzerland)*

*N. Galindo Munoz (CERN, Switzerland & University of Naples Federico II, Italy)*

*J.C. Gayde (CERN, Switzerland)*

*S. W. Kamugasa (CERN, Switzerland)*

*H. Mainaud Durand (CERN, Switzerland)*

*M. Modena (CERN, Switzerland)*

*P. Novotny (CERN, Switzerland)*

*S. Russenschuck (CERN, Switzerland)*

*C. Sanz (CERN, Switzerland)*

*G. Severino (CERN, Switzerland & University of Sannio, Italy)*

*D. Tshilumba (CERN, Switzerland)*

*V. Vlachakis (CERN, Switzerland)*

*M. Wendt (CERN, Switzerland)*

*S. Zorzetti (CERN, Switzerland)*

**Novel Sensor Concepts for the Compliance with the EMF Directive 2013/35/EU ..... 259**

*Valerio De Santis (University of L'Aquila, Italy)*

*Tommaso Campi (University of L'Aquila, Italy)*

*Silvano Cruciani (University of L'Aquila, Italy)*

*Mauro Feliziani (University of L'Aquila, Italy)*

## Friday, April 22

08:30 - 09:30

### Poster Session I

Chair: Pasquale Arpaia (University of Naples Federico II, Italy) & Nicola Donato (University of Messina, Italy)

- Radon Monitor Using Alpha-Detecting CMOS IC .....263**  
*Alexander J.H. Ross (Carleton University, Canada)*  
*Ryan Griffin (Carleton University, Canada)*  
*N. Garry Tarr (Carleton University, Canada)*
- A cooperative monitoring and diagnostic architecture for PV systems.....268**  
*Loredana Cristaldi (Politecnico di Milano, Italy)*  
*Marco Faifer (Politecnico di Milano, Italy)*  
*Massimo Lazzaroni (Università degli Studi di Milano, Italy)*
- A Study of Efficient Speaklet Driving Mechanisms for Use in a Digital Loudspeaker Array Based on PZT Actuators .....274**  
*Sangchai Monkronthong (University of Southampton, United Kingdom)*  
*Neil M White (University of Southampton, United Kingdom)*  
*Nick Harris (University of Southampton, United Kingdom)*
- FPGA Based Emulation of Multiple 1-Wire Sensors for Hardware in the Loop Tests.....279**  
*Markus Eider (Degendorf Institute of Technology, Germany)*  
*Stefan Kunze (Degendorf Institute of Technology, Germany)*  
*Rainer Poeschl (Degendorf Institute of Technology, Germany)*
- Estimating Viscosity of non-Newtonian Fluids using Support Vector Regression Method.....285**  
*Khim Chhantyal (University College of Southeast Norway, Norway)*  
*Saba Mylvaganam (University College of Southeast Norway, Norway)*  
*Håkon Viumdal (University College of Southeast Norway, Norway)*  
*Geir Elseth (Statoil, Norway)*
- A multidisciplinary strategy for in-situ and remote sensing monitoring of areas affected by pressurized fluids: application to mud volcanoes .....291**  
*Filippo Greco (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Giuseppe Salerno (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Salvatore Giammanco (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Letizia Spampinato (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Rosalba Napoli (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Alfio Amantia (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Gilda Currenti (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Massimo Cantarero (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Annamaria Vicari (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Alfio Messina (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Alessandro La Spina (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*  
*Antonino Sicali (Istituto Nazionale di Geofisica e Vulcanologia, Italy)*
- A Neural Network Approach for Safety Monitoring Applications.....297**  
*Zlatica Marinković (University of Niš, Serbia)*  
*Aleksandar Atanasković (Faculty of Electronic Engineering, University of Niš, Serbia)*  
*Maria Gabriella Xibilia (University of Messina, Italy)*  
*Calogero Pace (University of Calabria, Italy)*  
*Mariangela Latino (University of Messina, Italy)*  
*Nicola Donato (University of Messina, Italy)*

<b>FPGA-based embedded system for the wind tunnel variable-geometry nozzle positioning .....</b>	<b>N/A</b>
<i>Biljana Ilić (Military Technical Institute, Serbia)</i>	
<i>Mirko Milosavljević (Military Technical Institute, Serbia)</i>	
<i>Dušan Ćurčić (Military Technical Institute, Serbia)</i>	
<i>Jovan Isaković (College of Applied Engineering Studies, Tehnikum-Taurunum, Serbia)</i>	
<b>In-flight roll angle estimation for a guided high spin projectile .....</b>	<b>308</b>
<i>Ronan Adam (French-German Research Institute of Saint-Louis, France)</i>	
<i>Emmanuel Pecheur (French-German Research Institute of Saint-Louis, France)</i>	
<i>Loïc Bernard (French-German Research Institute of Saint-Louis, France)</i>	
<i>Sébastien Changey (French-German Research Institute of Saint-Louis, France)</i>	
<b>Real-Time Sensor Data Integration in Vertical Transport Systems.....</b>	<b>314</b>
<i>Jaroslav M. Francik (Kingston University, United Kingdom)</i>	
<i>Vesna Brujic-Okretic (Kingston University, United Kingdom)</i>	
<i>Mirko Menegazzo (Imperial College, United Kingdom)</i>	
<i>Adrian Godwin (Movvéo Ltd., United Kingdom)</i>	
<i>Krzysztof Zienowicz (Movvéo Ltd., United Kingdom)</i>	
<b>COSA: An Approach to Classifying Uncertainty in an Ontology Tree for Sensor Data Fusion .....</b>	<b>320</b>
<i>Aditya Gaur (University of Ulster, United Kingdom)</i>	
<i>Bryan Scotney (University of Ulster, United Kingdom)</i>	
<i>Gerard Parr (University of Ulster, United Kingdom)</i>	
<i>Sally McClean (University of Ulster, United Kingdom)</i>	
<b>Methodologies for continuous activity classification of user through wearable devices Feasibility and preliminary investigation .....</b>	<b>326</b>
<i>Filippo Pietroni (Università Politecnica delle Marche, Italy)</i>	
<i>Sara Casaccia (Università Politecnica delle Marche, Italy)</i>	
<i>Gian Marco Revel (Università Politecnica delle Marche, Italy)</i>	
<i>Lorenzo Scalise (Università Politecnica delle Marche, Italy)</i>	
<b>10:00 - 11:20</b>	
<b>Flexible sensors and sensor characterisation</b>	
<b>Chair:</b> Bruno Andò (University of Catania, Italy)	
<b>Innovative Large Area Touch Sensor: Design and Tests of a Compact Acquisition System .....</b>	<b>332</b>
<i>Nissem Selmene (Ecole des Mines de Saint Etienne &amp; Telecom Sud Paris, France)</i>	
<i>Sylvain Blayac (Ecole des Mines de saint Etienne - Center for Microelectronics in Provence, France)</i>	
<i>Muriel Muller (Institut Mines-Telecom / Telecom SudParis, France)</i>	
<i>Ghalid Abib (Institut Mines Telecom / Télécom SudParis, France)</i>	
<b>Study on a Telemetric System that Works with an Inkjet-printed Resistive Strain Gauge.....</b>	<b>338</b>
<i>Michele Bona (University of Brescia, Italy)</i>	
<i>Emilio Sardini (University of Brescia, Italy)</i>	
<i>Mauro Serpelloni (University of Brescia, Italy)</i>	
<i>Bruno Andò (University of Catania, Italy)</i>	
<i>Cristian Orazio Lombardo (University of Catania, Italy)</i>	
<b>Resistive Characterization of Soft Conductive PDMS Membranes for Sensor Applications .....</b>	<b>344</b>
<i>Cyril Baby K (Technische Universität München, Germany)</i>	
<i>Ubaidul Fikri (Technical University of Munich, Singapore)</i>	
<i>Norbert Schwesinger (Technische Universität München, Germany)</i>	

<b>Fabrication and Characterization of Magnetic Composite Membrane Pressure Sensor .....</b>	<b>350</b>
<i>Mohammed Asadullah Khan (King Abdullah University of Science and Technology, Saudi Arabia)</i>	
<i>Ahmed Alfadhel (King Abdullah University of Science and Technology, Saudi Arabia)</i>	
<i>Mashail Bakolka (Effat University, Saudi Arabia)</i>	
<i>Jürgen Kosel (King Abdullah University of Science and Technology, Saudi Arabia)</i>	

**10:00 - 11:20**

**SPECIAL SESSION: Wireless sensor networks for distributed measurement applications**

**Chair:** Alessandro Depari (University of Brescia, Italy)

<b>A wireless cloud network platform for critical data publishing in industrial process automation.....</b>	<b>355</b>
<i>Leonardo Ascorti (Pepper+Fuchs srl, Italy)</i>	
<i>Stefano Savazzi (National Research Council of Italy (CNR) &amp; Politecnico di Milano, Italy)</i>	
<i>Emiliano Sisinni (University of Brescia, Italy)</i>	
<i>Stefano Galimberti (Pepperl+Fuchs srl, Italy)</i>	

<b>Automatic Detection of Radio Signal Obstruction in Wireless Sensor Networks' on-Demand Deployment .....</b>	<b>361</b>
<i>Tajudeen Olasupo (Florida Institute of Technology, USA)</i>	
<i>Carlos Otero (Florida Institute of Technology, USA)</i>	
<i>Abrar Qureshi (The University of Virginia - College at Wise, USA)</i>	
<i>Kehinde O. Olasupo (Florida Institute of Technology, USA)</i>	

<b>Accelerating Distributed Averaging in Sensor Networks: Randomized Gossip over Virtual Coordinates .....</b>	<b>367</b>
<i>Valerio Freschi (University of Urbino, Italy)</i>	
<i>Emanuele Lattanzi (University of Urbino, Italy)</i>	
<i>Alessandro Bogliolo (University of Urbino, Italy)</i>	

<b>A Low-Power MEMS Microphone Array for Wireless Acoustic Sensors.....</b>	<b>373</b>
<i>Geoffrey Ottoy (KU Leuven &amp; Technology Campus Ghent, Belgium)</i>	
<i>Bart Thoen (KU Leuven, Belgium)</i>	
<i>Lieven De Strycker (KU Leuven, Belgium)</i>	

**11:20 - 12:40**

**Automotive and Transportations**

**Chair:** Michael O'Toole (University of Manchester, United Kingdom)

<b>Performance Measurements of Energy Storage Systems and Control Strategies in Real-world e-bikes .....</b>	<b>379</b>
<i>Sergio Saponara (University of Pisa, Italy)</i>	
<i>Riccardo Moras (University of Pisa, Italy)</i>	
<i>Roberto Roncella (University of Pisa, Italy)</i>	
<i>Roberto Saletti (University of Pisa, Italy)</i>	
<i>Davide Benedetti (Carbon Dream, Italy)</i>	

<b>Ship Motion Sensor Isolation System Development and Testing for use with Low Cost IMUs.....</b>	<b>385</b>
<i>Eddy Trinklein (Michigan Technological University, USA)</i>	
<i>Gordon Parker (Michigan Technological University, USA)</i>	

<b>A Wireless Steering Wheel Gripping Sensor for Hands On/Off Detection .....</b>	<b>391</b>
<i>Stephan Mühlbacher-Karrer (Alpen-Adria Universität, Austria)</i>	
<i>Lisa-Marie Faller (Alpen-Adria Universität, Austria)</i>	
<i>Raiyan Hamid (Alpen-Adria Universität, Austria)</i>	
<i>Hubert Zangl (Alpen-Adria Universität, Austria)</i>	

**Flexible Architecture to Automate Farm Machinery Operation: Preliminary Results .....396**  
*Brendan Taylor (Massey University, New Zealand)*  
*Gourab Sen Gupta (Massey University, New Zealand)*  
*Ken Mercer (Massey University, New Zealand)*

**11:20 - 12:40**

**Smartphone applications and RF sensing**

**Chair:** Emiliano Sisinni (University of Brescia, Italy)

**Smart fLAIr: a Smartphone Application for Fast LAI Retrieval using Ambient Light Sensors .....401**  
*Jan Bauer (University of Osnabrück & Institute of Computer Science, Germany)*  
*Bastian Siegmann (University of Osnabrück, Germany)*  
*Thomas Jarmer (University of Osnabrück, Germany)*  
*Nils Aschenbruck (University of Osnabrück & Institute of Computer Science, Germany)*

**Microwave-based leaf wetness detection in agricultural wireless sensor networks .....407**  
*Elisa Pievanelli (Politecnico di Torino - iXem Labs, Italy)*  
*Riccardo Stefanelli (Politecnico di Torino - iXem Labs, Italy)*  
*Daniele Trincherò (Politecnico di Torino & iXem Labs, Italy)*

**Physical and Virtual Cell Phone Sensors for Traffic Control: Algorithms and Deployment Impact .....411**  
*Shumeet Baluja (Google, USA)*  
*Michele Covell (Google, USA)*  
*Rahul Sukthankar (Google, USA)*

**Radar Sensor Signal Acquisition and 3D FFT Processing for Smart Mobility Surveillance Systems .....417**  
*Sergio Saponara (University of Pisa, Italy)*  
*Bruno Neri (University of Pisa, Italy)*

**14:30 - 15:30**

**Poster Session II**

**Chair:** Michele Bona (University of Brescia, Italy) & Loredana Cristaldi (Politecnico di Milano, Italy)

**Mathematical Process of Transforming RF Signal to Position Information for Tracking Ingestible Capsules .....423**  
*Francis Adepoju (American University of Nigeria, Nigeria)*  
*Khalil Arshak (University of Limerick, Ireland)*

**A compact electronic interface for electrochemical sensors .....429**  
*Luca Lombardo (University of Messina, Italy)*  
*Silvia Generelli (Centre Suisse D'Electronique et de Microtechnique SA, Italy)*  
*Noe Tschärner (Centre Suisse D'Electronique et de Microtechnique SA, Italy)*  
*Davide Migliorelli (Centre Suisse D'Electronique et de Microtechnique SA, Switzerland)*  
*Nicola Donato (University of Messina, Italy)*

**Auto Calibrated Head Orientation Controller for Robotic-Wheelchair Using MEMS Sensors and Embedded Technologies .....433**  
*Mohammed Faeik Ruzajj (Center for Life Science Automation (Celisca), University of Rostock & Technical Institute of Babylon, Al-Furat Al-Awsat Technical University (ATU), Germany)*  
*Sebastian Neubert (University of Rostock, Germany)*  
*Norbert Stoll (University of Rostock & Institute of Automation, Germany)*  
*Kerstin Thurow (Center for Life Science Automation - CELISCA, Germany)*

<b>Simulation-based Approach to Application Fitness for an E-Bike.....</b>	<b>439</b>
<i>Alexandra Iosub (Gheorghe Asachi Technical University of Iasi, Romania &amp; Infineon AG Neubiberg, Germany)</i>	
<i>Jerome Kirscher (Infineon AG Neubiberg, Germany)</i>	
<i>Monica Rafaila (Infineon AG Neubiberg, Germany)</i>	
<i>Andi Buzo (Infineon Technologies Romania &amp; Co SCS, Romania)</i>	
<i>Georg Pelz (Infineon Technologies AG, Germany)</i>	
<i>Liviu Goras (Technical University of Iasi, Romania)</i>	
<b>Multisensor Electrostatic Detection of Moving Charged Particles .....</b>	<b>445</b>
<i>Tommaso Addabbo (University of Siena, Italy)</i>	
<i>Ada Fort (University of Siena, Italy)</i>	
<i>Marco Mugnaini (University of Siena, Italy)</i>	
<i>Enza Panzardi (University of Siena, Italy)</i>	
<i>Santina Rocchi (University of Siena, Italy)</i>	
<i>Valerio Vignoli (University of Siena, Italy)</i>	
<b>Milk quality analysis based on a novel ultrasound spectroscopy method .....</b>	<b>451</b>
<i>Emanuele Viviani (University of Trieste, Italy)</i>	
<i>Daniele Salvalaggio (University of Trieste, Italy)</i>	
<i>Cristina Bertoni (University of Trieste, Italy)</i>	
<i>Antonio Boscolo (University of Trieste, Italy)</i>	
<b>Weather Stations-Assisted Barometric Altimeter for Android: Interpolation Techniques for Improved Accuracy.....</b>	<b>456</b>
<i>João Azevedo (Universidade do Porto, Portugal)</i>	
<i>Sérgio Crisóstomo (University of Porto &amp; Instituto de Telecomunicações, Portugal)</i>	
<b>Stability evaluation of YCoO3 based perovskites used for NO2 detection .....</b>	<b>462</b>
<i>Francesco Bertocci (University of Siena, Italy)</i>	
<i>Ada Fort (University of Siena, Italy)</i>	
<i>Marco Mugnaini (University of Siena, Italy)</i>	
<i>Valerio Vignoli (University of Siena, Italy)</i>	
<b>Integrating Remote Sensors in a Smartphone: the project "Sensors for ANDROID in Embedded systems".....</b>	<b>468</b>
<i>Angelo Vezzoli (University of Brescia, Italy)</i>	
<i>Alessandra Flammini (University of Brescia, Italy)</i>	
<i>Stefano Rinaldi (University of Brescia, Italy)</i>	
<i>Alessandro Depari (University of Brescia, Italy)</i>	
<b>A Multi-Perspective Virtual Reality Visualization of Unmanned Aerial Systems in the U.S. National Airspace.....</b>	<b>474</b>
<i>Michael Bucceroni (Rowan University, USA)</i>	
<i>George D. Lecakes, Jr. (Rowan University, USA)</i>	
<i>Mira Lalovic-Hand (Rowan University, USA)</i>	
<i>Shreekanth Mandayam (Rowan University, USA)</i>	
<b>Methods for Improving the Accuracy of Sensors with a Significant Influence of Non-Informative Factors.....</b>	<b>478</b>
<i>Nataliia Roshchupkina (Chernivtsi National University, Ukraine)</i>	
<i>Volodymyr Kochan (Ternopil National Economic University, Ukraine)</i>	
<i>Oleksiy Roshchupkin (Czech Technical University in Prague, Ukraine)</i>	
<i>Anatoliy Sachenko (Silesian University of Technology, Poland &amp; Ternopil National Economic University, Ukraine)</i>	
<i>Jun Su (Hubei University of Technology, P.R. China)</i>	

<b>A Rugged Sensor System for Real-time Bridge Safety Monitoring in Taiwan .....</b>	<b>484</b>
<i>Chih-Chyau Yang (National Chip Implementation Center, Taiwan)</i>	
<i>Ssu-Ying Chen (National Chip Implementation Center, Taiwan)</i>	
<i>Yi-Jie Hsieh (National Chip Implementation Center, Taiwan)</i>	
<i>Fu-Chen Cheng (National Chip Implementation Center, Taiwan)</i>	
<i>Chih-Ting Kuo (National Chip Implementation Center, Taiwan)</i>	
<i>Jin-Ju Chue (National Chip Implementation Center, Taiwan)</i>	
<i>Chien-Ming Wu (National Chip Implementation Center, Taiwan)</i>	
<i>Chun-Ming Huang (National Chip Implementation Center, Taiwan)</i>	
<i>Yu-Cheng Huang (National Chip Implementation Center, Taiwan)</i>	

<b>Fibre Optic Acoustic Emission Sensor System for Hydrogen Induced Cold Crack Monitoring in Welding Applications .....</b>	<b>489</b>
<i>Sagar Jinachandran (University of Wollongong, Australia)</i>	
<i>Chen Shen (School of Mechanical, Materials and Mechatronics, Australia)</i>	
<i>Huijun Li (University of Wollongong, Australia)</i>	
<i>Jiangtao Xi (University of Wollongong, Australia)</i>	
<i>Gangadhara Prusty (UNSW Australia, Australia)</i>	
<i>Ginu Rajan (University of Wollongong, Australia)</i>	

**16:00 - 17:20**

**Localisation and position sensing**

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

<b>Accessible Synthetic Aperture Radar System for Autonomous Vehicle Sensing .....</b>	<b>495</b>
<i>Seongha Park (Purdue University, USA)</i>	
<i>Yongho Kim (Purdue University, USA)</i>	
<i>Eric Matson (Purdue University, USA)</i>	
<i>Anthony Smith (Purdue University, USA)</i>	

<b>Evaluation of the accuracy in the determination of the center of rotation by magneto-inertial sensors ...</b>	<b>501</b>
<i>Michele Crabolu (University of Cagliari, Italy)</i>	
<i>Danilo Pani (University of Cagliari, Italy)</i>	
<i>Andrea Cereatti (University of Sassari, Italy)</i>	

<b>Indoor distance estimated from Bluetooth Low Energy signal strength: comparison of regression models .....</b>	<b>506</b>
<i>Stefano Bertuletti (University of Sassari, Italy)</i>	
<i>Andrea Cereatti (University of Sassari, Italy)</i>	
<i>Ugo Della Croce (University of Sassari, Italy)</i>	
<i>Michele Caldara (University of Bergamo, Italy)</i>	
<i>Michael Galizzi (STMicroelectronics, USA)</i>	

<b>Breadcrumb: An Indoor Simultaneous Localization and Mapping System for Mobile Devices .....</b>	<b>511</b>
<i>Duke Danielle Delos Santos (De La Salle University, Philippines)</i>	
<i>Alron Jan Lam (De La Salle University, Philippines)</i>	
<i>Jules Macatangay (De La Salle University, Philippines)</i>	
<i>Ivan Paner (De La Salle University, Philippines)</i>	
<i>Courtney Anne Ngo (De La Salle University, Philippines)</i>	

16:00 - 17:20

**Sensors for Industrial Applications and Processes Monitoring 2**

**Chair:** Gourab Sen Gupta (Massey University, New Zealand)

**The error compensation for static hysteresis characteristics of Giant Magneto-Resistance sensor .....517**

*Zhao Xiaodong (Beihang University, P.R. China)*

*Qian Zheng (Beihang University, P.R. China)*

*Tian Yuan (Beihang University, P.R. China)*

*Wang Jingyi (Beihang University, P.R. China)*

*Yu Hao (Beihang University, P.R. China)*

**Dielectric spectroscopy of artificial faeces for smouldering applications .....522**

*Thierry Bore (The University of Queensland, Australia)*

*Luis Yermán (The University of Queensland, Australia)*

*Marcelo Llano Serna (The University of Queensland, Australia)*

*Harrison Wall (The University of Queensland, Australia)*

*Jose Torero (The University of Queensland, Australia)*

*Alexander Scheuermann (The University of Queensland, Australia)*

**A Counting Sensor for Inbound and Outbound People Using IR-UWB Radar Sensors .....528**

*Jeong Woo Choi (Hanyang University, Korea)*

*Sung Ho Cho (Hanyang University, Korea)*

*Young Soo Kim (Seoul-Metro Urban Railway R&D Center, Korea)*

*No Joong Kim (Seoul-Metro Urban Railway R&D Center, Korea)*

*Soon Sung Kwon (Seoul-Metro Urban Railway R&D Center, Korea)*

*Jae Suk Shim (Seoul-Metro Urban Railway R&D Center, Korea)*

**Imaging Sensor and Imaging Algorithms for Quality Inspection of flexible Materials .....533**

*Maik Rosenberger (Ilmenau University of Technology, Germany)*

*Chen Zhang (Ilmenau University of Technology, Germany)*

*Gunther Notni (Ilmenau University of Technology, Germany)*

*Mike Bartmuß (Ilmenau University of Technology, Germany)*

**Author Index.....539**