



# IEEE SENSORS 2021

Virtual Conference – Oct 31 – Nov 4, 2021



## SENSORS 2021 CONFERENCE PROGRAM

Please visit website for  
more information!

[2021.ieee-sensorsconference.org](https://2021.ieee-sensorsconference.org)

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## **WELCOME IEEE SENSORS 2021**

Dear IEEE SENSORS 2021 participants,

Welcome to the online SENSORS 2021!

On behalf of the Organizing Committee of the 20th IEEE SENSORS Conference, we are excited to welcome you to our online meeting environment. While we are disappointed that we are unable to be together in Sydney this year, we are still enthusiastic about the opportunity to “gather” online to discuss important research developments in the sensors community. With the tools for online presentation and chat, and the networking events aimed at engaging online attendees, we are confident that the meeting will be productive for those that commit to participating.

Despite some worldwide challenges, 2021 is still a fantastic time to be involved in sensor technologies. The technical area of sensors is one of the most exciting fields in which to work and study, and IEEE SENSORS 2021 is bringing together research scientists, engineers and practitioners from around the world to present their latest research, ideas, and applications. Advances continue at a rapid pace, and the use and application of sensors is expanding daily; as new developments occur, the IEEE SENSORS conference helps keep you informed and up to date on the technology as well as the people involved. We hope you will take the time to fully engage with other attendees and invited speakers, as our purpose is to not only provide information but also to facilitate collaborations and connections.

Faced with the difficulty in accommodating global attendance in an international online conference we have decided this year to distribute the conference activities over 5 days, rather than 4. This allows to keep the technical program each day to about 4.5 hours of which 1.5 hour or more can be used for active interaction with poster presenters, exhibitors, authors, attendees, new colleagues in the field, etc.

We will kick off our Conference with a Welcome Reception, highlighting Young Professionals. Over the next several days, you will have the opportunity to hear a diverse set of globally-renowned Keynote Speakers: Professor Justin Gooding from University of New South Wales (Sydney), Professor Debbie Senesky from Stanford University, and Professor Jérôme Casas from University of Tours, France. In addition, a plenary session on Women in Sensors (WiSe) will highlight the contributions of some women leaders from our community. A broad combination of technical sessions – platform talks and poster sessions – will be presented in parallel each day, and we will have special sessions targeted for Young Professionals and Women in Sensors. Of course, all are welcome and encouraged to attend each of these events! As in previous years, we will have some dedicated time to highlight our sponsors and exhibitors. On Wednesday and Thursday mornings, we will have our annual awards ceremonies highlighting extraordinary achievements in our community, service to the IEEE Sensors Council, as well as conference awards. This is just a sampling of the exciting things happening this week; please refer to the full online program for complete details.

Our conference this year received a total of 568 submissions, of which 333 will be presented during the conference. Of these accepted submissions, 159 will be presented during oral presentation sessions, and the remainder will be presented as posters. All contributed papers went through an identical peer-review process; finally accepted papers will be published in the Conference Proceedings, available electronically on IEEE Xplore. Submissions were from academia (86.6%), research facilities and government laboratories (5.1%), industry (6.5%), and other (0.7%). The submitted papers came from all global regions,

with about 35% from Europe, 41.4% from Asia/Pacific, 21.7% from North America and about 2% from Latin America and Middle East/Africa.

We are honored to have you participating in IEEE SENSORS 2021. We hope that you will learn, share, expand your network, and have a great time! We look forward to your feedback on this event and we hope to see you – physically – in Dallas (2022), Vienna (2023), and Kobe (2024)! With some good fortune, we will be able to hold an IEEE SENSORS meeting in Sydney in the not-too-distant future.

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Octavian Postolache, *Instituto de Telecomunicacoes, IT-IUL*

Sampo Tuukkanen, *Tampere University, Finland*

### **Track 2: Sensor Materials, Processing and Fabrication (including Printing)**

Mohsen Asadnia, *Macquarie University, Australia*

Masato Sone, *Tokio Institute of Technology, Japan*

### **Track 3: Chemical, Electrochemical and Gas Sensors**

Preethi Preethichandra, *Central Queensland University, Australia*

Marios Sophocleous, *University of Cyprus, Cyprus*

### **Track 4: Microfluidics and Biosensors**

Chirasree RoyChowdhury, *Indian Institute of Engineering Science and Technology, India*

Loes Segerink, *University of Twente, The Netherlands*

### **Track 5: Optical Sensors**

Wan-Young Chun, *Kyungpook National University, South Korea*

Hengky Chandralim, *US Air Force Institute of Technology, USA*

Minghong Yang, *Wuhan University of Technology, China*

### **Track 6: Physical Sensors - Temperature, Mechanical, Magnetic and Others**

Kunihisa Tashiro, *Shinshu University, Japan*

Giacomo Langfelder, *Politecnico di Milano, Italy*

### **Track 7: Acoustic and Ultrasonic Sensors**

Bernhard Jakoby, *Johannes Kepler University Linz, Austria*

Sheng-Shian Li, *National Tsing Hua University, Taiwan*

Krishnan Balasubramaniam, *Indian Institute of Technology Madras, India*

### **Track 8: Sensor Packaging (including on Flexible Materials)**

Alex Mason, *Norwegian University of Life Sciences, Norway*

Eric MacDonald, *Youngstown State University, USA*

### **Track 9: Sensor Networks (including IoT and Related Areas)**

Henry Leung, *University of Calgary, Canada*

Binbin Chen, *Singapore University of Technology and Design, Singapore*

### **Track 10: Emerging Sensor Applications**

Theerawit Wilaiprasitporn, *Vidyasirimedhi Institute of Science & Technology, Thailand*

Volker Nock, *University of Canterbury, New Zealand*

### **Track 11: Sensor Systems: Signals, Processing and Interfaces**

Boby George, *Indian Institute of Technology Madras, India*

Michael Daniele, *NC State University, USA*

### **Track 12: Actuators and Sensor Power Systems**

Djilali Kourtiche, *Institut Jean Lamour, France*

Andrew Holmes, *Imperial University, UK*

**Track 13: Sensors data processing including soft computing, data fusion, estimation and classification**

Valérie Renaudin, *University Gustave Eiffel GEOLOC Laboratory, France*

Marco Jose Da Silva, *Federal University of Technology - Paraná, Brazil*

**Track 14: Sensors in Industrial Practices**

James Brusey, *Coventry University, UK*

Stoyan Nihitjanov, *Technical University Delft, Netherlands*

**Track 15: Demos**

Zhi Liu, *Shandong University, China*

Tao Li, *University of Cincinnati, USA*

**Track 16: Focused Session**

Graham Brooker, *University of New South Wales, Australia*

Ashwin Seshia, *University of Cambridge, UK*

16.1: Emerging wearable sensors and systems

Hun Cao, *Southern Methodist University*

Etcetera.

**Focussed Session 16.1: Emerging wearable sensors and systems**

Hun Cao, *Southern Methodist University*

Mohamed Irfan, *University of Twente*

Bert-Jan van Beijnum

**Focussed Session 16.2: Microwave sensors**

Karthik Shankar, *University of Alberta*

Mohammad Zarifi, *Fondazione Bruno Kessler*

**Focussed Session 16.3: Emerging Sensors and Sensing Systems for Underground Infrastructure**

Sarath Kodagoda, *University of Technology Sydney, Australia*

Karthick Thiyagarajan, *University of Technology Sydney, Australia*

**Focussed Session 17: Sensors Letters/Sensors Journal**

**Focussed Session 18: Late News**

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## PRESENTATION DOWNLOADS



### **IEEE SENSORS COUNCIL YOUTUBE CHANNEL**



### **The IEEE Sensors Council's YouTube Channel is growing!**

Because of the parallel sessions, IEEE SENSORS 2021 participants will probably miss some important presentations they would have liked to see. Therefore, as an extra benefit for conference participants, consented presentations are being captured through the duration of the conference.

You may view these presentations after the conference concludes by visiting the IEEE Sensors Council YouTube Channel ([bit.ly/SensorsCouncilYouTube](https://bit.ly/SensorsCouncilYouTube)). Subscribe to our channel today to stay up to date with all the latest videos!

**YOUNG PROFESSIONALS RECEPTION**  
**Sunday, October 31<sup>st</sup> from 1:00 – 2:00 PM UTC**



**Introduce Yourself with Networking for ALL young professionals**

It's so rare we have the opportunity to connect, so why not learn an essential tool to connect both in person, and virtually? IEEE SENSORS Council invites all young professionals attending the IEEE SENSORS Conference to join in on the Networking session at the Young Professionals Reception on **Sunday, October 31<sup>st</sup> from 1:00 – 2:00 PM**. Come ready to meet SENSORS Council members, Industry intellects and other Young Professionals, and learn about the different opportunities available through the IEEE SENSORS Council and IEEE Young Professionals Program.

In this fun, one-hour session, learn a tool to introduce yourself, and meet others at the conference using this networking tool. In this facilitated session, you'll be guided through a template to use to introduce yourself and welcomed to meet others at the conference.

**You'll experience:**

- Learn an elevator pitch format you can use to introduce yourself at the conference (and also use on LinkedIn/Twitter)
- A facilitated networking experience with your peers to meet others at the conference

The IEEE Young Professionals Program is aimed at supporting IEEE members at an early stage in their career, up to 15 years after their first degree, by helping them evaluate their career goals, polish their professional image and create building blocks of a lifelong and diverse professional network.

## YOUNG PROFESSIONALS DEVELOPMENT PROGRAM

Wednesday, November 03<sup>rd</sup> from 10 – 11.30 hrs UTC

We welcome all the attendees who are interested in Innovations, Patents, Start ups and Entrepreneurship to this session. We have speakers and panellists who are experts and experienced in the field.

**Time: 10-10.45 hrs**

**Topic: Patent landscaping and start ups**



### **Speaker: Pooja Bhatia**

She is MBA, CLP, RTTP, is Chief Manager, Innovation-Technology Transfer Office (i-TTO) of the Foundation for Innovation and Technology Transfer (FITT) in New Delhi, India. Ms. Bhatia heads the i-TTO, a regional tech transfer office set up at FITT with support from National Biopharma Mission, a joint project of Government of India and World Bank, with the mandate to cater to academia, startups and incubation centres. Her work entails innovation management, technology transfer, marketing, strategic partnership, industry engagement and policy development. Ms. Bhatia serves on the CLP Exam Development and Maintenance committee.

She has over 15 years of professional experience in intellectual property, licensing, collaborations, and policy framing, and is a recipient of Global Women Leader Award 2021 and WIPF Powerful Women In IP 2021.

**Time: 10.47- 11.30 hrs**

**Panel Discussion: Challenges, solutions and tips in starting a Start-up**

Meet our Panelists: Dana Pordel, Rajul Patkar, Ravikrishnan Elangovan, Bruce Hecht



**Dana Pordel** is a CEO of **danaXa** spun off dLabel.org, which provides image and video annotation services to CSIRO, the Australian Institute of Sports and different companies and startups around Australia. Currently, dLabel.org is planning to expand beyond Australia, where it can serve the many

companies in AI with large datasets of images and videos. Dana is also an investor as he invested in dNumbers.org (AI accounting system), where the goal is to let the software manage your accounting tasks.



**Rajul Patkar** is the co-founder and chief executive of **Proximal Soilsens Technologies**. Entrepreneurship is anyways tough and particularly challenging when you are a woman starting at 50. A sheer will to inspire many other women who are in a similar boat is the key driving force for her.



**Ravikrishnan Elangovan** is a faculty in Department of Biochemical Engg and Biotechnology, IIT Delhi since 2010 and co-founder of **Valetude Primus Healthcare Pvt. Ltd.** Ravi and his team have developed four platform technologies for infectious disease diagnosis. He is keen to develop technologies to identify pathogens and drug susceptibility with a faster turnaround time in low resource settings.



**Bruce Hecht** is CEO and Chief Technology Officer, **VG2PLAY**, and Fellow, MIT System Design & Management, Cambridge, MA.

**“THERE IS NO REGISTRATION FEE FOR BOTH OF THESE SESSIONS”**



## KEYNOTE SPEAKERS

### " 'TINY-BUT-TOUGH' GALLIUM NITRIDE SENSORS FOR EXTREME HARSH ENVIRONMENTS"



Debbie G. Senesky, *Associate Professor, Aeronautics and Astronautics, Stanford University*

Gallium nitride (GaN) nanoelectronics have operated at temperatures as high as 1000°C making it a viable platform for robust space-grade (“tiny-but-tough”) sensors and electronics. In addition, there has been a tremendous amount of research and industrial investment in GaN as it is positioned to replace silicon in the billion-dollar (USD) power electronics industry, as well as the post-Moore microelectronics universe. Furthermore, the 2014 Nobel Prize in physics was awarded for pioneering research in GaN that led to the realization of the energy-efficient blue light-emitting diode (LED). Even with these major technological breakthroughs, we have just begun the “GaN revolution.” New communities are adopting this nano-electronic platform for a multitude of emerging device applications including the following: sensing, energy harvesting, actuation, and communication. In this talk, we will review and discuss the benefits of GaN’s two-dimensional electron gas (2DEG) over silicon’s p-n junction for space exploration applications (e.g., radiation-hardened, temperature-tolerant Venus instrumentation). In addition, we will discuss recent results that advance this nanoelectronic device platform for extreme-environment Internet-of-things (IoT) sensors for combustion and down-hole monitoring.

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## " INSECTS BIO-INSPIRED SENSORS "



Jérôme Casas, *Professor, University of Tours*

The millions of insect species are millions of solutions to a huge variety of problems, many involving sensing and actuation. Equipped with countless types of sensors, most insects are small, smaller than one centimeter. They are hence perfect templates for bioinspired microtechnology. I will start my talk with a broad survey of the technological sensors designed according to biological models, from acoustic to optical flow to IR sensors. Then, I will describe our work on flow sensing hairs and the MEMS we designed, with a special emphasis on the interactions between several sensors. The geometry and multiplicity of sensors is at the heart of the transport phenomena around insect antennae in the context of sensing minutes amounts of pheromones and I shall present this as well. We will then dwell into signal processing and tap into the unique ability of invertebrates to process information in a distributed way in their different neural centers: the latest neuromorphic network inspired from insects shows indeed most promising performances and interpretability, compared to a generic deep learning approach. I end the talk by sharing my decades-long experience of interacting with applied physicists, engineers and mathematicians. The biologist's and engineer's approaches differ a lot; the successful production of bioinspired artefacts demands thus more than a passing interest for interdisciplinarity, and from both parties. Taping into the fast treasure trove of energy sparse, carbon-based sensors of the insect world is certainly worth the effort, given the most serious technological and environmental bottlenecks facing us.

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## " FROM ULTRASENSITIVE TO SINGLE MOLECULE BIOSENSORS THAT OPERATE IN COMPLEX BIOLOGICAL FLUIDS "



Justin Gooding, *University of New South Wales*

One major opportunity in biomedical sensors is technology that can selectively detect species at ultra-low levels. This is because many of the existing pathologies, such as early detection of cancer, pathogen detection and assessment of treatment efficacy, are all required to be detected at low levels that existing commercial technologies seldom reach. We have developed a suite of technologies that are amenable to commercialisation that can detect species at femtomolar and lower levels. The suite of technologies all use the same strategy of making magnetic nanoparticle sensors collect the biomarker of interest rather than the normal approach of making the biomarker find the sensing surface. Using this strategy, the first technology will focus on the detection of ultralow levels of microRNA, as a cancer marker, in whole blood with 10 aM detection limits. Next will be discussed taking this strategy down to single molecules using a unique nanopore blockade sensor that we have developed for detecting proteins at femtomolar levels. This will be followed by a dark-field microscopy method for detecting viral RNA that exploits a new concept of performing quantitative analysis by counting many single-molecule events. Taken together, the common thread in all these technologies is the use of nanoparticles to confine the measurement volume to nanolitres, or lower, such that a single molecule in that volume is an appreciable concentration.

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## INVITED SPEAKERS

Track ID	Track Name	Name	Paper Title
3	Chemical, Electrochemical and Gas Sensors	Thomas Thundat	Chemical Selectivity and Reproducibility Challenges in Nanomechanical Sensors
4	Microfluidics and Biosensors	Roozbeh Jafari	Bio-Impedance Sensing for Precision Medicine: Challenges and Opportunities
5	Optical Sensors	Judith Su	Ultra-Sensitive Microtoroid Optical Sensing Technology for Biomedical Applications
6	Physical Sensors - Temperature, Mechanical, Magnetic and Others	Jae Yoong Cho	High-Q Fused-Silica Micro Birdbath Shell Resonator Gyroscope
8	Sensor Packaging (including on Flexible Materials)	Olga Korostynska	Sensors for Smart Packaging in Healthcare and Food Industry
9	Sensor Networks (including IoT and Related Areas)	Baris Aksanli	Robust Sensor Placement Optimization With Distance Uncertainty
10	Emerging Sensor Applications	Francesco Fioranelli	Radar Sensing for Human Healthcare: Challenges and Results
12	Actuators and Sensor Power Systems	Elie Lefeuvre	Biomechanical Energy Harvesting for Medical Implant Applications
13	Sensors data processing including soft computing, data fusion, estimation and classification	Ashish Pandharipande	Luminaire-Based Environmental Sensing for Comfort Monitoring and Control
16.1	Emerging wearable sensors and systems	Chao-Hsiung Tseng	A Wearable Cuffless Blood Pressure Sensor with Radio-Frequency Technology
16.1	Emerging wearable sensors and systems	Oliver Amft	From Digital Twins to Wearables and Back
16.2	Microwave sensors	Paris Velez	A Microwave Microfluidic Reflective-Mode Phase-Variation Sensor
16.2	Microwave sensors	Michal Cifra	Molecular Understanding of Electromagnetic Field-Biomatter Interaction for Rational Bio/Chemical Sensing Device Design
16.3	Emerging Sensors and Sensing Systems for Underground Infrastructure	Siddharth Tallur	Enig Pcb Electrodes: Low Cost Electrochemical Biosensing Platform for Wastewater Epidemiology
16.3	Emerging Sensors and Sensing Systems for Underground Infrastructure	Kirill V Horoshenkov	Acoustic and Ultrasonic Characterisation of Blockages and Defects in Underground Pipes

## PROGRAM GRID – SUNDAY, OCTOBER 31

All times listed in UTC

10:30 – 11:45	<p>Piezoelectric MEMS Resonator Technology  Gayathri Pillai, <i>Center for Nano Science and Engineering, Indian Institute of Science (IISc), Bengaluru, India</i></p>
12:00 – 13:15	<p>Biosensors introduction: From fabrication to application  Winnie E. Svendsen, <i>Zurich Instruments</i>  Maria Dimaki, <i>Zurich Instruments</i></p>
13:00 – 14:00	<p>Young Professionals Reception</p>
13:30 – 14:45	<p>Signal Processing for IoT – Decision Fusion in Sensor Networks  Pierluigi Salvo Rossi, <i>Norwegian University of Science and Technology, Norway</i>  Domenico Ciuonzo, <i>University of Naples, Federico II, Italy</i>  Pramod K. Varshney, <i>Syracuse University, USA</i></p>
15:00 – 16:30	<p>Sensing using THz radiation  Michael Shur, <i>Rensselaer Polytechnic Institute, USA</i></p>

## PROGRAM GRID – MONDAY, NOVEMBER 1

All times listed in UTC

<b>9:30 – 10:00</b>	Social & Networking							
<b>10:00 - 10:30</b>	Opening & Welcome							
<b>10:30 – 11:30</b>	Keynote 1: Justin Gooding							
<b>11:30 – 12:00</b>	Exhibitor Presentations							
<b>12:00 – 13:30</b>	A1L-01: Microwave Sensors Applied in Medicine & Materials Science	A1L-02: Chemical, Electrochemical & Gas Sensors I	A1L-03: Acoustic & Ultrasonic Transducers	A1L-04: Sensor Packaging (including on Flexible Materials)	A1L-05: Sensor Networks (IoT)	A1L-06: Power Sources & Actuators I	A1L-07: Emerging Wearable Sensors & Systems I	A1L-08: Microfluidics & Biosensors I
<b>13:30 – 14:30</b>	Poster Sessions A2P-10 – A2P-15 & Exhibitors							
<b>14:30 – 15:00</b>	Social & Networking							

## PROGRAM GRID – TUESDAY, NOVEMBER 2

All times listed in UTC

10:00 – 11:00	Social & Networking							
11:00 – 12:30	B1L-01: Optical Sensors I	B1L-02: Chemical, Electrochemical & Gas Sensors II	B1L-03: Inertial, Magnetic & Pressure Sensors	B1L-04: Sensor Systems I	B1L-05: Emerging Sensor Applications I	B1L-06: Sensor Data Processing I (Soft Sensors)	B1L-07: Emerging Sensors & Sensing Systems for Underground Infrastructure	B1L-08: Sensor Phenomenology I
12:30 – 14:30	<p style="text-align: center;">WiSE Keynote Speakers</p> <p style="text-align: center;">FUNCTIONAL NANOMATERIALS AND DEVICES FOR BIOMEDICAL SENSING APPLICATIONS <i>Sohini Kar-Narayan</i></p> <p style="text-align: center;">SENSE AND SENSIBILITY: WHY DIVERSITY MATTERS <i>Cathy Foley</i></p> <p style="text-align: center;">ENVIRONMENTAL MONITORING VIA METAL OXIDES NANOSTRUCTURES CHEMICAL SENSORS <i>Elisabetta Comini</i></p> <p style="text-align: center;">SELF-POWERED ELECTRONIC SKIN <i>Haixia Zhang</i></p>							
14:30 – 15:30	<p style="text-align: center;">Poster Sessions B2P-10 – B2P-15 &amp; Exhibitors</p>							
15:30 – 16:00	Social & Networking							



## PROGRAM GRID – WEDNESDAY, NOVEMBER 3

All times listed in UTC

10:00 – 11:30	Young Professional (YP) Technical Session				Social & Networking			
11:30 - 12:00	Sensors Council Awards							
12:00 – 13:30	C1L-01: Microwave Sensors for Industrial & Commercial Applications	C1L-02: Chemical, Electrochemical & Gas Sensors III	C1L-03: Tactile & Strain Sensors	C1L-04: Sensor Systems II	C1L-05: Sensor Networks (IoT) II	C1L-06: Sensor Materials, Processing & Fabrication I	C1L-07: Emerging Wearable Sensors & Systems II	C1L-08: Microfluidics & Biosensors II
13:30 – 14:00	Exhibitor Presentations							
14:00 – 15:00	Poster Sessions C2P-10 – C2P-14 & Exhibitors							
15:00 – 16:00	Keynote 2:: Debby Senesky							
16:00 – 16:30	Social & Networking							

## PROGRAM GRID – THURSDAY, NOVEMBER 4

All times listed in UTC

<b>10:00 – 10:30</b>	Social & Networking					
<b>10:30 - 11:00</b>	Conference Awards & 2022 Announcement					
<b>11:00 – 12:30</b>	D1L-01: Optical Sensors II	D1L-02: Chemical, Electrochemical & Gas Sensors IV	D1L-03: Temprature Sensors & Others	D1L-04: Sensor Systems III	D1L-05: Emerging Sensor Applications II	D1L-06: Sensor Data Processing II (Navigation & Positioning)
<b>12:30 – 13:30</b>	Keynote 3: Jérôme Casas					
<b>13:30 – 14:00</b>	Networking & Exhibitors					
<b>14:00 – 15:00</b>	Poster Sessions D2P-10 – D2P-15 & Exhibitors					
<b>15:00 – 15:30</b>	Social & Networking					

**12:00 – 13:30 UTC**

**A1L-01: MICROWAVE SENSORS APPLIED IN MEDICINE & MATERIALS SCIENCE**

**SESSION CHAIRS:** Karthik Shankar, University of Alberta & Mohammad Zarifi, University of British Columbia

**A1L-01-01**

**12:00**

**INVITED: Molecular Understanding of Electromagnetic Field-Biomatter Interaction for Rational Bio/Chemical Sensing Device Design**

*Michal Cifra*

*Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Rep.*

**A1L-01-02**

**12:30**

**Detecting Charge Separation in Optoelectronic Materials and Devices Using Planar Microwave Resonators: An Overview**

*Md. Masud Rana, Karthik Shankar*

*University of Alberta, Canada*

**A1L-01-03**

**12:45**

**Investigating the Potential of a PEDOT:PSS Organic Microwave Resonator for Gas Sensing Applications**

*Maryam Moradpour, Mandeep Jain, Nicolas Tanguy, Mohammad Hossein Zarifi*

*University of British Columbia, Canada*

**A1L-01-04**

**13:00**

**Advanced 3D Printed Conductive Polymer Nanocomposites for Electromagnetic Shielding**

*Milad Kamkar, Majed Amini, Saeed Ghaderi, Ahmadreza Ghaffarkhah, Amir Hosein Ahmadian Hoseini, Mohammad Arjmand*

*University of British Columbia, Canada*

**A1L-01-05**

**13:15**

**Microwave Sensors: Implication of Long-Term Non-Invasive Monitoring for Health**

*Olga Korostynska<sup>{2}</sup>, Bruno Dzogovic<sup>{2}</sup>, Alex Mason<sup>{1}</sup>*

*<sup>{1}</sup>Norwegian University of Life Sciences, Animalia AS, Norway; <sup>{2}</sup>Oslo Metropolitan University, Norway*

**12:00 – 13:30 UTC**

**A1L-02: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS 1**

**SESSION CHAIRS:** Marios Sophocleous, University of Cyprus & Preethi Preethichandra, Central Queensland University

**A1L-02-1**

**12:00**

**INVITED: Chemical Selectivity and Reproducibility Challenges in Nanomechanical Sensors**

*Yaoli Zhao, Siyu Cui, Thomas Thundat*

*University at Buffalo, United States*

**A1L-02-2**

**12:30**

**Polyaniline-Atomic Au Modified Platinum Electrode with Ionic Liquid as Configuration for Enhanced Electrochemical Sensing**

*Parthojit Chakraborty, Hiroki Kawakami, Anifatul Faricha, Tso-Fu Mark Chang, Masato Sone, Takamichi Nakamoto*

*Tokyo Institute of Technology, Japan*

**A1L-02-3**

**12:45**

**Monitoring Zeolite Formation with Moving Electrode Conductometry**

*Nikolaus Doppelhammer<sup>{1}</sup>, Nick Pellens<sup>{3}</sup>, Bernhard Jakoby<sup>{1}</sup>, Christine Kirschhock<sup>{3}</sup>, Erwin Reichel<sup>{2}</sup>*

*<sup>{1}</sup>Institute for Microelectronics and Microsensors, Johannes Kepler Universität Linz, Austria;*

*<sup>{2}</sup>Johannes Kepler Universität Linz, Austria; <sup>{3}</sup>Katholieke Universiteit Leuven, Belgium*

**A1L-02-4**

**1:00**

**Characterization of pH Sensors Based on Iridium Oxide and Gold Encapsulated Polypropylene Membranes**

*Khengdauliu Chawang<sup>{2}</sup>, Shih-Cheng Chou<sup>{1}</sup>, Sen Bing<sup>{2}</sup>, Pu-Wei Wu<sup>{1}</sup>, J.-C. Chiao<sup>{2}</sup>*

*<sup>{1}</sup>National Yang Ming Chiao Tung University, Taiwan; <sup>{2}</sup>Southern Methodist University, United States*

**A1L-02-5**

**13:15**

**Pulsed UV-Irradiated Graphene Sensors for Ethanol Detection at Room Temperature**

*Katarzyna Drozdowska<sup>{3}</sup>, Adil Rehman<sup>{1}</sup>, Pavlo Sai<sup>{1}</sup>, Bartłomiej Stonio<sup>{2}</sup>, Aleksandra Krajewska<sup>{1}</sup>, Grzegorz Cywiński<sup>{1}</sup>, Maciej Haras<sup>{2}</sup>, Sergey Rumyantsev<sup>{1}</sup>, Janusz Smulko<sup>{3}</sup>, Andrzej Kwiatkowski<sup>{3}</sup>*

**12:00 – 13:30 UTC**

**A1L-03: ACOUSTIC & ULTRASONIC TRANSDUCERS**

**SESSION CHAIRS:** Bernhard Jakoby, Johannes Kepler University Linz & Krishnan Balasubrama, Indian Institute of Technology Madras

**A1L-03-1**

**12:00**

**On the Performance Enhancement of Cantilever Diaphragm Piezoelectric Microphone**

*Shao-Da Wang<sup>{3}</sup>, Yu-Chen Chen<sup>{2}</sup>, Sung-Cheng Lo<sup>{3}</sup>, Yi-Jia Wang<sup>{3}</sup>, Mingching Wu<sup>{1}</sup>, Weileun Fang<sup>{3}</sup>*

*<sup>{1}</sup>Coretronic MEMS Co., LTD., Taiwan; <sup>{2}</sup>Institute of NanoEngineering and MicroSystem, National Tsing Hua University, Taiwan; <sup>{3}</sup>National Tsing Hua University, Taiwan*

**A1L-03-2**

**12:15**

**Bandwidth Extension Technique of Piezoelectric Micromachined Ultrasonic Transducers for Air Coupled Applications**

*Tingzhong Xu, Lixiang Wu, Mohssen Moridi*

*Silicon Austria Labs GmbH, Austria*

**A1L-03-3**

**12:30**

**Quality Control of Ultrasound Transducers Using Distribution-Free Overlapping Coefficients**

*Martin Angerer<sup>{1}</sup>, Michael Zapf<sup>{1}</sup>, Martin Koch<sup>{2}</sup>, Nicole V. Ruiter<sup>{1}</sup>*

*<sup>{1}</sup>Karlsruhe Institute of Technology, Germany; <sup>{2}</sup>Technische Universität Dresden, Germany*

**A1L-03-4**

**12:45**

**Single Microcontroller Air-Coupled Waveguided Ultrasonic Sonar System**

*Tim Maier, Gianni Allevato, Matthias Rutsch, Mario Kupnik*

*Technische Universität Darmstadt, Germany*

**A1L-03-5**

**13:00**

**Why Lasers Inject Perceived Sound Into MEMS Microphones: Indications and Contraindications of Photoacoustic and Photoelectric Effects**

*Benjamin Cyr<sup>{2}</sup>, Takeshi Sugawara<sup>{1}</sup>, Kevin Fu<sup>{2}</sup>*

*<sup>{1}</sup>University of Electro-Communications, Japan; <sup>{2}</sup>University of Michigan, United States*

**A1L-03-6**

**13:15**

**Lamb Waves Sensor in Liquid Media Utilizing Higher-Order Quasi-Longitudinal S5 and S6 Modes**

*Muhammad Hamidullah, Nassim Rezzag, Céline Élie-Caille, Thérèse Leblois*

*FEMTO-ST Institute, University Bourgogne Franche-Comté, France*

**12:00 – 13:30 UTC**

**A1L-04: SENSOR PACKAGING (INCLUDING ON FLEXIBLE MATERIALS)**

**SESSION CHAIRS:** Alex Mason, Norwegian University of Life Sciences & Eric MacDonald, University of Texas in El Paso

**A1L-04-1**

**12:00**

**INVITED: Sensors for Smart Packaging in Healthcare and Food Industry**

*Olga Korostynska*

*Oslo Metropolitan University, Norway*

**A1L-04-2**

**12:30**

**Evaluation of Low Cost Sealing Methods to Protect Sustainable Printed Temperature Sensors Against Degradation Due to UV Irradiation**

*Lukas Rauter<sup>{3}</sup>, Johanna Zikulnig<sup>{3}</sup>, Muhammad-Hassan Malik<sup>{3}</sup>, Sherjeel Khan<sup>{3}</sup>, Lisa-Marie Faller<sup>{2}</sup>, Hubert Zangl<sup>{1}</sup>, Jürgen Kosel<sup>{3}</sup>*

*<sup>{1}</sup>Alpe-Adria University Klagenfurt, Austria; <sup>{2}</sup>Carinthian University of Applied Sciences, Austria;*

*<sup>{3}</sup>Silicon Austria Labs GmbH, Austria*

**A1L-04-3**

**12:45**

**Evaluation of Environmental Enclosures for Effective Ambient Ozone Sensing in Wrist-Worn Health and Exposure Trackers**

*Tahmid Latif, James Dieffenderfer, Akhilesh Tanneeru, Bongmook Lee, Veena Misra, Alper Bozkurt*

*North Carolina State University, United States*

**A1L-04-4**

**13:00**

**Flexible Enzymatic Sensors for Detection of Hydrogen Peroxide**

*Jacopo Giaretta, Haowei Duan, Farshad Oveissi, Syamak Farajikhah, Fariba Dehghani, Sina Naficy  
University of Sydney, Australia*

**A1L-04-5**

**13:15**

**Integrated Sensing in Robotic Skin Modules**

*William R. Johnson III, Joran Booth, Rebecca Kramer-Bottiglio  
Yale University, United States*

**12:00 – 13:30 UTC**

**A1L-05: SENSOR NETWORKS (IoT) 1**

**SESSION CHAIRS:** Binbin Chen, Singapore University of Technology and Design & Henry Leung, University of Calgary

**A1L-05-1**

**12:00**

**CAHEROS: Constraint-Aware HEuristic Approach for RObust Sensor Placement**

*Onat Gungor{2}, Tajana Rosing{2}, Baris Aksanli{1}  
{1}San Diego State University, United States; {2}University of California San Diego, United States*

**A1L-05-2**

**12:30**

**Hybridly Integrated MEMS-IC RF Front-End for IoT with Embedded Filtering and Passive Voltage Amplification**

*Giuseppe Michetti{2}, Gabriel Giribaldi{2}, Michele Pirro{2}, Ankit Mittal{2}, Tanbir Haque{1}, Patrick Cabrol{1}, Ravikumar Pragada{1}, Hussain Elkotby{1}, Luca Colombo{2}, Aatmesh Shrivastava{2}, Matteo Rinaldi{2}  
{1}InterDigital Communications Inc., United States; {2}Northeastern University, United States*

**A1L-05-3**

**12:45**

**Sub-Millisecond Video Synchronization of Multiple Android Smartphones**

*Azat Akhmetyanov, Anastasiia Kornilova, Marsel Faizullin, David Pozo, Gonzalo Ferrer  
Skolkovo Institute of Science and Technology, Russia*

**A1L-05-4**

**13:00**

**Spatio-Temporal Analyses of Environmental Monitoring Based on Wireless Sensor Networks**

*Ryoma Yasutani{1}, Koki Kitazumi{1}, Shusuke Narieda{1}, Takeo Fujii{3}, Kenta Umebayashi{2}, Hiroshi Naruse{1}  
{1}Mie University, Japan; {2}Tokyo University of Agriculture and Technology, Japan; {3}University of Electro-Communications, Japan*

**A1L-05-5**

**13:15**

**Distributed Opportunistic Wireless Mapplicationing System Towards Smart City Service Provision**

*Jesus Villadangos, Francisco Falcone, Antonio Lopez, Jose Javier Astrain, Pablo Sanchis, Ignacio Raúl Matías Maestro*

*Universidad Pública de Navarra, Spain*

**12:00 – 13:30 UTC**

**A1L-06: POWER SOURCES & ACTUATORS 1**

**SESSION CHAIRS:** Andrew Holmes, Imperial University London & Djilali Kourtiche, Institut Jean Lamour - Université de Lorraine-CNRS-UMR

**A1L-06-1**

**12:00**

**INVITED: Biomechanical Energy Harvesting for Medical Implant Applications**

*Elie Lefeuvre, Marion Woytasik, Xavier Leroux, Fabien Parrain*

*University of Paris-Saclay, CNRS, France*

**A1L-06-2**

**12:30**

**A Micro-Watt Electrolytic Power Scavenger Driven by Eye-Blinking Motion**

*Erfan Pourshaban, Mohit U. Karkhanis, Adwait Deshpande, Aishwaryadev Banerjee, Hanseup Kim, Carlos H. Mastrangelo*

*University of Utah, United States*

**A1L-06-3**

**12:45**

**Enhanced TENG Performance by Engineering the Compression Modulus of Triboelectric Layers**

*Valliammai Palaniappan, Xingzhe Zhang, Dinesh Maddipatla, Binu Baby Narakathu, Bradley Bazuin, Massood Atashbar*

*Western Michigan University, United States*

**A1L-06-4**

**13:00**

**Wireless Power Transfer Through Soil Over a Range of Moisture Levels for In-Situ Soil Health Monitoring**

*Weijie Luo<sup>{1}</sup>, Aidan Jackson<sup>{1}</sup>, Jack Sorensen<sup>{1}</sup>, Archana Dahal<sup>{1}</sup>, Ramesh Goel<sup>{1}</sup>, Shad Roundy<sup>{1}</sup>, Cody Zesiger<sup>{2}</sup>, Darrin Young<sup>{1}</sup>*

*<sup>{1}</sup>University of Utah, United States; <sup>{2}</sup>Utah State University, United States*

**A1L-06-5**

**13:15**

**Surface Micromachined Out-of-Plane Electrostatic MEMS Actuator Integrated with Displacement Sensor**

*Seyedfakhreddin Nabavi<sup>{1}</sup>, Michaël Ménard<sup>{2}</sup>, Frederic Nabki<sup>{1}</sup>*

*<sup>{1}</sup>École de Technologie Supérieure, Canada; <sup>{2}</sup>Université du Québec à Montréal, Canada*

**12:00 – 13:30 UTC**

**A1L-07: EMERGING WEARABLE SENSORS & SYSTEMS 1**

**SESSION CHAIRS:** Hung Cao, University of California Irvine & Mohamed Irfan Mohamed Refai, University of Twente

**A1L-07-1**

**12:00**

**INVITED: A Wearable Cuffless Blood Pressure Sensor with Radio-Frequency Technology**

*Chao-Hsiung Tseng<sup>{2}</sup>, Tzu-Jung Tseng<sup>{1}</sup>*

*<sup>{1}</sup>National Taiwan University, Taiwan; <sup>{2}</sup>National Taiwan University of Science and Technology, Taiwan*

**A1L-07-2**

**12:30**

**A Wearable, Multiplexed Sensor for Real-Time and In-Situ Monitoring of Wound Biomarkers**

*Alina Pereira, Tanzila Noushin, Shawana Tabassum*

*University of Texas at Tyler, United States*

**A1L-07-3**

**12:45**

**Multifunctional Stretchable Sensor for Detecting Flow, Strain and Temperature**

*Shiqiang Liu, Yuzhong Zhang, Rong Zhu*

*Tsinghua University, China*

**A1L-07-4**

**13:00**

**Assessing the Role of Textiles in the Performance of Wearable Screen-Printed Strain Sensors for Breathing Rate Monitoring**

*Martina Aurora Costa Angeli<sup>{1}</sup>, Mallikarjun Madagalam<sup>{1}</sup>, Mattia Petrelli<sup>{1}</sup>, Silvia Pogliaghi<sup>{3}</sup>,*

*Alessandra Scarton<sup>{2}</sup>, Pietro Ibba<sup>{1}</sup>, Enrico Avancini<sup>{1}</sup>, Federico Gori<sup>{2}</sup>, Roberto Biasi<sup>{2}</sup>, Luisa Petti<sup>{1}</sup>, Paolo Lugli<sup>{1}</sup>*

*<sup>{1}</sup>Free University of Bozen-Bolzano, Italy; <sup>{2}</sup>Microgate Srl, Italy; <sup>{3}</sup>Università degli Studi di Verona, Italy*

**A1L-07-5**

**13:15**

**Wearable Triboelectric Sensor for Respiration and Coughing Monitoring**

*David Fernando Vera Anaya, Mehmet Rasit Yuce*

*Monash University, Australia*



**12:00 – 13:30 UTC**

**A1L-08: MICROFLUIDICS & BIOSENSORS I**

**SESSION CHAIRS:** Loes Segerink, University of Twente/BIOS & Chirasree RoyChaudhuri, IEST

**12:00**

**A1L-08-1**

**INVITED: Cuffless Blood Pressure Monitoring using Bio-Impedance Circuits and Systems**

*Roozbeh Jafari, Texas A&M University, USA*

**A1L-08-2**

**12:15**

**Plasmonic Nanoparticles Based Flexible Micro Stripe Pattern for Cellular Behavior Regulation and Localized pH Detection**

*Xiaoyu Wu, Wencheng Li, Shan He, Kai Yang, Yanyan Wang*

*Tianjin University, China*

**A1L-08-3**

**12:30**

**An Integrated Flexible Multi-Sensing Device for Daily Urine Analysis at Home**

*Xiyu Mao, Shiyi Xu, Shanshan Zhang, Xuesong Ye, Bo Liang*

*Zhejiang University, China*

**A1L-08-4**

**12:45**

**A Point of Care Sensor for Milk Adulteration Detection**

*Subhashis Patari, Pallab Sinha Mahapatra*

*Indian Institute of Technology Madras, India*

**A1L-08-5**

**13:00**

**Single-Chained Fragment Variable (scFv) Recombinant as a Potential Receptor for SARS-CoV-2 Biosensor Based on Surface Plasmon Resonance (SPR)**

*Isa Anshori<sup>{1}</sup>, Muhammad Yusuf<sup>{3}</sup>, Brian Yulianto<sup>{1}</sup>, Antonius Eko Nugroho<sup>{1}</sup>, Taufik Ramdani Tohari<sup>{3}</sup>, Gilang Gumilar<sup>{1}</sup>, Lavita Nuraviana<sup>{2}</sup>, Aminul Solihin<sup>{1}</sup>, Silmina Prastriyati Sari<sup>{3}</sup>, Yeni Wahyuni Hartati<sup>{3}</sup>, Raih Rona Althof<sup>{2}</sup>, Jessika Jessika<sup>{1}</sup>Institut Teknologi Bandung, Indonesia; <sup>{2}</sup>Research Center for Nanoscience and Nanotechnology Institut Teknologi Bandung, Indonesia; <sup>{3}</sup>Research Center of Molecular Biotechnology and Informatics Universitas Padjajaran, Indonesia*

**13:30 – 14:30 UTC**

**A2P-10: Sensor Systems IV**

**SESSION CHAIR: Michal Janosek, Czech Technical University in Prague**

**A2P-10-1**

**A 9 Ps DNL/INL/RMS FPGA-Based Sigma Accumulation TDC with Unlimited Dynamic Range for Time-Based Analog Front End Applications**

*Masayoshi Todorokihara*

*Seiko Epson Corporation, Japan*

**A2P-10-2**

**A Combined Capacitance and Resistance Digital Readout Circuit for Sensory Nodes**

*Anis Fatema, Abhinav Navnit, Deeksha Devendra, Aftab Hussain*

*International Institute of Information Technology, Hyderabad, India*

**A2P-10-3**

**A Two-Step Approach for Pulse RFI Detection in SAR Data**

*Zongsen Lv, Hengrui Zhang, Ning Li, Zhengwei Guo*

*Henan University, China*

**A2P-10-4**

**Low Frequency Noise Investigation of pT-Level Magnetic Sensors by Cross-Spectral Method**

*Michal Janošek{1}, David Novotný{1}, Michal Dressler{1}, Elda Saunderson{2}*

*{1}Czech Technical University in Prague, Czech Rep.; {2}South African National Space Agency, South Africa*

**13:30 – 14:30 UTC**

**A1P-11: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS V**

**SESSION CHAIRS: Aakash Jog, Tel Aviv University & Marios Sophocleous, University of Cyprus**

**A2P-11-1**

**Humidity Sensing Characteristics and Transduction Mechanism of Mg<sup>2+</sup> Added BaSrTiO<sub>3</sub> Perovskites**

*Hamid Farahani{1}, Rahman Wagiran{2}, Gerald Urban{1}*

*{1}IMTEK, Albert-Ludwigs-Universität Freiburg, Germany; {2}University Putra Malaysia, Malaysia*

**A2P-11-2**

**Narrowing of Bandgap with Silver Doping on TiO<sub>2</sub> Nanotubes Arrays for Electrochemical Sensing Application**

*Sarda Sharma, Siddhartha P. N., Karumbaiah Chappanda*

*Birla Institute of Technology and Science, Pilani, India*

**A2P-11-3**

**An LC-Type Flexible Wireless Humidity Sensor with Electrospun Isolation Layer**

*Yong Li, Zhenyu Wei, Jianqiu Huang*

*Key Laboratory of MEMS of the Ministry of Education, Southeast University, China*

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**A2P-11-4**

**A LC Resonator Based Flexible Printed RFID for Wireless Potassium Ion Sensing**

*Tianhang Wu, Sharmistha Bhadra*

*McGill University, Canada*

**A2P-11-5**

**Leakage-Waveguide-Type Plastic Optical Fiber Humidity Sensor Using Dye-Doped Swellable Polymers as Cladding**

*Yuta Shimura, Yutaka Suzuki, Masayuki Morisawa*

*University of Yamanashi, Japan*

**A2P-11-6**

**Multiplexed Electrochemical Sensor for Real-Time Monitoring of Inflammatory Biomarkers**

*Tanzila Noushin, Shawana Tabassum*

*University of Texas at Tyler, United States*

**A2P-11-7**

**Flexible Chemiresistive pH Sensor Based on Polyaniline / Carbon Nanotube Nanocomposite for IoT Applications**

*Homa Emami, Shirin Mahinnezhad, Ahmad Al Shboul, Mohsen Ketabi, Andy Shih, Ricardo Izquierdo*

*École de Technologie Supérieure, Canada*

**A2P-11-8**

**Sensor for In-Situ Detection of Bacteria in Urinary Tract Infection**

*Wei Yi{1}, Jiachen Liu{1}, Tung-Shi Huang{1}, Kenny Brock{2}, Zhongyang Cheng{1}*

*{1}Auburn University, United States; {2}VCOM-Auburn, United States*

**A2P-11-9**

**A Differential p-ISFET Based On-Chip pH Sensor with Substrate Based Drift Reset Capability**

*Vaishak Prathap, Albert H Titus*

*State University of New York at Buffalo, United States*

**13:30 – 14:30 UTC**

**A2P-12: SENSOR DATA PROCESSING III**

**SESSION CHAIR: Valérie Renaudin, Université Gustav Eiffel**

**A2P-12-1**

**Multi-Magnet Tracking Method Using Extended Kalman Filter**

*Han Ge{1}, Shuang Song{1}, Jiaole Wang{1}, Max Q.-H. Meng{2}*

*{1}Harbin Institute of Technology, Shenzhen, China; {2}Southern University of Science and Technology, China*

**A2P-12-2**

**An Orbital Angular Momentum Mode Estimation Method with an Unknown Beam Axis**

*Gaofeng Shu, Bingxu Chen, Ning Li*

*Henan University, China*

**A2P-12-3**

**An Adaptive Irregular Convolution U-Net for Reconstructing Ancient Channel of the Yellow River**

*Zhishun Guo, Jianhui Zhao, Ning Li, Lin Wu*

*Henan University, China*

**A2P-12-4**

**A Preliminary Study on Fast Calibration Method for Magnetic Positioning Sensor Array**

*Xiaoyang Wu, Shuang Song, Jiaole Wang*

*Harbin Institute of Technology, Shenzhen, China*

**A2P-12-5**

**People Counting Solution Using an FMCW Radar with Knowledge Distillation from Camera Data**

*Michael Stephan{1}, Souvik Hazra{2}, Avik Santra{2}, Robert Weigel{1}, Georg Fischer{1}*

*{1}Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; {2}Infineon Technologies AG, Germany*

**A2P-12-6**

**HAUD: A High-Accuracy Underwater Dataset for Visual-Inertial Odometry**

*Yang Song, Jiuchao Qian, Ruihang Miao, Wuyang Xue, Rendong Ying, Peilin Liu  
Shanghai Jiao Tong University, China*

**13:30 – 14:30 UTC**

**A2P-13: EMERGING SENSOR APPLICATIONS III**

**SESSION CHAIRS: Volker Nock & Azadeh Hashemi, University of Canterbury**

**A2P-13-1**

**Flying Ant Robot – Aerial Chemical Trail Detection and Localization**

*Patrick Neumann, Paul Hirschberger, Matthias Bartholmai  
BAM Bundesanstalt für Materialforschung und -prüfung, Germany*

**A2P-13-2**

**INVITED: Piezoelectric MEMS for Microparticles Detection**

*Francesco Foncellino<sup>{3}</sup>, Luigi Barretta<sup>{4}</sup>, Ettore Massera<sup>{1}</sup>, Alberto Corigliano<sup>{2}</sup>  
<sup>{1}</sup>ENEA CR Portici, Italy; <sup>{2}</sup>Politecnico di Milano, Italy; <sup>{3}</sup>STMicroelectronics, Italy; <sup>{4}</sup>Università degli  
Studi di Napoli Federico II, Italy*

**A2P-13-3**

**Investigation of Meat Classifying and Their Freshness Estimating Performance of a Heater-Temperature-Modulated Metal Oxide Semiconductor Type Gas Sensor**

*Hyoungkyun Kim, Jangpyo Park, Hee-Jin Park, Yong Won Jeong  
Samsung Research, Samsung Electronics Co.,Ltd., Korea*

**A2P-13-4**

**Noninvasive Current Measurement in Multi-Conductor Cables**

*Sebastian Böller<sup>{1}</sup>, Belmin Alić<sup>{1}</sup>, Andreas Hennig<sup>{1}</sup>, Anton Grabmaier<sup>{2}</sup>  
<sup>{1}</sup>Fraunhofer Institute for Microelectronic Circuits and Systems, Germany; <sup>{2}</sup>University of Duisburg-  
Essen, Germany*

**A2P-13-5**

**Wireless Sensor Readout System for Bone Intramedullary Pressure Monitoring Applications**

*Ziyu Chen, Jeong Bong Lee  
University of Texas at Dallas, United States*

**A2P-13-6**

**From 0.18 $\mu$ m to 28nm CMOS Down-Scaling for Data Links in Body Dust Applications**

*Gian Luca Barbruni<sup>{1}</sup>, Paolo Motto Ros<sup>{2}</sup>, Danilo Demarchi<sup>{2}</sup>, Sandro Carrara<sup>{1}</sup>  
<sup>{1}</sup>École Polytechnique Fédérale de Lausanne, Switzerland; <sup>{2}</sup>Politecnico di Torino, Italy*

**A2P-13-7**

**Experimentations and Analysis on Indoor Positioning Through Fusion with Inertial Sensors and Dynamically Calibrated Wi-Fi FTM Ranging**

*Lu Wang, Xiaodong Cai, Liang Cheng, Ke Han, Hemin Han, Lili Michael Ma  
Intel Corporation, China*

**A2P-13-8**

**Ionogel Based Material for the Colorimetric Detection of  $\Delta^9$ -Tetrahydrocannabinol**

*Raquel Catalan-Carrio{2}, Guillermo Moreno-Sanz{1}, Lourdes Basabe-Desmonts{2}, Fernando Benito-Lopez{2}*

*{1}ABAGUNE, Spain; {2}UPV/EHU, University of the Basque Country, Spain*

**A2P-13-9**

**Smart Cushion Based on Pressure Sensor Array for Human Sitting Posture Recognition**

*Liangqi Yuan, Jia Li*

*Oakland University, United States*

**A2P-13-10**

**A Smart Mandibular Device for Intra-Oral Electroencephalogram Monitoring**

*Shibam Debbarma, Sharmistha Bhadra*

*McGill University, Canada*

**A2P-13-11**

**Assessing Soil Spatial Heterogeneity Using Proximal Soil Sensing**

*Hella Ellen Ahrends, Antti Lajunen*

*University of Helsinki, Finland*

**A2P-13-12**

**Wearable Bioimpedance Hydration Monitoring System Using Conformable AgNW Electrodes**

*Tanner Songkakul{1}, Shuang Wu{1}, Parvez Ahmmed{1}, William D. Reynolds Jr.{2}, Yong Zhu{1}, Alper Bozkurt{1}*

*{1}North Carolina State University, United States; {2}Onda Vision Technologies, United States*

**A2P-13-13**

**Development of a Flexible and Conformable EEG Sensors Using 3D Printing Process**

*Adam Schuhknecht, Evan Fadanelli, Mohit Patel, Anthony Hanson, Dinesh Maddipatla, Massood Atashbar*

*Western Michigan University, United States*

**A2P-13-14**

**Smart Armband with Graphene Textile Electrodes for EMG-Based Muscle Fatigue Monitoring**

*Ozberk Ozturk{2}, Ata Golparvar{1}, Murat Kaya Yapici{2}*

*{1}École Polytechnique Fédérale de Lausanne, Switzerland; {2}Sabancı University, Turkey*

**A2P-13-15**

**Where's My Cellphone: Non-Contact Based Hand-Gestures and Ultrasound Haptic Feedback for Secondary Task Interaction While Driving**

*Ahmed Farooq, Tomi Nukarinen, Antti Sand, Hanna Venesvirta, Oleg Spakov, Veikko Surakka, Roope Raisamo*

*Tampere University, Finland*

**A2P-13-16**

**Pilot Study: A Visuotactile Haptic Primary Colors Sensor**

*Alexander Abad, Manex Ormazabal, David Reid, Anuradha Ranasinghe*

*Liverpool Hope University, United Kingdom*

**A2P-13-17**

**AI-Based Fall Detection Using Contactless Sensing**

*Ahmad Taha{3}, Mohammad Mahmoud Taha{2}, Basel Barakat{1}, William Taylor{3}, Qammer H. Abbasi{3}, Muhammad Ali Imran{3}*

*{1}Edinburgh Napier University, United Kingdom; {2}Independant Scholar, United States; {3}University of Glasgow, United Kingdom*

**13:30 – 14:30 UTC**

**A2P-14: DEMOS & IEEE SENSORS JOURNAL/LETTERS**

**SESSION CHAIRS:** Tao Li, University of Cincinnati & Zhi Liu, Shandong University

**A2P-14-1**

**Design of a Customised BB8 Robot Companion**

*Mia Innes, Emanuele Lindo Secco*

*Robotics Laboratory, Liverpool Hope University, United Kingdom*

**A2P-14-2**

**Recent Advances in MEMS Coupled Resonant Sensors**

*Vinayak Pachkawade*

*Self-employed, India*

**A2P-14-3**

**Statistical and Machine-Learning Based Recognition of Coughing Events Using Tri-Axial Accelerometer Sensor Data from Multiple Wearable Points**

*Kruthi Doddabasappa, Rushi Vyas*

*University of Calgary, Canada*

**A2P-14-4**

**Live Demonstration: Highly Sensitive Hollow-Core Fiber Optic Sensor Using a Ring Laser for Measuring Material Thermal Expansion**

*Angie Torres{1}, Silvia Diaz{2}, Omar Fuentes{2}, Jesús Corres{2}, Ignacio Del Villar{2}, Ignacio Raúl Matías Maestro{2}*

*{1}Public University of Navarre, Spain; {2}Universidad Pública de Navarra, Spain*

**A2P-14-5**

**Live Demonstration: Double SLERP Gravity-Magnetic Vector (GMV-D) Orientation Correction in a MARG Sensor**

*Neeranut Ratchatanantakit, Nonnarit O-Larnnithipong, Pontakorn Sonchan, Malek Adjouadi, Armando Barreto*

*Florida International University, United States*

**13:30 – 14:30 UTC**

**A2P-15: POWER SOURCES & ACTUATORS II**

**SESSION CHAIR:** Andrew Holmes, Imperial University

**A2P-15-1**

**Gold and Silver Oxide Conducting Nanocomposite Cathode for Glucose Biofuel Cell**

*Saikat Banerjee, Mathew Nguyen, Gymama Slaughter*

*Center for Bioelectronics, Old Dominion University, United States*

**A2P-15-2**

**An Untethered Multimodal Haptic Hand Wearable**

*Alexander Abad, Manex Ormazabal, David Reid, Anuradha Ranasinghe  
Liverpool Hope University, United Kingdom*

**A2P-15-3**

**Enhanced Performance of Triboelectric Nanogenerator Using Custom Fabricated PDMS**

*Xingzhe Zhang, Duo He, Dinesh Maddipatla, Valliammai Palaniappan, Qiang Yang, Bradley Bazuin,  
Massood Atashbar  
Western Michigan University, United States*

**A2P-15-4**

**Cavity Flow Controlled with an Array of Magneto-Mechanical Micro-Valves**

*Thomas Arnoult<sup>{1}</sup>, Cécile Ghouila-Houri<sup>{1}</sup>, Colin Leclercq<sup>{3}</sup>, Aurélien Mazzamurro<sup>{1}</sup>, Romain  
Viard<sup>{2}</sup>, Eric Garnier<sup>{3}</sup>, Denis Sipp<sup>{3}</sup>, Alain Merlen<sup>{1}</sup>, Abdelkrim Talbi<sup>{1}</sup>, Philippe Pernod<sup>{1}</sup>  
<sup>{1}</sup>Institute of Electronics, Microelectronics and Nanotechnology, Centrale Lille, France; <sup>{2}</sup>JMH  
Conception, France; <sup>{3}</sup>ONERA, France*

**A2P-15-5**

**Enhancing Open-Loop Control of MEMS Using Linear Electrostatic Levitation Actuators**

*Mohammad Mousavi, Mohammad Alzgool, Shahrzad Towfighian  
Binghamton University, United States*



**11:00 – 12:30 UTC**

**B1L-01: OPTICAL SENSORS I**

**SESSION CHAIRS:** Hengky Chandralhim, The U.S. Air Force Institute of Technology & Guozhen Liu, University of New South Wales

**B1L-01-1**

**11:00**

**INVITED: Ultra-Sensitive microtoroid Optical Sensing Technology for Biomedical Applications**

*Judith Su*

*University of Arizona, United States*

**B1L-01-2**

**11:30**

**Multi-Modal Sensor and Data Processing for Comprehensive Skin Evaluation**

*Song Wang, Ning Xi*

*University of Hong Kong, Hong Kong*

**B1L-01-3**

**11:45**

**Photoconductivity Enhancement in MoS<sub>2</sub> and WSe<sub>2</sub> Hybrids Aided by Light-Absorbing Carbon-Based Zero-Dimensional Quantum Dots**

*Kishan Jayanand, Anupama Kaul*

*University of North Texas, United States*

**B1L-01-4**

**12:00**

**Optical Plasmonic Nanoantenna-MWCNT Diode Energy Harvester for Solar Powered Wireless Sensors**

*Patrizia Livreri, Fabrizio Beccaccio*

*Università degli Studi di Palermo, Italy*

**B1L-01-5**

**12:15**

**Evaluation of Non-Invasive Swallowing Test Device Using Hetero-Core Fiber Optic Pressure Sensor**

*Masanori Maeda<sup>{3}</sup>, Miyuki Kadokura<sup>{3}</sup>, Ryoko Aoki<sup>{3}</sup>, Masaru Kawakami<sup>{2}</sup>, Yuya Koyama<sup>{1}</sup>, Michiko Nishiyama<sup>{3}</sup>, Kazuhiro Watanabe<sup>{3}</sup>*

*<sup>{1}</sup>Chiba Institute of Technology, Japan; <sup>{2}</sup>Jichi Medical University, Japan; <sup>{3}</sup>Soka University, Japan*

**11:00 – 12:30 UTC**

**B1L-02: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS II**

**SESSION CHAIRS:** Preethi Preethichandra, Central Queensland University & Marios Sophocleous, University of Cyprus

**B1L-02-1**

**11:00**

**Limiting Current-Type MEMS Oxygen Gas Sensor Integrated with Micro-Hotplate**

*Shunsuke Akasaka<sup>{2}</sup>, Isaku Kanno<sup>{1}</sup>*

*<sup>{1}</sup>Kobe University, Japan; <sup>{2}</sup>Rohm Co. Ltd, Japan*

**B1L-02-2**

**11:15**

**Paper-Based Chemiresistive Gas Sensor Using Molecularly Imprinted Sol-Gels for Volatile Organic Acids Detection**

*Xiao Ye{1}, Tianshu Jiang{1}, Lingpu Ge{1}, Fumihiro Sassa{1}, Chuanjun Liu{2}, Kenshi Hayashi{1}{1}Kyushu University, Japan; {2}U.S.E. Co., Ltd., Japan*

**B1L-02-3**

**11:30**

**Functional Validation of an Additional Device to the Gas Sensor for Arbitrary Control Sensing Properties**

*Ryomei Wada{2}, Naho Minowa{2}, Takeru Wada{2}, Manase Mizutani{1}, Yoshihisa Suzuki{1}, Yong-Joon Choi{2}, Kazuhiro Takahashi{2}, Kazuaki Sawada{2}, Toshihiko Noda{2}{1}SINTOKOGIO, LTD., Japan; {2}Toyohashi University of Technology, Japan*

**B1L-02-4**

**11:45**

**Enhanced Gas Sensing Characteristics of Metal Doped WS<sub>2</sub> Nanoflowers**

*Aanchal Alagh, Fatima Ezahra Annanouch, Eduard Llobet  
Universitat Rovira i Virgili, Spain*

**B1L-02-5**

**12:00**

**Estimation of Distributed Concentration of Mixed Gases Using Au/Ag Core-Shell 2D LSPR Gas Sensor**

*Arata Sawada, Fumihiro Sassa, Kenshi Hayashi  
Kyushu University, Japan*

**B1L-02-6**

**12:15**

**Carbon Nanotube Ammonia Gas Sensor: A Comparative Analysis Between Impedance Spectroscopy and Resistive Measurements**

*Ali Douaki, Martina Aurora Costa Angeli, Mukhtar Ahmad, Mattia Petrelli, Bajramshahe Shkodra, Sahira Vasquez, Enrico Avancini, Luisa Petti, Paolo Lugli  
Free University of Bozen-Bolzano, Italy*

**11:00 – 12:30 UTC**

**B1L-03: INERTIAL, MAGNETIC & PRESSURE SENSORS**

**SESSION CHAIRS:** Giacomo Langfelder, Politecnico di Milano & Kuniyoshi Tashiro, Shinshu University

**B1L-03-1**

**11:00**

**INVITED: High-Q Navigation-Grade Fuse-Silica Micro Birdbath Resonator Gyroscope**

*Jae Yoong Cho, Sajal Singh, Tal Nagourney, Jongkwan Woo, Ali Darvishian, Behrouz Shiari, Guohong He, Christopher Boyd, Ester Bentley, Khalil Najafi  
University of Michigan, United States*

**B1L-03-2**

**11:30**

**A Simplified Analytical Damping Constant Model for Perforated Proof Mass Structure of MEMS Capacitive Accelerometer by Multi-Layer Metal Technology**

*Kohei Shibata{2}, Akihiro Uchiyama{2}, Akira Onishi{2}, Shin-Ichi Iida{1}, Toshifumi Konishi{1}, Noboru Ishihara{2}, Katsuyuki Machida{2}, Kazuya Masu{2}, Hiroyuki Ito{2}*

*{1}NTT Advanced Technology Corporation, Japan; {2}Tokyo Institute of Technology, Japan*

**B1L-03-3**

**11:45**

**Miniaturized Quadruple Mass Gyroscopes: Challenges and Implementation**

*Matteo Gianollo{1}, Valentina Mastri{1}, Valentina Zega{1}, Marco Bestetti{1}, Luca Falorni{2}, Giacomo Langfelder{1}*

*{1}Politecnico di Milano, Italy; {2}STMicroelectronics, Italy*

**B1L-03-4**

**12:00**

**Vertical Integration of Pressure/Humidity/Temperature Sensors for CMOS-MEMS Environmental Sensing Hub**

*Yung-Chian Lin, Ya-Chu Lee, Chia-Hung Yang, Weileun Fang*

*National Tsing Hua University, Taiwan*

**B1L-03-5**

**12:15**

**Orthogonal Fluxgate Sensor Noise Depends on Annealing-Induced Magnetostriction of the Core**

*Mattia Butta{1}, Alexander Valeriano Inchausti{2}, Michal Dressler{1}, Michal Janošek{1}*

*{1}Czech Technical University in Prague, Czech Rep.; {2}Instituto de Ciencia de Materiales de Madrid, Spain*

**11:00 – 12:30 UTC**

**B1L-04: SENSOR SYSTEMS I**

**SESSION CHAIR: Michael Daniele, NC State University**

**B1L-04-1**

**11:00**

**Augmentative and Alternative Communication with Eye-Gaze Technology and Augmented Reality: Reflections from Engineers, People with Cerebral Palsy and Caregivers**

*Haifeng Zhao{1}, Petra Karlsson{2}, Omid Kavehei{1}, Alistair McEwan{1}*

*{1}University of Sydney, Australia; {2}University of Sydney, Cerebral Palsy Alliance Research Institute, Australia*

**B1L-04-2**

**11:15**

**Front-End Electronics for Beta-Cell Function Monitoring with an Integrated FOPP Detector**

*Zili Yu{2}, Cor Scherjon{1}, Daniel Brosch{1}, Udo Kraushaar{3}, René von Metzen{3}, Joachim Burghartz{1}*

*{1}IMS CHIPS, Germany; {2}Institut für Mikroelektronik Stuttgart IMS CHIPS, Germany; {3}NMI Natural and Medical Sciences Institute at the University of Tübingen, Germany*

**B1L-04-3**

**11:30**

**Development of a 3D Printed Gap Gauge with Embedded Force Sensor for Balancing Unicompartmental Knee Arthroplasty**

*Dimitrios Kosmas<sup>{2}</sup>, Hans-Peter van Jonbergen<sup>{1}</sup>, Martijn Schouten<sup>{2}</sup>, Momen Abayazid<sup>{2}</sup>, Gijs Krijnen<sup>{2}</sup>*

*<sup>{1}</sup>Deventer Hospital, Netherlands; <sup>{2}</sup>University of Twente, Netherlands*

**B1L-04-4**

**11:45**

**Diagnosing Lung and Gastric Cancers Through Exhaled Breath Analysis by Using Electronic Nose Technology Combined with Pattern Recognition Methods**

*Benachir Bouchikhi<sup>{2}</sup>, Omar Zaim<sup>{2}</sup>, Nezha El Bari<sup>{2}</sup>, Naoual Lagdali<sup>{1}</sup>, Imane Benelbarhdadi<sup>{1}</sup>, Fatima Zohra Ajana<sup>{1}</sup>*

*<sup>{1}</sup>Ibn Sina Hospital, Mohammed V University, Morocco; <sup>{2}</sup>University Moulay Ismail Faculty of Sciences of Meknes, Morocco*

**B1L-04-5**

**12:00**

**“Sugar-Cube” PLT: A Real-Time Pedestrian Localization Testbed Utilizing Foot-Mounted IMU/Barometer/Ultrasonic Sensors**

*Chi-Shih Jao, Austin Parrish, Andrei Shkel*

*University of California, Irvine, United States*

**11:00 – 12:30 UTC**

**B1L-05-1: EMERGING SENSOR APPLICATIONS I**

**SESSION CHAIR: Theerawit Wilaiprasitpor, Vidyasirimedhi Institute of Science & Technology (VISTEC)**

**B1L-05-1**

**11:00**

**Radar Sensing for Human Healthcare: Challenges and Results**

*Francesco Fioranelli<sup>{1}</sup>, Julien Le Kernec<sup>{2}</sup>*

*<sup>{1}</sup>Technische Universiteit Delft, Netherlands; <sup>{2}</sup>University of Glasgow, United Kingdom*

**B1L-05-2**

**11:30**

**A Quantum-Inspired Biotelemetry System for Robust and Ultrasensitive Wireless Intracranial Pressure Monitoring**

*Minye Yang, Zhilu Ye, Pai-Yen Chen*

*University of Illinois at Chicago, United States*

**B1L-05-3**

**11:45**

**Rapid Classification of Respiratory Syncytial Virus and Sendai Virus by a Low-Cost and Portable Near-Infrared Spectrometer**

*Weiran Song<sup>{3}</sup>, Hui Wang<sup>{3}</sup>, Enayetur Rahman<sup>{3}</sup>, Judit Barabas<sup>{1}</sup>, Jiandong Huang<sup>{3}</sup>, Ultan Power<sup>{1}</sup>, Hugh Byrne<sup>{2}</sup>, James McLaughlin<sup>{3}</sup>, Chris Nugent<sup>{3}</sup>, Paul Maguire<sup>{3}</sup>*

*<sup>{1}</sup>Queen’s University Belfast, United Kingdom; <sup>{2}</sup>Technological University Dublin, Ireland; <sup>{3}</sup>Ulster University, United Kingdom*

**B1L-05-4**

**12:00**

**In-Skin Pressure and Curvature Sensors for Soft Robots**

*Tzu-Yun Hsu, Amal El-Ghazaly*

*Cornell University, United States*

**B1L-05-5**

**12:15**

**Classification of Textures Using a Tactile-Enabled Finger in Dynamic Exploration Tasks**

*Vinicius Prado Da Fonseca<sup>{2}</sup>, Bruno Monteiro Rocha Lima<sup>{3}</sup>, Thiago Eustaquio Alves de Oliveira<sup>{1}</sup>  
<sup>{1}</sup>Lakehead University, Canada; <sup>{2}</sup>Memorial University of Newfoundland, Canada; <sup>{3}</sup>University of  
Ottawa, Canada*

**11:00 – 12:30 UTC**

**B1L-06: SENSOR DATA PROCESSING I (SOFT SENSORS)**

**SESSION CHAIRS:** Krikor Ozanyan, University of Manchester & Marco Jose Da Silva, Federal University of Technology Parana

**B1L-06-1**

**11:00**

**INVITED: Luminaire-Based Environmental Sensing for Comfort Monitoring and Control**

*Ashish Pandharipande, Martijn Lankhorst, Emmanuel Frimout*

*Signify, Netherlands*

**B1L-06-2**

**11:30**

**Automatic Displacement and Vibration Measurement in Laboratory Experiments with a Deep Learning Method**

*Yongsheng Bai, Ramzi M. Abdullallah, Halil Sezen, Alper Yilmaz*

*Ohio State University, United States*

**B1L-06-3**

**11:45**

**Enabling Real-Time Estimation of Borehole Parameters in Deep Drilling**

*Shanti Swaroop Kandala, Roman Shor*

*University of Calgary, Canada*

**B1L-06-4**

**12:00**

**A Graph-Based Method for Interbeat Interval and Heart Rate Variability Estimation Featuring Multi-Channel PPG Signals During Intensive Activity**

*Luffina Huang, Ali Akbari, Roozbeh Jafari*

*Texas A&M University, United States*

**B1L-06-5**

**12:15**

**False Positives Avoidance in Pulse Detection from ECG and PPG Sensor Signals**

*Hans Herrmann, Hartmut Ewald*

*Universität Rostock, Germany*

**11:00 – 12:30 UTC**

**B1L-07: EMERGING SENSORS & SENSING SYSTEMS FOR UNDERGROUND INFRASTRUCTURE**

**SESSION CHAIRS:** Karthick Thiyagarajan & Sarath Kodagoda, University of Technology Sydney

**B1L-07-1**

**11:00**

**INVITED: Acoustic and Ultrasonic Characterisation of Blockages and Defects in Underground Pipes**

*Alex Towlson{1}, Yicheng Yu{2}, Gavin Sailor{2}, Kirill Horoshenkov{2}, Anthony Croxford{1}, Bruce Drinkwater{1}*

*{1}University of Bristol, United Kingdom; {2}University of Sheffield, United Kingdom*

**B1L-07-2**

**11:30**

**INVITED: ENIG PCB Electrodes: Low Cost Electrochemical Biosensing Platform for Wastewater Epidemiology**

*Siddharth Tallur, Ruchira Nandeshwar, M.S. Kumar, Kiran Kondabagil*

*Indian Institute of Technology Bombay, India*

**B1L-07-3**

**12:00**

**Evaluation of Battery-Free UHF-RFID Sensor Wireless Signals for In-Pipe Robotic Applications**

*Amal Gunatilake, Karthick Thiyagarajan, Sarath Kodagoda*

*University of Technology Sydney, Australia*

**B1L-07-4**

**12:15**

**Gaussian Process as a Benchmark for Optimal Sensor Placement Strategy**

*Nalika Ulapane{1}, Karthick Thiyagarajan{2}, Sarath Kodagoda{2}*

*{1}Swinburne University of Technology, Australia; {2}University of Technology Sydney, Australia*

**11:00 – 12:30 UTC**

**B1L-08: SENSOR PHENOMENOLOGY I**

**SESSION CHAIRS:** Guozhen Liu, The Chinese University of Hong Kong & Azadeh Hashemi, University of Canterbury

**B1L-08-1**

**11:00**

**Radio-Frequency-Based Resonating Sensor for Condition Monitoring on Rotary Equipment**

*Ali Alshehri{2}, Yip Fun Yeung{2}, Mikio Furokawa{1}, Takayuki Hirano{1}, Kamal Youcef-Toumi{2}*

*{1}Japan Steel Works, LTD., Japan; {2}Massachusetts Institute of Technology, United States*

**B1L-08-2**

**11:15**

**Design of Optical Waveguide Channels for 3D Distributed Tactile Sensing**

*Federica De Chiara{2}, Jian Hu{2}, Stephen Wang{1}, Rong Wang{1}, Hongbin Liu{2}*

*{1}Huawei Technologies Research & Development UK Ltd., United Kingdom; {2}King's College London, United Kingdom*

**B1L-08-3**

**11:30**

**Frequency and Quality Factor Matched 2-Axis Dual Mass Resonator**

*Jianlin Chen{2}, Takashiro Tsukamoto{2}, Giacomo Langfelder{1}, Shuji Tanaka{2}  
{1}Politecnico di Milano, Italy; {2}Tohoku University, Japan*

**B1L-08-4**

**11:45**

**An Integrated Temperature Compensation Method for Thermal Expansion-Based Angular Motion Sensors**

*Huahuang Luo, Jose Cabot, Mingzheng Duan, Yi-Kuen Lee  
Hong Kong University of Science and Technology, Hong Kong*

**B1L-08-5**

**12:00**

**Characterization of 3D Printed Sheets Using Multi-Frequency Scanning Impedance Microscopy**

*Martijn Schouten, Gijs Krijnen  
University of Twente, Netherlands*

**14:30 – 15:30 UTC**

**B2P-10: SENSOR SYSTEMS V**

**SESSION CHAIR: René Lerch, Fraunhofer IMS**

**B2P-10-1**

**Fraud Detection of Black Pepper Using Metal Oxide Semiconductor Gas Sensors**

*Hui En Lee{3}, Hong Siang Chua{3}, Zehnder Jarroop Augustine Mercer{1}, Sing Muk Ng{2}, Mahnaz Shafiei{3}  
{1}Malaysian Pepper Board, Malaysia; {2}Sarawak Energy Berhad, Malaysia; {3}Swinburne University of Technology, Australia; {3}Swinburne University of Technology, Malaysia*

**B2P-10-2**

**Radar-Thermal Sensor Fusion Methods for Deep Learning Hand Gesture Recognition**

*Sruthy Skaria, Akram Al-Hourani, Da Huang  
RMIT University, Australia*

**B2P-10-3**

**Classification of PCG Signals Using Fourier-Based Synchrosqueezing Transform and Support Vector Machine**

*Samit Kumar Ghosh, Rajesh Kumar Tripathy, R N Ponnalagu  
Birla Institute of Technology and Science, Pilani, India*

**B2P-10-4**

**Design of an Artificial Neural Network Circuit for Detecting Atrial Fibrillation in ECG Signals**

*René Lerch{1}, Babak Hosseini{2}, Pierre Gembaczka{1}, Gernot Fink{2}, André Lüdecke{1}, Viktor Brack{2}, Furkan Ercan{1}, Alexander Utz{1}, Karsten Seidl{1}  
{1}Fraunhofer Institute for Microelectronic Circuits and Systems, Germany; {2}Technische Universität Dortmund, Germany*

**B2P-10-5**

**A Fully Differential PPG Readout Amplifier with a Reconfigurable Bandwidth for Power Minimization**

*Zeqi Zhang, Shuang Song, Tian Yang, Mengyu Li, Zheng Gu, Yizhao Zhou, Menglian Zhao  
Zhejiang University, China*

**14:30 – 15:30 UTC**

**B2P-11: ENVIRONMENTAL SENSORS (TEMP, PRESSURE, MOISTURE)**

**SESSION CHAIR: Valentina Zega, Politecnico di Milano**

**B2P-11-1**

**Pressure Sensor with Novel Electrical Circuit Utilizing Bipolar Junction Transistor**

*Mikhail Basov*

*Federal State Unitary Enterprise Dukhov Automatics Research Institute, Russia*

**B2P-11-2**

**Temperature Model Calibration for a Resonant Pipe Viscosity and Density Sensor**

*Stefan Clara{2}, Friedrich Feichtinger{2}, Thomas Voglhuber-Brunnmaier{2}, Andreas Tröls{2}, Bernhard Jakoby{1}*

*{1}Institute for Microelectronics and Microsensors, Johannes Kepler Universität Linz, Austria;*

*{2}Johannes Kepler Universität Linz, Austria*

**B2P-11-3**

**Fluid Independent Thermal Flow Sensor Using Constant-Temperature Anemometry and the 3 $\omega$ -Method**

*Ralf Emanuel Bernhardsgrütter{1}, Christoph Hepp{1}, Katrin Schmitt{2}, Jürgen Wöllenstein{2}*

*{1}Innovative Sensor Technology IST AG, Switzerland; {2}IPM, Albert-Ludwigs-Universität Freiburg, Germany*

**B2P-11-4**

**Capacitive Pressure Sensing Unit for Racket Sports**

*Ye-Jin Zheng, Wei-Cheng Wang, Rongshun Chen, Wen-Hsin Chiu, Yi-Yang Chen, Cheng-Yao Lo  
National Tsing Hua University, Taiwan*

**B2P-11-5**

**Diamond-Like Carbon Based Micro-Pressure Sensor with Ultra-Thin Sensitive Membrane**

*Xin Ma{2}, Qi Zhang{2}, Peng Guo{1}, Yulong Zhao{2}, Aiyong Wang{1}*

*{1}Ningbo Institute of Materials Technology and Engineering, China; {2}Xi'an Jiaotong University, China*

**B2P-11-6**

**Pushing the Limits of LiNbO<sub>3</sub>-Based High Temperature SAW Sensors**

*Jordan Maufay{2}, Ulrich Youbi{2}, Thierry Aubert{2}, Ninel Kokanyan{2}, Sami Hage-Ali{1}, Michel Vilasi{1}, Omar Elmazria{1}*

*{1}Jean Lamour Institute, Université de Lorraine, CNRS, France; {2}LMOPS, Université de Lorraine CentraleSupélec, France*



**B2P-11-7**

**Seebeck Coefficient in SiC/Si Heterojunction for Self-Powered Thermal Sensor**

*Pablo Guzman{1}, Toan Dinh{2}, Thanh Nguyen{1}, Van Thanh Dau{1}, Abu Riduan Md Foisal{1}, Hung Nguyen{1}, Trung Hieu Vu{1}, Tuan-Khoa Nguyen{1}, Hoang-Phuong Phan{1}, Huaizong Li{1}, Nam-Trung Nguyen{1}, Dzung Viet Dao{1}*

*{1}Griffith University, Australia; {2}University of Southern Queensland, Australia*

**B2P-11-8**

**Resistive and CTAT Temperature Sensors in a Silicon Carbide CMOS Technology**

*Joost Romijn{1}, Luke Middelburg{1}, Sten Vollebregt{1}, Brahim El Mansouri{1}, Henk van Zeijl{1}, Alexander May{2}, Tobias Erlbacher{2}, Guoqi Zhang{1}, Pasqualina Sarro{1}*

*{1}Delft University of Technology, Netherlands; {2}Fraunhofer Institute for Integrated Systems and Devices Technology, Germany*

**B2P-11-9**

**Design and Characterization of a Low-Power Moisture Sensor from Commercially Available Electronics**

*John Sanchez{1}, Archana Dahal{1}, Cody Zesiger{2}, Ramesh Goel{1}, Darrin Young{1}, Shad Roundy{1}*

*{1}University of Utah, United States; {2}Utah State University, United States*

**B2P-11-10**

**Molybdenum Disulfide Membrane-Based Ultrasensitive Temperature Sensor**

*Nishta Arora, Akshay Naik*

*Indian Institute of Science, Bengaluru, India*

**14:30 – 15:30 UTC**

**B2P-12: OPTICAL SENSORS III**

**SESSION CHAIR: Hengky Chandralim, The U.S. Air Force Institute of Technology**

**B2P-12-1**

**Plasmonic Refractive Index Sensor Based on a Multiple D-Shaped Au/Fe<sub>3</sub>O<sub>4</sub> Nanowire**

*Riadh A. Kadhim{1}, Nawar AL-Hemeary{2}, Jiang Wu{1}*

*{1}IFFS, University of Electronic Science and Technology of China, China; {2}Pazmany Peter Catholic University, Hungary*

**B2P-12-2**

**A Fiber Bragg Grating Accelerometer Based on Novel Biaxial Arc Hinge**

*Jianyu Yang, Haokun Mi, Lei Liang, Xiaoling Tong*

*Wuhan University of Technology, China*

**B2P-12-3**

**Accuracy Evaluation of a CDM-WDM Interrogator for Quasi-Distributed FBG Sensing**

*Marek Götten{4}, Steffen Lochmann{3}, Andreas Ahrens{3}, Eric Lindner{2}, Johan Vlekken{1}, Jan Van Roosbroeck{1}*

*{1}FBGS International NV, Belgium; {2}FBGS Technologies GmbH, Germany; {3}Hochschule Wismar, Germany; {4}Hochschule Wismar / University of Applied Sciences Wismar, Germany*

**B2P-12-4**

**Multi-Layer ToF: Comparison of Different Multipath Resolve Methods for Indirect 3D Time-of-Flight**

*Jonas Gutknecht, Teddy Loeliger*

*ZHAW School of Engineering, Switzerland*

**B2P-12-5**

**Two-Dimensional Close-Packed Arrays of Polystyrene Microspheres Bragg Grating for Refractive Index Sensing**

*Lingxi Xiong, Donglai Guo, Minghong Yang*

*Wuhan University of Technology, China*

**B2P-12-6**

**Effects of Sensor Cover Damages on Point Clouds of Automotive Lidar**

*Birgit Schlager<sup>{2}</sup>, Thomas Goelles<sup>{1}</sup>, Daniel Watzenig<sup>{2}</sup>*

*<sup>{1}</sup>Virtual Vehicle Research GmbH, Austria; <sup>{2}</sup>Virtual Vehicle Research GmbH, Graz University of Technology, Austria*

**14:30 – 15:30 UTC**

**B2P-13: ACOUSTIC & ULTRASONIC SENSORS**

**SESSION CHAIR: Sheng-Shian Li, National Tsing Hua University**

**B2P-13-1**

**Biomimetic Multi-Band Directionality Using a Microchip Level Microphone Array for Sound Controlled Robot Orientation**

*Ashiqur Rahaman, Byungki Kim*

*Korea University of Technology and Education, Korea*

**B2P-13-2**

**Towards a Bio-Inspired Acoustic Sensor: Achroia Grisella's Ear**

*Lara Díaz-García, Andrew Reid, Joseph Jackson, James F. C. Windmill*

*University of Strathclyde, United Kingdom*

**B2P-13-3**

**Biosensor for Rapid Detection of SARS-CoV-2 in Real-World Samples**

*Michala Forinová<sup>{4}</sup>, Alina Pilipenco<sup>{4}</sup>, Ivana Víšová<sup>{4}</sup>, Jakub Kunčák<sup>{4}</sup>, N. Scott Lynn<sup>{4}</sup>, Petr Yudin<sup>{4}</sup>, Jakub Dostálek<sup>{3}</sup>, Václav Hönl<sup>{2}</sup>, Martin Palus<sup>{2}</sup>, Hana Mašková<sup>{5}</sup>, Filip Dyčka<sup>{5}</sup>, Jan Štěrba<sup>{5}</sup>, Markéta Vrabcová<sup>{4}</sup>, Judita Arnoštová<sup>{4}</sup>, Moni*

*<sup>{1}</sup>Academia Sinica, Taiwan; <sup>{2}</sup>Biology Centre CAS, Veterinary Research Institute, Czech Rep.; <sup>{3}</sup>Institute of Physics of the CAS, Austrian Institute of Technology GmbH, Austria; <sup>{4}</sup>Institute of Physics of the Chinese Academy of Sciences, Czech Rep.; <sup>{5}</sup>Un*

**B2P-13-4**

**Numerical and Experimental Study of a Phononic-Fluidic Sensor Using a Cubic Unit Cell with Spherical Void**

*Yauheni Belahurau, Jacob Søndergaard Jensen, Frieder Lucklum*

*Danmarks Tekniske Universitet, Denmark*

**B2P-13-5**

**Passive Ultrasonic Temperature Measurement Through a Metal Wall**

*Bibhu Kar, Thomas Schaechtle, Stefan Rupitsch, Ulrike Wallrabe  
IMTEK, Albert-Ludwigs-Universität Freiburg, Germany*

**B2P-13-6**

**An Implantable Umbo Microphone for Fully-Implantable Assistive Hearing Devices**

*Benjamin Cary{4}, John Zhang{4}, Christopher McHugh{3}, Ioannis John Kymissis{1}, Elizabeth Olson{1}, Heidi Nakajima{2}, Jeffrey Lang{4}  
{1}Columbia University, United States; {2}Harvard Medical School, United States; {3}Massachusetts Eye and Ear, United States; {4}Massachusetts Institute of Technology, United States*

**B2P-13-7**

**Passive Acoustic Transducer as a Fluid Flow Sensor**

*Samuel Yang, Michail Kiziroglou, Eric Yeatman, Andrew Holmes  
Imperial College London, United Kingdom*

**14:30 – 15:30 UTC**

**B1P-09: MICROWAVE SENSORS FOR WIRELESS TECHNOLOGIES**

**SESSION CHAIRS:** Rashid Mirzavand & Karthik Shankar, University of Alberta

**B2P-14-1**

**Alive Monitoring Sensor System with 2.45-GHz Wireless Power Transfer for Self-Powered Wireless Sensor**

*Fumiya Nishimura{2}, Yuichiro Hirai{2}, Ayano Kamitani{2}, Ami Tanaka{2}, Fumiyasu Utsunomiya{1}, Hisashi Nishikawa{2}, Takakuni Douseki{2}  
{1}ABLIC Inc., Japan; {2}Ritsumeikan University, Japan*

**B2P-14-2**

**Electromagnetic Wave Sensor for Proximity Target Detection Under Radio and Radar Coexistence at 2.4-GHz ISM Band**

*Dae Young Koh{1}, Timothy S. Han{2}, Joseph Zubah{2}  
{1}Applied Matrix Systems LLC, United States; {2}Lockheed Martin, United States*

**B2P-14-3**

**Epoxy/CNT-Zn<sub>0.5</sub>Ni<sub>0.5</sub>Fe<sub>2</sub>O<sub>4</sub> Multilayer Polymeric Nanocomposites for Electromagnetic Wave Absorption**

*Majed Amini, Milad Kamkar, Ahmadsreza Ghaffarkhah, Saeed Ghaderi, Mohammad Arjmand  
University of British Columbia, Canada*

**B2P-14-4**

**3D Printing of Transparent pH-Mediated High-Water-Content Hydrogels for Electromagnetic Interference (EMI) Shielding**

*Saeed Ghaderi, Milad Kamkar, Ahmadsreza Ghaffarkhah, Majed Amini, Amir Hosein Ahmadian Hoseini, Mohammad Arjmand  
University of British Columbia, Canada*

**B2P-14-5**

**Exploring the Potential of Cellulose Nanofibrils for Humidity Sensing Using an Organic Microwave Resonator**

*Nicolas Tanguy{1}, Maryam Moradpour{1}, Mandeep Jain{1}, Ning Yan{2}, Mohammad Hossein Zarifi{1}  
{1}University of British Columbia, Canada; {2}University of Toronto, Canada*

14:30 – 15:30 UTC

**B2P-15: SENSOR PHENOMENOLOGY II**

**SESSION CHAIRS:** Hung Cao, University of California Irvine & Theerawit Wilaiprasitporn, Vidyasirimedhi Institute of Science & Technology (VISTEC)

**B2P-15-1**

**Dual-Mass Resonator with Dynamically Balanced Structure for Roll/Pitch Rate Integrating Gyroscope**

*Shihe Wang<sup>{2}</sup>, Muhammad Salman Al Farisi<sup>{1}</sup>, Jianlin Chen<sup>{2}</sup>, Takashiro Tsukamoto<sup>{2}</sup>, Shuji Tanaka<sup>{2}</sup>*

*<sup>{1}</sup>Hiroshima City University, Japan; <sup>{2}</sup>Tohoku University, Japan*

**B2P-15-2**

**A Methodology for Analyzing the Impact of Crosstalk on LIDAR Measurements**

*Lara Briñón-Arranz<sup>{2}</sup>, Tiana Rakotovao<sup>{2}</sup>, Thierry Creuzet<sup>{2}</sup>, Cem Karaoguz<sup>{1}</sup>, Oussama El-Hamzaoui<sup>{1}</sup>*

*<sup>{1}</sup>Transdev Autonomous Transport Systems, France; <sup>{2}</sup>Université Grenoble Alpes and CEA, France*

**B2P-15-3**

**Modeling of the Transient Behavior of a Nuclear Magnetic Resonance Gyroscope**

*Riccardo Cipolletti<sup>{3}</sup>, Janine Riedrich-Moeller<sup>{3}</sup>, Tino Fuchs<sup>{2}</sup>, Arne Wickenbrock<sup>{1}</sup>, Dmitry Budker<sup>{1}</sup>*

*<sup>{1}</sup>GSI Helmholtzzentrum für Schwerionenforschung, Johannes Gutenberg University Mainz, Germany; <sup>{2}</sup>Robert Bosch GmbH, Germany; <sup>{3}</sup>Robert Bosch GmbH and Johannes Gutenberg University Mainz, Germany*

**B2P-15-4**

**A Behavior-Descriptive Model of Love Wave Sensor in Liquid Medium for Circuit-Design and Analysis with QucsStudio**

*Maxence Rube<sup>{2}</sup>, Ollivier Tamarin<sup>{2}</sup>, Simon Hemour<sup>{1}</sup>, Martine Sebeloue<sup>{2}</sup>, Asawari Choudhari<sup>{2}</sup>, Idris Sadli<sup>{2}</sup>, Laurent Linguet<sup>{2}</sup>, Dominique Rebiere<sup>{1}</sup>, Corinne Dejous<sup>{1}</sup>*

*<sup>{1}</sup>Université de Bordeaux, France; <sup>{2}</sup>University of French Guiana, France*

**B2P-15-5**

**Analysis of the Impact of the Processing Time-Delay on the Stability of a Digital GMI Magnetometer**

*Papa Silly Traoré<sup>{1}</sup>, Serge Konan<sup>{2}</sup>, Aktham Asfour<sup>{2}</sup>, Jean Paul Yonnet<sup>{2}</sup>*

*<sup>{1}</sup>École Supérieure Polytechnique - Université Cheikh Anta Diop de Dakar, Senegal; <sup>{2}</sup>Grenoble Electrical Engineering Laboratory, Université Grenoble Alpes, France*

**B2P-15-6**

**Estimation of a Magnetization Curve of a Fluxgate Wire Core Using an Inverse Technique**

*Mehran Mirzaei, Pavel Ripka, Václav Grim*

*Czech Technical University in Prague, Czech Rep.*

**B2P-15-7**

**A Thermal Expansion-Based Angular Motion Sensor with Detection Limit Towards Sub-Degree Per Second**

*Huahuang Luo, Mingzheng Duan, Hadi Tavakkoli, Jose Cabot, Yi-Kuen Lee*

*Hong Kong University of Science and Technology, Hong Kong*

**B2P-15-8**

**Optimizing Fringing Field Sensor Performance with Non-Spherical Particles**

*Robert Dean, Moriah Reed, Elizabeth Guertal*

*Auburn University, United States*

**B2P-15-9**

**Towards Continuous Plant Bioimpedance Fitting and Parameter Estimation**

*Devon Martin, James Reynolds, Michael Daniele, Edgar Lobaton, Alper Bozkurt*

*North Carolina State University, United States*

12:00 – 13:30 UTC

**C1L-01: MICROWAVE SENSORS FOR INDUSTRIAL & COMMERCIAL APPLICATIONS**

**SESSION CHAIRS:** Mohammad Zarifi, University of British Columbia & Karthik Shankar, University of Alberta

**C1L-01-1**

**12:00**

**INVITED: A Microwave Microfluidic Reflective-Mode Phase-Variation Sensor**

*Paris Vélez<sup>{1}</sup>, Cristian Herrojo<sup>{4}</sup>, Xavi Illa<sup>{2}</sup>, Rosa Villa<sup>{2}</sup>, Jonathan Muñoz-Enano<sup>{4}</sup>, Lijuan Su<sup>{4}</sup>, Pau Casacuberta<sup>{4}</sup>, Marta Gil<sup>{3}</sup>, Ferran Martín<sup>{4}</sup>*

*<sup>{1}</sup>CIMITEC, Universitat Autònoma de Barcelona, Spain; <sup>{2}</sup>Institute of Microelectronics of Barcelona (IMB-CNM-CSIC), Spain; <sup>{3}</sup>Universidad Politécnica de Madrid, Spain; <sup>{4}</sup>Universitat Autònoma de Barcelona, Spain*

**C1L-01-2**

**12:30**

**Detection of Organoleptic Faults in Wine by Microwave Sensor Coupled with Molecularly Imprinted Silica**

*Jerome Rossignol<sup>{2}</sup>, Elias Bou Maroun<sup>{1}</sup>, Didier Stuerger<sup>{2}</sup>, Alexis Lasserre<sup>{2}</sup>, Regis Gougeon<sup>{1}</sup>, Philippe Cayot<sup>{1}</sup>, Etienne Kayser<sup>{3}</sup>, Elisabeth Closier<sup>{3}</sup>*

*<sup>{1}</sup>Agrosup, PAM UMRA 02.102, University Bourgogne Franche-Comté, France; <sup>{2}</sup>ICB UMR CNRS 6303, Université Bourgogne Franche-Comté, France; <sup>{3}</sup>SATT SAYENS, France*

**C1L-01-3**

**12:45**

**Smart Knife for Robotic Meat Cutting**

*Alex Mason<sup>{2}</sup>, Dmytro Romanov<sup>{1}</sup>, Luis Eduardo Cordova-Lopez<sup>{1}</sup>, Olga Korostynska<sup>{3}</sup>*

*<sup>{1}</sup>Norwegian University of Life Sciences, Norway; <sup>{2}</sup>Norwegian University of Life Sciences, Animalia AS, Norway; <sup>{3}</sup>Oslo Metropolitan University, Norway*

**C1L-01-4**

**13:00**

**Durable Ice Sensors Utilizing Microwave SRRs Coated with Protective Epoxy for De-Icing Control**

*Ryan Kozak, Mandeep Jain, Jack McClelland, Aaryaman Shah, Mohammad Hossein Zarifi*  
*University of British Columbia, Canada*

**C1L-01-5**

**13:15**

**Flexible EGaIn Liquid Metal Microstrip Patch Antenna Based Pressure Sensor**

*Sheikh Dobir Hossain, Annatoma Arif, Bhushan Lohani, Robert C. Roberts*  
*University of Texas at El Paso, United States*

**12:00 – 13:30 UTC**

**C1L-02: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS III**

**SESSION CHAIRS: Marios Sophocleous, University of Cyprus & Aakash Jog, Tel Aviv University**

**C1L-02-1**

**12:00**

**Toward Subcutaneous Electrochemical Aptasensors for Neuropeptide Y**

*Hayley Richardson, Grace Maddocks, Kaila Peterson, Michael Daniele, Spyridon Pavlidis  
North Carolina State University, United States*

**C1L-02-2**

**12:15**

**High Electron Mobility Transistor-Based Hydrogen Sensor Using ITO as a Sensing Layer**

*Mohammad Iktiham Bin Taher{2}, Yacine Halfaya{3}, Rouba Alrammouz{5}, Mathieu Lazerges{5},  
Aurelien Randi{5}, Tarik Moudakir{3}, Nossikpendou Yves Sama{3}, Thomas Guermont{1}, Nicolas  
Pelissier{1}, Thomas Pichler{4}, Médéric Piedevache{4}, Jacques Pironon  
{1}45-8 Energy, France; {2}GeoRessources laboratory, Université de Lorraine, France; {3}Lafayette  
Institute, France; {4}Solexperts AG, France; {5}Université de Lorraine, France*

**C1L-02-3**

**12:30**

**Single-Sensor Gas Discrimination and Quantification Based on Novel Temperature Modulation Method**

*Maaki Saeki, Yuki Okura, Takefumi Yoshikawa, Tatsuya Iwata  
Toyama Prefectural University, Japan*

**C1L-02-4**

**12:45**

**A Graphene-Based Composite for Selective Detection of Ethylene at Ambient Environment**

*Fowzia Akhter, Hasin Reza Siddiquei, Subhas Chandra Mukhopadhyay  
Macquarie University, Australia*

**C1L-02-5**

**13:00**

**A Robotic Electrochemical Biosensor Based on Kinetic Electronics Technique**

*Shiyi Zhang{1}, Joseph Wang{2}, Kenshi Hayashi{1}, Fumihiro Sassa{1}  
{1}Kyushu University, Japan; {2}University of California San Diego, United States*

**C1L-02-6**

**13:15**

**An Electrochemical Immunosensor for Global DNA Methylation Determination Using Magnetic Bead-Based Enrichment and Enzymatic Amplification**

*Yitao Liang, Bin Zhang, Zexin Xue, Xuesong Ye, Bo Liang  
Zhejiang University, China*

12:00 – 13:30 UTC

**C1L-03: TACTILE & STRAIN SENSORS**

**SESSION CHAIRS:** Kunihisa Tashiro, Shinshu University

**C1L-03-1**

**12:00**

**Soft-Material-Based Highly Reliable Tri-Axis Tactile Thin-Film Sensors for Robotic Manipulation Tasks**

*Kei Tsukamoto, Akira Ebisui, Tetsuro Goto, Yoshiaki Sakakura, Ken Kobayashi, Satoshi Sato, Takahiro Kamei, Yutaka Imai, Kazumasa Nomoto*  
*R&D Center, Sony Group Corporation, Japan*

**C1L-03-2**

**12:15**

**Modeling the Optical Sensing Principle of the PapillArray Tactile Sensor**

*Pablo Martinez Ulloa{1}, David Cordova Bulens{1}, Benjamin Xia{2}, Heba Khamis{2}, Stephen Redmond{1}*  
*{1}University College Dublin, Ireland; {2}University of New South Wales, Australia*

**C1L-03-3**

**12:30**

**Detection of Rigid Object Embedded in Skin Model Using Tactile Sensor for Palpation**

*Shu Ogawara, Jun Kido, Takashi Abe, Masayuki Sohigawa*  
*Niigata University, Japan*

**C1L-03-4**

**12:45**

**Low-Power Static and Dynamic Tactile Sensing Using In-Situ Fabricated PVDF-TrFE e-skin**

*Jarred Fastier-Wooler, Trung Hieu Vu, Yong Zhu, Hong-Quan Nguyen, Van Thanh Dau, Dzung Viet Dao*  
*Griffith University, Australia*

**C1L-03-5**

**13:00**

**An Internet-of-Things Enabled Flexible Strain Sensor for Stem Growth Measurements**

*Nafize Hossain, Shawana Tabassum*  
*University of Texas at Tyler, United States*

**C1L-03-6**

**13:15**

**Ultrasensitive Strain Sensor Enhanced by Bonded Light Emitting Diodes**

*Thanh Nguyen{1}, Toan Dinh{2}, Van Thanh Dau{1}, Abu Riduan Md Foisal{1}, Hung Nguyen{1}, Trung Hieu Vu{1}, Tuan Anh Pham{1}, Canh-Dung Tran{2}, Tuan-Khoa Nguyen{1}, Hoang-Phuong Phan{1}, Nam-Trung Nguyen{1}, Dzung Viet Dao{1}*  
*{1}Griffith University, Australia; {2}University of Southern Queensland, Australia*



**12:00 – 13:30 UTC**

**C1L-04: SENSOR SYSTEMS II**

**SESSION CHAIRS:** Javier Bilbao de Men, NM Numerical Modelling GmbH & Michael Daniele, NC State University

**C1L-04-1**

**12:00**

**On the Influence of Home Appliances on the Smartphone's Inertial Sensors**

*Shunit Truzman{2}, Guy Revach{1}, Itzik Klein{2}*

*{1}ETH Zürich, Switzerland; {2}University of Haifa, Israel*

**C1L-04-2**

**12:15**

**On Amplitude-Gain-Control Optimization for Lissajous Frequency Modulated MEMS Gyroscopes**

*Marco Bestetti{1}, Giorgio Mussi{1}, Christian Padovani{1}, Andrea Donadel{2}, Carlo Valzasina{2}, Giacomo Langfelder{1}, Andrea Bonfanti{1}*

*{1}Politecnico di Milano, Italy; {2}STMicroelectronics, Italy*

**C1L-04-3**

**12:30**

**Magnetic Position Sensors Revisited**

*Markus Roos{2}, Javier Bilbao de Mendizabal{1}*

*{1}maglab AG, Switzerland; {2}NM Numerical Modelling GmbH, Switzerland*

**C1L-04-4**

**12:45**

**A 14-Channel 7 GHz VCO-Based EPR-on-a-Chip Sensor with Rapid Scan Capabilities**

*Mohamed Atef Hassan{2}, Tarek Elrifai{2}, Ayman Sakr{2}, Michal Kern{2}, Klaus Lips{1}, Jens Anders{2}*

*{1}Helmholtz Center for Materials and Energy, Germany; {2}Institute of Smart Sensors, Universität Stuttgart, Germany*

**C1L-04-5**

**13:15**

**A Novel Light-to-Frequency Converter Based Analog Front-End for Optical Sensing Applications**

*Guido Di Patrizio Stanchieri{1}, Andrea De Marcellis{1}, Marco Faccio{1}, Elia Palange{1}, Ulkuhan Guler{2}*

*{1}University of L'Aquila, Italy; {2}Worcester Polytechnic Institute, United States*

**12:00 – 13:30 UTC**

**C1L-05: SENSOR NETWORKS (IoT) II**

**SESSION CHAIRS:** Henry Leung, University of Calgary & Binbin Chen, Singapore University of Technology & Design

**C1L-05-1**

**12:00**

**Detection of Skin RGB Color with a Battery-Free NFC Skincare Device**

*Syed Muhammad Ali, Wan-Young Chung*

*Pukyong National University, Korea*

**C1L-05-2**

**12:15**

**Individual and Longitudinal Trend Analysis of Stairway Gait via Ambient Measurement Using Handrail-Shaped Force Sensor**

*Moe Hamada{2}, Koji Kitamura{1}, Yoshifumi Nishida{2}*

*{1}Advanced Industrial Science and Technology, Japan; {2}Tokyo Institute of Technology, Japan*

**C1L-05-3**

**12:30**

**A LoRaWAN-Based Environmental Sensor System for Urban Tree Health Monitoring**

*Haokai Zhao{1}, Kevin Kam{1}, Ioannis John Kymissis{1}, Patricia Culligan{2}*

*{1}Columbia University, United States; {2}University of Notre Dame, United States*

**C1L-05-4**

**12:45**

**Intrinsically Self-Powered, Battery-Free, and Sensor-Free Ambient Light Control System**

*Roberto La Rosa{3}, Mario Costanza{2}, Andreas Burg{1}, Catherine Dehollain{1}, Patrizia Livreri{4}*

*{1}École Polytechnique Fédérale de Lausanne, Switzerland; {2}FEMTO-ST Institute, France;*

*{3}STMicroelectronics, École Polytechnique Fédérale de Lausanne, Italy; {4}Università degli Studi di Palermo, Italy*

**C1L-05-5**

**13:00**

**Electronic System for Citizens' Air Quality Mapping**

*Sergio Palomeque-Mangut, Félix Meléndez, Jaime Gómez-Suárez, Patricia Arroyo, José-Ignacio*

*Suárez, Jesús Lozano*

*Universidad de Extremadura, Spain*

**12:00 – 13:30 UTC**

**C1L-06: SENSOR MATERIALS, PROCESSING & FABRICATION I**

**SESSION CHAIRS: Masato Sone, Tokyo Institute of Technology & Mohsen Asadnia, Macquarie University**

**C1L-06-1**

**12:00**

**Laser Induced Graphene-Based Glucose Biofuel Cell**

*Md Faruk Hossain, Gymama Slaughter*

*Center for Bioelectronics, Old Dominion University, United States*

**C1L-06-2**

**12:15**

**Directly Deposited Thin-Film Strain Gauges on Curved Metallic Surfaces**

*Rico Ottermann{2}, Daniel Klaas{2}, Folke Dencker{2}, Dominik Hoheisel{1}, Sebastian Jung{1},*

*Alexander Wienke{3}, Jan Friedrich Düsing{3}, Jürgen Koch{3}, Marc Christopher Wurz{2}*

*{1}Baker Hughes Inteq GmbH, Germany; {2}Institute of Micro Production Technology, Leibniz University Hannover, Germany; {3}Laser Zentrum Hannover e.V., Germany*

**C1L-06-3**

**12:30**

**Piezoresistive 4H-Silicon Carbide (SiC) Pressure Sensor**

*Piotr Mackowiak{1}, Kolja Erbacher{1}, Manuel Baeuscher{1}, Michael Schiffer{1}, Klaus-Dieter Lang{2}, Martin Schneider-Ramelow{2}, Ha-Duong Ngo{3}*

*{1}Fraunhofer Institute for Reliability and Microintegration, Germany; {2}Technische Universität Berlin, Germany; {3}University of Applied Sciences Berlin, Germany*

**C1L-06-4**

**12:45**

**Fabrication Process and Structural Characterization of Fused Silica-on-Silicon Toroidal Ring Gyroscope**

*Daryosh Vatanparvar, Doreen Hii, Andrei Shkel*

*University of California, Irvine, United States*

**C1L-06-5**

**13:00**

**A Novel Engine Air Intake Sensor Based on 3D Printing and PCB Technology**

*Dimitrios-Nikolaos Pagonis{1}, Grigoris Kaltsas{1}, Tzoulis Koutsis{1}, Antonios Pagonis{2}*

*{1}University of West Attica, Greece; {2}Wärtsilä Greece S.A., Greece*

**C1L-06-6**

**13:15**

**Characterization of Reversibly-Actuating Shape Memory Alloy Foils Produced by Planar Flow Casting**

*Ling Chen, David Renshaw, Michael Kellam, Ritaban Dutta, Daniel Liang*

*Commonwealth Scientific and Industrial Research Organisation, Australia*

**12:00 – 13:30 UTC**

**C1L-07: EMERGING WEARABLE SENSORS & SYSTEMS II**

**SESSION CHAIRS:** Mohamed Irfan Mohamed Refai, University of Twente & Hung Cao, University of California Irvine

**C1L-07-1**

**12:00**

**INVITED: From Digital Twins to Wearables and Back**

*Oliver Amft*

*Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany*

**C1L-07-2**

**12:30**

**ASRE: Adaptive Spatial Resolution Wearable EEG**

*Yongchao Yang{1}, Ye Sun{2}*

*{1}Michigan Technological University, United States; {2}University of Virginia, United States*

**C1L-07-3**

**12:45**

**Gel-Free Wearable Electroencephalography (EEG) with Soft Graphene Textiles**

*Ata Golparvar{1}, Ozberk Ozturk{2}, Murat Kaya Yapici{2}*

*{1}École Polytechnique Fédérale de Lausanne, Switzerland; {2}Sabancı University, Turkey*

**C1L-07-4**

**13:00**

**Tracking Lower Body 3D Kinematics Using Three IMUs**

*Luke Wicent Sy{2}, Nigel Lovell{2}, Stephen Redmond{1}*

*{1}University College Dublin, Ireland; {2}University of New South Wales, Australia*

**C1L-07-5**

**13:15**

**A Nano-Joule Burst-Mode Eye-Gaze Angle and Object Distance Sensor for Smart Contact Lenses**

*Chayanjit Ghosh{1}, Sakthidasan Kalidasan{1}, Mohit U. Karkhanis{1}, Alex Mastrangelo{2},*

*Aishwaryadev Banerjee{1}, Ross Walker{1}, Hanseup Kim{1}, Carlos H. Mastrangelo{1}*

*{1}University of Utah, United States; {2}University of Washington, United States*

**12:00 – 13:30 UTC**

**C1L-08: MICROFLUIDICS & BIOSENSORS II**

**SESSION CHAIRS:** Shekhar Bhansali, Florida International University & Loes Segerink, University of Twente/BIOS

**C1L-08-1**

**12:00**

**Electroosmotic Pump Using a Glass Fiber Filter for High Flow Rate Water Transport**

*Rafael Ecker{2}, Andreas Fuchsluger{2}, Bernhard Jakoby{1}*

*{1}Institute for Microelectronics and Microsensors, Johannes Kepler Universität Linz, Austria;*

*{2}Johannes Kepler Universität Linz, Austria*

**C1L-08-2**

**12:15**

**A Novel Calibration-Free Fully Integrated CMOS Capacitive Sensor for Life Science Applications**

*Hamed Osouli Tabrizi{2}, Saghi Forouhi{2}, Omid Farhanieh{1}, Sebastian Magierowski{2}, Ebrahim Ghafar-Zadeh{2}*

*{1}Sabancı University, Turkey; {2}York University, Canada*

**C1L-08-3**

**12:30**

**Flexible Organic Electrolyte Gated FET Biosensor with Integrated Soft Fluidics for Cortisol Monitoring in Oral Samples**

*Roslyn Massey, Ravi Prakash*

*Carleton University, Canada*

**C1L-08-4**

**12:45**

**Linear Pulse-Frequency Modulator ISFET with a Wide Supply Range**

*Jose Cortes-Guzman{1}, Andreas Tsiamis{1}, David Cumming{2}, Srinjoy Mitra{1}*

*{1}University of Edinburgh, United Kingdom; {2}University of Glasgow, United Kingdom*

**C1L-08-5**

**13:00**

**Development of a Flexible Wireless MWCNTs-Based ECG Monitoring Device**

*Yonatan Beyene, Ruth Bahre, Feysel Mohammed, Simin Masihi, Anthony Hanson, Masoud Panahi, Dinesh Maddipatla, Massood Atashbar*

*Western Michigan University, United States*

**C1L-08-6**

**13:15**

**An Approach Towards Development of Point of Care Diagnostics Using ELISA**

*Nidhi Gupta{1}, Saakshi Dhanekar{2}, Sruti Chattopadhyay{1}, Shradha Suman Panda{2}, Harpal Singh{1}*

*{1}Indian Institute of Technology Delhi, India; {2}Indian Institute of Technology Jodhpur, India*

**14:00 – 15:00 UTC**

**C2P-10: SENSOR SYSTEMS VI**

**SESSION CHAIR: Bobby George, IIT-Madras**

**C2P-10-1**

**Nonlinear Tactile Estimation Model Using Vibration Information from Tactile Sensor Mediated by Mechanoreceptors' Perceptibility**

*Momoko Sagara, Lisako Nobuyama, Kenjiro Takemura*

*Keio University, Japan*

**C2P-10-2**

**A 125 dBQ 1.1 GHz Transimpedance Amplifier for 150 MHz Capacitive MEMS Disk Oscillator**

*Hua Chen{2}, Ruiwei Xia{1}, Ke Liu{2}, Zhen Meng{2}, Yuepeng Yan{2}*

*{1}Hisilicon Corporation, China; {2}Institute of Microelectronics Chinese Academy of Sciences, China*

**C2P-10-3**

**An Ultra-Low Power Voice Interface Design for MEMS Microphones Sensor**

*Jordan Chiao-Teng Chung, Chih-Cheng Lu, Wei-Shu Rih, Ching-Feng Lee, Cheng Ming Shih, Yu Li Yeh*

*Industrial Technology Research Institute, Taiwan*

**C2P-10-4**

**Signal Classification Using a Mechanically Coupled MEMS Neural Network**

*Hamed Nikfarjam{4}, Amin Abbasalipour{4}, Mehari K. Tesfay{3}, Mohammad H. Hasan{1}, Siavash Pourkamali{4}, Roozbeh Jafari{2}, Fadi Alsaleem{3}*

*{1}Columbus State University, United States; {2}Texas A&M University, United States; {3}University of Nebraska, United States; {4}University of Texas at Dallas, United States*

**14:00 – 15:00 UTC**

**C2P-11: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS VI**

**SESSION CHAIRS: Aakash Jog, Tel Aviv University & Marios Sophocleous, University of Cyprus**

**C2P-11-1**

**Characteristics of Hetero-Core Optical Fiber Hydrogen Sensor Based on Au/WO<sub>3</sub>/Pt Thin Film**

*Yuji Nagao{2}, Koji Yuhashi{2}, Ai Hosoki{1}, Michiko Nishiyama{2}, Shoichi Kubodera{2}, Kazuhiro Watanabe{2}*

*{1}National Institute of Genetics, Japan; {2}Soka University, Japan*

**C2P-11-2**

**Detection of Odorant Using TFT Multi-Array with Various Polymers**

*Sohee Kim, Hyun Woo Jang, Hyeokjin Kwon, Su Jin Heo, Goeun Pyo, Dong Su Kim, Ji Won Chae, Jae Eun Jang*

*Daegu Gyeongbuk Institute of Science and Technology, Korea*

**C2P-11-3**

**Principal Component Analysis Augmented Identification of Volatile Organic Compounds Using a Micromachined AT-Cut Quartz Resonator-Based Gas Sensor Array**

*Jiayuan Zhang{1}, Nishit Goel{2}, Vedant Sumaria{1}, Stephen Bart{2}, Srinivas Tadigadapa{1}  
{1}Northeastern University, United States; {2}TDK Invensense Inc, United States*

**C2P-11-4**

**Leaky-Waveguide-Conversion-Type POF Alkane-Gas Sensor Using Carbon-Black Dye**

*Naoki Yoda, Yutaka Suzuki, Masayuki Morisawa  
University of Yamanashi, Japan*

**C2P-11-5**

**Gas Discrimination Based on Feature Patterns of Sensor Transient Extracted by Memristor with Resistance-Voltage Converter**

*Takehiro Hirota, Takefumi Yoshikawa, Tatsuya Iwata  
Toyama Prefectural University, Japan*

**C2P-11-6**

**A Fringe Field Shaping CMOS Capacitive Imaging Array**

*Kangping Hu, Christopher Arcadia, Jacob Rosenstein  
Brown University, United States*

**C2P-11-7**

**Stress Effects in Semiconducting Metal Oxide (SMOx) Materials on MEMS Gas Sensors**

*Vedant Sumaria{1}, Nishit Goel{2}, Stephen Bart{2}  
{1}Northeastern University, United States; {2}TDK Invensense Inc, United States*

**C2P-11-8**

**Invasive Species Prosopis Juliflora Derived Carbon Biomass/SnO<sub>2</sub> Based Hazardous NO<sub>2</sub> Gas Sensor**

*Vetrivel Sankar, Krishnan Balasubramaniam, Sundara Ramaprabhu  
Indian Institute of Technology Madras, India*

**C2P-11-9**

**Gas sensing properties of CuO bundles network synthesized in liquid phase**

*Rutuja Bhusaria{1}, Jean-Sébastien Thomann{2}, Renaud Leturcq{2}  
{1}, Materials Research and Technology Department, Luxembourg Institute of Science and Technology,  
{2}Luxembourg University of Luxembourg, Luxembourg*

**14:00 – 15:00 UTC**

**C2P-12: SENSOR DATA PROCESSING IV**

**SESSION CHAIR: Marco Jose Da Silva, Federal University of Technology Parana**

**C2P-12-1**

**Compact CNN for Rapid Inter-Day Hand Gesture Recognition and Person Identification from sEMG**

*Benjakarn Leelakittisin, Theerawit Wilaiprasitporn, Thapanun Sudhawiyangkul  
Vidyasirimedhi Institute of Science and Technology, Thailand*

**C2P-12-2**

**Estimation of Leak Time Parameter Based on Fusion of Leak Behavior and Data Distribution Characteristic from Gas Flow Sensor Data**

*Jing Liang{1}, Shan Liang{1}, Hao Zhang{1}, Li Ma{2}*

*{1}Chongqing University, China; {2}Southwest Oil and Gasfield Company, China*

**C2P-12-3**

**Estimation Method of Interfacial Stress Distribution by Inverse Analysis of Deformed Shape Data**

*Yoshinao Kishimoto{1}, Yuki Yoshi Kobayashi{1}, Feng Jin{2}*

*{1}Tokyo City University, Japan; {2}Xi'an Jiaotong University, China*

**C2P-12-4**

**Air-Coupled Ultrasound Resonant Spectroscopy Sensitivity Study in Plant Leaf Measurements**

*Linias Svilainis{2}, Žilvinas Nakutis{2}, Valdas Eidukynas{2}, Dobilas Liaukonis{2}, Arturas*

*Aleksandrovas{2}, Andrius Chaziachmetovas{2}, Tomas Gomez Alvarez-Arenas{1}*

*{1}Institute for Physical and Information Technologies, Spain; {2}Kaunas University of Technology, Lithuania*

**C2P-12-5**

**ENFES: ENsemble FEw-Shot Learning for Intelligent Fault Diagnosis with Limited Data**

*Onat Gungor{2}, Tajana Rosing{2}, Baris Aksanli{1}*

*{1}San Diego State University, United States; {2}University of California San Diego, United States*

**C2P-12-6**

**Autoencoder-Based Ultrasonic NDT of Adhesive Bonds**

*Ivan Kraljevski{2}, Frank Duckhorn{2}, Martin Barth{2}, Constanze Tschoepe{2}, Frank Schubert{2}, Matthias Wolff{1}*

*{1}Brandenburgische Technische Universität Cottbus-Senftenberg, Germany; {2}Fraunhofer Institute for Ceramic Technologies and Systems, Germany*

**C2P-12-7**

**Assessment of a Neural Network for the Correction of Measurement Errors**

*Phil Meier, Kris Rohrmann, Marvin Sandner, Marcus Prochaska*

*Ostfalia University of Applied Sciences, Germany*

**C2P-12-8**

**Deep Learning Based Volume Fraction Estimation for Two-Phase Water-Containing Flows**

*Rafiul Rasel{1}, Benjamin Straiton{2}, Alex Solon{2}, Qussai Marashdeh{2}, Fernando Teixeira{1}*

*{1}Ohio State University, United States; {2}Tech4Imaging, United States*

**C2P-12-9**

**One-Shot Radar-Based Gesture Recognizer for Fast Prototyping**

*Xiaodong Cai{1}, Haoyang Wu{2}, Jingyi Ma{2}, Hemin Han{1}, Lili Michael Ma{1}*

*{1}Intel Corporation, China; {2}Intel Labs China, China*

**14:00 – 15:00 UTC**

**C2P-13: SENSOR NETWORKS (IoT) III**

**SESSION CHAIRS: Henry Leung, University of Calgary & Binbin Chen, Singapore University of Technology & Design**

**C2P-13-1**

**Energy Monitoring Using LoRaWAN-Based Smart Meters and oneM2M Platform**

*Shubham Mante, Ruthwik Muppala, Niteesh D., Aftab Hussain  
International Institute of Information Technology, Hyderabad, India*

**C2P-13-2**

**Low-Cost NB-IoT Microgrid Power Quality Monitoring System**

*Dmitry Petrov, Konstantin Kroschewski, Ibrahim Mwammenywa, Geoffrey Mark Kagarura, Ulrich Hilleringmann  
Paderborn University, Germany*

**C2P-13-3**

**Using Redundancy in a Sensor Network to Compensate Sensor Failures**

*Nicolas Winkler<sup>{1}</sup>, Patrick Neumann<sup>{1}</sup>, Erik Schaffernicht<sup>{2}</sup>, Achim Lilienthal<sup>{2}</sup>  
<sup>{1}</sup>BAM Bundesanstalt für Materialforschung und -prüfung, Germany; <sup>{2}</sup>Örebro University, Sweden*

**C2P-13-4**

**A Doppler-Based Human Activity Recognition System Using WiFi Signals**

*Yao Ge<sup>{2}</sup>, Shibo Li<sup>{1}</sup>, Minjian Shentu<sup>{1}</sup>, Ahmad Taha<sup>{2}</sup>, Shuyuan Zhu<sup>{1}</sup>, Jonathan Cooper<sup>{2}</sup>,  
Muhammad Ali Imran<sup>{2}</sup>, Qammer H. Abbasi<sup>{2}</sup>  
<sup>{1}</sup>University of Electronic Science and Technology of China, China; <sup>{2}</sup>University of Glasgow, United Kingdom*

**C2P-13-5**

**Oversampling Highly Imbalanced Indoor Positioning Data Using Deep Generative Models**

*Fahad Alhomayani, Mohammad Mahoor  
University of Denver, United States*

**14:00 – 15:00 UTC**

**C2P-14: SENSOR MATERIALS, PROCESSING & FABRICATION II**

**SESSION CHAIRS:** Masato Sone, Tokyo Institute of Technology & Mohsen Asadnia, Macquarie University

**C2P-14-1**

**Smartphone Sensor for Pesticide Monitoring Using CuO Modified Screen Printed Electrodes**

*Narat Maraprasertsak<sup>{1}</sup>, Patamaporn Subpanyadee<sup>{1}</sup>, Punvinai Vinaisuratern<sup>{1}</sup>, Chanchana Thanachayanont<sup>{2}</sup>, Porpin Pungetmongkol<sup>{1}</sup>  
<sup>{1}</sup>Chulalongkorn University, Thailand; <sup>{2}</sup>Thailand National Metal and Materials Technology Center, Thailand*

**C2P-14-2**

**DC Electric Metamaterial Behaviour in Tuned Fused Deposition Modelling Prints**

*Alexander Dijkshoorn, Thijs Hamstra, Remco Sanders, Stefano Stramigioli, Gijs Krijnen  
University of Twente, Netherlands*

**C2P-14-3**

**New Heterostructured Ni<sub>3</sub>S<sub>2</sub>-rGO Based Room Temperature NH<sub>3</sub> Sensor**

*Boitumelo Tlhaole<sup>{2}</sup>, Neil Coville<sup>{2}</sup>, Ella Liganiso<sup>{2}</sup>, Nathalie Redon<sup>{1}</sup>, Jean-Luc Wojkiewicz<sup>{1}</sup>,  
Thomas Fagniez<sup>{1}</sup>, Caroline Duc<sup>{1}</sup>*



**C2P-14-4**

**Investigation of the Effect of Printing Angle and Device Orientation on Micro-Stereolithographically Printed, and Self-Insulated, 24-Well, High-Throughput 3D Microelectrode Arrays**

*Jorge Manrique Castro, Avra Kundu, Adam Rozman, Swaminathan Rajaraman  
University of Central Florida, United States*

**C2P-14-5**

**Towards All-Polymeric Cochlear Implant Micro-Electrode Arrays**

*Alberto Miralles-Abete, Paddy French  
Delft University of Technology, Netherlands*

**C2P-14-6**

**A Screen-Printed Stretchable Bioelectrical Sensing Sleeve with QuasiDry Microfluid-Wicking Interface**

*Mingde Zheng, Salvatore Zarra, Bibek Samanta  
Nokia Bell Labs, United States*

**C2P-14-8**

**High Strength Piezoelectric Materials for Extreme Environments**

*Tim Comyn, Peter Cowin, Tim Stevenson  
Ionix Advanced Technologies, United Kingdom*

**C2P-14-9**

**Anisotropic Magneto-Resistive Sensor Effect Based Sensor Using Daisy Chain on Polyether Ether Ketone Substrate**

*Sascha de Wall, Sebastian Bengsch, Eike Fischer, Folke Dencker, Marc Christopher Wurz  
Institute of Micro Production Technology, Leibniz University Hannover, Germany*

**C2P-14-10**

**Membrane-Based Artificial Hair Sensors for Flow Sensing and Haptic Exploration**

*Minerva Vargas Gleason, Walter Lang  
Institute for Microsensors, Actuators and Systems, Universität Bremen, Germany*

**C2P-14-11**

**Implantable Sufficiently Integrated Multimodal Flexible Sensor for Intracranial Monitoring**

*Tiezhu Liu{1}, Pan Yao{1}, Zhou Li{2}, Hongqing Feng{2}, Chengyu Zhuang{4}, Xuan Sun{3}, Chunxiu Liu{1}, Ning Xue{1}  
{1}Aerospace Information Research Institute, Chinese Academy of Sciences, University of Chinese Academy, China; {2}Beijing Institute of Nanoenergy and Nanosystems, University of Chinese Academy of Sciences, China; {3}Beijing Tiantan Hospital, Capital Medi*

**C2P-14-12**

**Stretchable Pressure Sensor Using Thermoplastic Polyurethane and Conductive Inks**

*Jawad Ahmad<sup>{2}</sup>, Johan Sidén<sup>{1}</sup>, Henrik Andersson<sup>{2}</sup>*

*<sup>{1}</sup>Mid Sweden University, Sweden; <sup>{2}</sup>Mid Sweden University, Sweden*

**C2P-14-13**

**Biodegradable Additive Manufactured Ferroelectret as Mechanical Sensor**

*Omar Ben Dali, Sergey Zhukov, Claas Hartman, Heinz von Seggern, Gerhard Martin Sessler, Mario Kupnik*

*Technische Universität Darmstadt, Germany*

**C2P-14-14**

**Dual-Printed Soil Sensors for Nitrate and Moisture Monitoring**

*Shenwei Yin, Muhammadeziz Tursunniyaz, Jingyi Huang, Joseph Andrews*

*University of Wisconsin-Madison, United States*

**C2P-14-15**

**Carbon Nanotubes/Polymer Films for Microsensors Applications**

*Marco Antonio Cen-Puc, Tim Mike de Rijk, Minerva Vargas Gleason, Walter Lang*

*Institute for Microsensors, Actuators and Systems, Universität Bremen, Germany*

**C2P-14-16**

**Fully Printed pH Sensor Based in Carbon Black/Polyaniline Nanocomposite**

*Shirin Mahinnejad, Homa Emami, Mohsen Ketabi, Ahmad Al Shboul, Najet Belkhamssa, Andy Shih, Ricardo Izquierdo*

*École de Technologie Supérieure, Canada*

**C2P-14-17**

**Aerosol-Jet Printing of Flexible Green Graphene Humidity Sensors for IoT Applications**

*Mohsen Ketabi, Ahmad Al Shboul, Shirin Mahinnejad, Ricardo Izquierdo*

*École de Technologie Supérieure, Canada*

**C2P-14-18**

**Inkjet Printed 3D Gold Electrochemical Sensor on Shape Memory Polymer for Lead Detection**

*Annatoma Arif, Angela Mendez Contreras, Sheikh Dobir Hossain, Robert C. Roberts*

*University of Texas at El Paso, United States*

**C2P-14-19**

**Printed Capacitive Pressure Sensor with Enhanced Sensitivity Through a Layered PDMS/BaTiO<sub>3</sub> Structure**

*Wenxin Wu, Kevin Schnittker, Joseph Andrews*

*University of Wisconsin-Madison, United States*

11:00 – 12:30 UTC

**D1L-01: OPTICAL SENSORS II**

**SESSION CHAIRS:** Minghong Yang, Wuhan University of Technology & Hengky Chandralalim, The U.S. Air Force Institute of Technology

**D1L-01-1**

11:00

**An All-in-One 64-Zone SPAD-Based Direct-Time-of-Flight Ranging Sensor with Embedded Illumination**

*Fabrice Martin, Pascal Mellot, Adam Caley, Bruce Rae, Colin Campbell, Duncan Hall, Sara Pellegrini*  
STMicroelectronics Imaging Sub-Group, France; STMicroelectronics Imaging Sub-Group, United Kingdom

**D1L-01-2**

11:15

**Wavelength Selective Colloidal Quantum Dot Photodetectors for Spectral Analysis**

*Carlo Venettacci<sup>{2}</sup>, Andrea De Iacovo<sup>{2}</sup>, Federica Mitri<sup>{2}</sup>, Carlo Giansante<sup>{1}</sup>, Lorenzo Colace<sup>{2}</sup>*  
*<sup>{1}</sup>CNR-NANOTEC, Italy; <sup>{2}</sup>University Roma Tre, Italy*

**D1L-01-3**

11:30

**Fiber Optic Biosensor Based on Long Period Grating for the Detection of Vitamin D**

*Flavio Esposito<sup>{3}</sup>, Lucia Sansone<sup>{1}</sup>, Anubhav Srivastava<sup>{3}</sup>, Angela Maria Cusano<sup>{2}</sup>, Stefania Campopiano<sup>{3}</sup>, Michele Giordano<sup>{1}</sup>, Agostino Iadicicco<sup>{3}</sup>*  
*<sup>{1}</sup>National Research Council of Italy, Italy; <sup>{2}</sup>Regional Centre on Information Communication Technology-CeRICT, Italy; <sup>{3}</sup>University of Naples Parthenope, Italy*

**D1L-01-4**

11:45

**Chemical Identifier for Particulate Matter Monitoring in Construction Sites**

*Javier Nuñez, Robin Koldeweij, Joe Trimoli, Arjen Boersma*  
TNO Netherlands Organisation for Applied Scientific Research, Netherlands

**D1L-01-5**

12:00

**Period Grating Fibers for Potential Refractive Index Sensing**

*Mengchuan Xing<sup>{2}</sup>, Frederic Surre<sup>{2}</sup>, James Sharp<sup>{2}</sup>, Han Cheng Seat<sup>{1}</sup>*  
*<sup>{1}</sup>Université de Toulouse, France; <sup>{2}</sup>University of Glasgow, United Kingdom*

11:00 – 12:30 UTC

**D1L-02: CHEMICAL, ELECTROCHEMICAL & GAS SENSORS IV**

**SESSION CHAIRS:** Preethi Preethichandra, Central Queensland University & Marios Sophocleous, University of Cyprus

**D1L-02-1**

11:00

**A Single-Chip Dual-Transduction Gas Sensor for BTX Detection**

*Xueyou Sun, Ye Chang, Hemi Qu, Wei Pang, Xuexin Duan*  
State Key Laboratory of Precision Measuring Technology and Instruments, Tianjin University, China

**D1L-02-2**

**11:15**

**A 3D MoS<sub>2</sub>/Carbon Nanofiber Network for Room Temperature Methane Sensing**

*Chengcheng Xu, Xiaosong Du, Jingjing Yang, Yin Long, Yang Wang*

*University of Electronic Science and Technology of China, China*

**D1L-02-3**

**11:30**

**A Model to Predict Mass Spectrum from Odor Impression Using Deep Neural Network**

*Daisuke Hasebe, Takamichi Nakamoto*

*Tokyo Institute of Technology, Japan*

**D1L-02-4**

**11:45**

**An Ultrasensitive Fluorescent Paper Based Acidic Gas Sensing Platform**

*Sachin Kadian<sup>{1}</sup>, Narendra Chaulagain<sup>{2}</sup>, Harshitha Rajashekhar<sup>{2}</sup>, Damini Vrushabendrakumar<sup>{2}</sup>, Gaurav Manik<sup>{1}</sup>, Karthik Shankar<sup>{2}</sup>*

*<sup>{1}</sup>Indian Institute of Technology Roorkee, India; <sup>{2}</sup>University of Alberta, Canada*

**D1L-02-5**

**12:00**

**Influence of Lanthanum Oxycarbonate Deposition on Carbon Dioxide Detection**

*Fabien Le Pennec, Ludovic Le Roy, Carine Perrin-Pellegrino, Marc Bendahan, Sandrine Bernardini*

*Aix Marseille Université, Université de Toulon, CNRS, IM2NP, AMUtech Institute, France*

**D1L-02-6**

**12:15**

**Discrimination of VOCs Along with Concentration Change Detection Applying a Combination of DWT and Machine Learning Tools**

*Snehanjan Acharyya, Sudip Nag, Prasanta Guha*

*Indian Institute of Technology Kharagpur, India*

**11:00 – 12:30 UTC**

**D1L-03: TEMPERATURE SENSORS & OTHERS**

**SESSION CHAIRS: Kuniyoshi Tashiro, Shinshu University & Giacomo Langfelder, Politecnico di Milano**

**D1L-03-1**

**11:00**

**SAW-RFID Temperature and Strain Sensors on Metallic Substrates**

*Prince Mengue<sup>{1}</sup>, Baptiste Paulmier<sup>{1}</sup>, Sami Hage-Ali<sup>{1}</sup>, Cécile Floer<sup>{1}</sup>, Hamid M'jahed<sup>{1}</sup>, Alexander Shvetsov<sup>{2}</sup>, Sergei Zhgoon<sup>{2}</sup>, Omar Elmazria<sup>{1}</sup>*

*<sup>{1}</sup>Jean Lamour Institute, Université de Lorraine, CNRS, France; <sup>{2}</sup>National Research University Moscow Power Engineering Institute, Russia*

**D1L-03-2**

**11:15**

**Characterization of Induced Pluripotent Stem Cells Using a Pyroelectric Sensor**

*Salvatore Andrea Pullano, Marta Greco, Stefania Scalise, Elvira I. Parrotta, Valeria Lucchino, Gianni Cuda, Antonino S. Fiorillo*

*Magna Graecia University of Catanzaro, Italy*

**D1L-03-3**

**11:30**

**Dynamic Thermoregulatory Photonic Crystal Fabric for Personal Thermal Management**

*Mohamed Boutghatin, Yan Pennec, Salim Alhaji-Assaf, Michèle Carette, Vincent Thomy, Abdellatif Akjouj, Bahram Djafari-Rouhani  
IEMN, Université de Lille, France*

**D1L-03-4**

**11:45**

**Rapid Fabrication of High-Responsivity Photodetectors Utilizing AlGaIn/GaN on Sapphire**

*Hong-Quan Nguyen, Abu Riduan Md Foisal, Thanh Nguyen, Hung Nguyen, Trung Hieu Vu, Jarred Fastier-Wooler, Sadegh Aberoumand, Van Thanh Dau, Hoang-Phuong Phan, Dzung Viet Dao  
Griffith University, Australia*

**D1L-03-5**

**12:00**

**Linear Organic Transistor Based Temperature Sensor Between 230 and 330 K**

*Rosalba Liguori, Luigi Di Benedetto, Gian Domenico Licciardo  
Università degli Studi di Salerno, Italy*

**D1L-03-6**

**12:15**

**Improving MOSFET Piezoresistive Strain Gauges Limit of Detection Using Lock-In Principle**

*Thibault P. Delhay, Nicolas Roisin, Nicolas André, Laurent A. Francis, Denis Flandre  
Université catholique de Louvain, Belgium*

**11:00 – 12:30 UTC**

**D1L-04: SENSOR SYSTEMS III**

**SESSION CHAIRS: Michael Daniele, NC State University & Bobby George, IIT-Madras**

**D1L-04-1**

**11:00**

**Amplitude Recovery of Saturated Sinusoidal Signals**

*Ravi Abhishek Shankar, Mohit Singh, Byunghoo Jung  
Purdue University, United States*

**D1L-04-2**

**11:15**

**S2L-SLAM: Sensor Fusion Driven SLAM Using Sonar, LiDAR and Deep Neural Networks**

*Niels Balemans<sup>{2}</sup>, Peter Hellinckx<sup>{3}</sup>, Steven Latré<sup>{3}</sup>, Philippe Reiter<sup>{3}</sup>, Jan Steckel<sup>{1}</sup>  
<sup>{1}</sup>CoSys-Lab, University of Antwerp, Belgium; <sup>{2}</sup>IDLab, CoSys-Lab, University of Antwerp, Belgium;  
<sup>{3}</sup>IDLab, University of Antwerp, Belgium*

**D1L-04-3**

**11:30**

**Design and Implementation of a Mobile Urban Low-Cost Environmental Sensor Network**

*Alex Cabral<sup>{1}</sup>, Asta Roseway<sup>{2}</sup>, Paul Johns<sup>{2}</sup>  
<sup>{1}</sup>Harvard University, United States; <sup>{2}</sup>Microsoft Research, United States*

**D1L-04-4**

**11:45**

**A Wireless, Multi-Channel Printed Capacitive Strain Gauge System for Structural Health Monitoring**

*Kshama Lakshmi Ranganatha{1}, Kaelee Novich{1}, Timothy Phero{1}, Kiyo Fujimoto{1}, Doug Litteken{2}, David Estrada{1}, Brian Jaques{1}, Benjamin Johnson{1}*

*{1}Boise State University, United States; {2}National Aeronautics and Space Administration, United States*

**D1L-04-5**

**12:00**

**Motor-Imagery EEGNet-Based Processing on a Low-Spec SoC Hardware**

*Ana Caren Hernandez-Ruiz, Daniel Enériz, Nicolas Medrano, Belen Calvo*  
*University of Zaragoza, Spain*

**11:00 – 12:30 UTC**

**D1L-05: EMERGING SENSOR APPLICATIONS II**

**SESSION CHAIRS: Azadeh Hashemi & Volker Nock, University of Canterbury**

**D1L-05-1**

**11:00**

**Long-Lasting Leaf Water Stress Detector Based on an Infrared Micromechanical Photoswitch and a Solar Powered Sunlight Digitizer**

*Antea Risso, Vageeswar Rajaram, Matilde Maria Pavese, Sungho Kang, Sila Deniz Calisgan, Zhenyun Qian, Matteo Rinaldi*

*Northeastern University, United States*

**D1L-05-2**

**11:15**

**Design of a Novel Biosensor Implant for Farmed Atlantic Salmon (*Salmo Salar*)**

*Eirik Svendsen, Martin Føre, Lise Lyngsnes Randeberg, Jo Arve Alfredsen*  
*Norwegian University of Science and Technology, Norway*

**D1L-05-3**

**11:30**

**Polarization Image Sensor-Based Laser Scanner for Reflective Metals: Architecture and Implementation**

*Jaime Marco-Rider, Lars Tingelstad, Olav Egeland*  
*Norwegian University of Science and Technology, Norway*

**D1L-05-4**

**11:45**

**Map-Aided Fusion of IMU PDR and RSSI Fingerprinting for Improved Indoor Positioning**

*Md Abdulla Al Mamun, Mehmet Rasit Yuce*  
*Monash University, Australia*

**D1L-05-5**

**12:00**

**Pseudo-Passive Indoor ToF Sensing Exploiting Visible Light Communication Sources**

*Faisal Ahmed, Miguel Heredia Conde, Otmar Loffeld*  
*ZEISS, Universität Siegen, Germany*

**D1L-05-6**

**12:15**

**Real-Time Dosimetry of Ultrahigh Dose-Rate X-Ray Beams Using Scintillation Detectors**

*Shahirah Shaharuddin<sup>{1}</sup>, Alexander Hart<sup>{2}</sup>, Daniel Cecchi<sup>{2}</sup>, Magdalena Bazalova-Carter<sup>{2}</sup>, Mark Foley<sup>{1}</sup>*

*<sup>{1}</sup>National University of Ireland Galway, Ireland; <sup>{2}</sup>University of Victoria, Canada*

**11:00 – 12:30 UTC**

**D1L-06: SENSOR DATA PROCESSING II (Navigation & Positioning)**

**SESSION CHAIRS: Ashish Pandharipande, Signify & Valérie Renaudin, Université Gustav Eiffel**

**D1L-06-1**

**11:00**

**Fusion from Multimodal Gait Spatiotemporal Data for Human Gait Speed Classifications**

*Abdullah Alharthi, Krikor Ozanyan*

*University of Manchester, United Kingdom*

**D1L-06-2**

**11:15**

**Lightweight Online Semi-Supervised Learning Algorithm for Ultrasonic Gesture Recognition**

*Pixi Kang, Xiangyu Li*

*Tsinghua University, China*

**D1L-06-3**

**11:30**

**Calibration-Free Target Detection Based on Thermal and Distance Sensor Fusion**

*Sanaz Kianoush<sup>{2}</sup>, Stefano Savazzi<sup>{3}</sup>, Vittorio Rampa<sup>{3}</sup>, Leonardo Costa<sup>{1}</sup>, Denis Tolochenko<sup>{1}</sup>*

*<sup>{1}</sup>Cognimade s.r.l, Italy; <sup>{2}</sup>IEIT CNR, Italy; <sup>{3}</sup>IEIT-CNR, Italy*

**D1L-06-4**

**11:45**

**Effective Very-Wide-Area 3D ToF Sensing**

*Alvaro Lopez Paredes<sup>{1}</sup>, Miguel Heredia Conde<sup>{2}</sup>, Otmar Loffeld<sup>{2}</sup>*

*<sup>{1}</sup>Universität Siegen, Germany; <sup>{2}</sup>ZESS, Universität Siegen, Germany*

**D1L-06-5**

**12:00**

**DeepTracks: Geopositioning Maritime Vehicles in Video Acquired from a Moving Platform**

*Jianli Wei, Guanyu Xu, Alper Yilmaz*

*Ohio State University, United States*

**D1L-06-6**

**12:15**

**Self-Supervised Underwater Source Localization Based on Contrastive Predictive Coding**

*Xiaoyu Zhu, Hefeng Dong, Pierluigi Salvo Rossi, Martin Landrø*

*Norwegian University of Science and Technology, Norway*

14:00 – 15:00 UTC

**D2P-10: SENSOR SYSTEMS VII**

**SESSION CHAIR:** Vincenzo Romano Marrazzo, University of Naples Federico II

**D2P-10-1**

**Compressive Detection for Camera Array Images**

*Rui Ma, Guangyao Ding, Qi Hao*

*Southern University of Science and Technology, China*

**D2P-10-2**

**External Load-Based Sensing of Electrical Current Degradation in Industrial Robots**

*Vinh Nguyen, Jeremy Marvel*

*National Institute of Standards and Technology, United States*

**D2P-10-3**

**Adding Object Manipulation Capabilities to Social Robots by Using 3D and RGB Cameras Data**

*Giovanni Mezzina, Daniela De Venuto*

*Politecnico di Bari, Italy*

**D2P-10-4**

**Research on Online Non-Intrusive Load Identification System Based on Multi-Threaded CUSUM-MLP algorithm**

*Hang Zhao<sup>{1}</sup>, Guangfen Wei<sup>{1}</sup>, Chunhua Hu<sup>{2}</sup>, Qian Liu<sup>{2}</sup>*

*<sup>{1}</sup>Shandong Technology and Business University, China; <sup>{2}</sup>Yantai Dongfang Wisdom Electric CO., LTD., China*

**D2P-10-5**

**Fiber Optic Monitoring System Ready for 4-20mA Industrial Control Standard**

*Vincenzo Romano Marrazzo<sup>{2}</sup>, Francesco Fienga<sup>{2}</sup>, Dario Laezza<sup>{2}</sup>, Michele Riccio<sup>{2}</sup>, Andrea Irace<sup>{2}</sup>, Salvatore Buontempo<sup>{1}</sup>, Giovanni Breglio<sup>{2}</sup>*

*<sup>{1}</sup>Istituto Nazionale di Fisica Nucleare, Italy; <sup>{2}</sup>Università degli Studi di Napoli Federico II, Italy*

**D2P-10-6**

**Radiographic Inspection of Submerged Arc Welding Using Semantic Segmentation**

*Yi Zhao, Shiyi Liu, Xiaohui Li*

*Chang'an University, China*

14:00 – 15:00 UTC

**D2P-11: PHYSICAL SENSORS & APPLICATIONS**

**SESSION CHAIR:** Valentina Zega, Politecnico di Milano

**D2P-11-1**

**Compact Pitot-Static-Tube-Based Waterflow Sensor for Biologging of Marine Animals**

*Takuto Kishimoto<sup>{1}</sup>, Ryosuke Saito<sup>{2}</sup>, Hiroto Tanaka<sup>{2}</sup>, Hidetoshi Takahashi<sup>{1}</sup>*

*<sup>{1}</sup>Keio University, Japan; <sup>{2}</sup>Tokyo Institute of Technology, Japan*

**D2P-11-2**

**DC Electric Field Sensor Based on Polyimide Substrate**

*Tao Chen, Brandon Hill, Sadna Isik, Cyrus Shafai, Lot Shafai*

*University of Manitoba, Canada*



**D2P-11-3**

**Simulink Model for an External Safety Mechanism in Inductive Position Sensors**

*Gentjan Qama{2}, Josef Janisch{1}, Juergen Kernhof{1}, Angel Karachomakov{1}  
{1}Renesas Electronics Corporation, Germany; {1}Renesas Electronics Corporation, Bulgaria;  
{1}Renesas Electronics Corporation, Austria; {2}Renesas Electronics Corporation/Renesas Electronics  
Europe GmbH, Germany*

**D2P-11-4**

**Identification and Compensation of Anisodamping for High Q Factor Resonator Under Whole-Angle Mode**

*Jiangkun Sun, Yongmeng Zhang, Sheng Yu, Qingsong Li, Xiang Xi, Xuezhong Wu, Dingbang Xiao  
National University of Defense Technology, China*

**D2P-11-5**

**A Sub-0.1°/H Bias-Instability MEMS Gyroscope Using Resonant Constant-Frequency Driving Technique**

*Haibin Wu, Xudong Zheng, Yaojie Shen, Xuotong Wang, Zhonghe Jin, Zhipeng Ma  
Zhejiang University, China*

**D2P-11-6**

**Self-Oscillating DC Current Transformer with Nanocrystalline Core**

*Václav Grim, Pavel Ripka  
Czech Technical University in Prague, Czech Rep.*

**D2P-11-7**

**Sensor for Bilateral Human Bite Force Measurements**

*Sven Suppelt{2}, Romol Chadda{2}, Niklas Schäfer{2}, Robert Sader{1}, Mario Kupnik{2}  
{1}Goethe University Frankfurt, Germany; {2}Technische Universität Darmstadt, Germany*

**D2P-11-8**

**Sensitivity Enhancement of MEMS Tactile Sensor by Redesign of Microcantilever and Strain Gauge**

*Ren Kaneta, Takumi Hasegawa, Takashi Abe, Masayuki Sohawa  
Niigata University, Japan*

**D2P-11-9**

**Electrostatic-Capacitive MEMS Stiffness Sensor with Position-Feedback Mechanism**

*Alessandro Nastro, Marco Ferrari, Vittorio Ferrari  
Università degli Studi di Brescia, Italy*

**D2P-11-10**

**Race-Track Fluxgate Sensor Scaling Versus Noise**

*Vojtech Petrucha, Mattia Butta  
Czech Technical University in Prague, Czech Rep.*

**D2P-11-11**

**Towards the Development of Soft Force and Pressure Sensors for Robot Safety Applications**

*Jennifer Case{1}, Nagarajan Rangarajan{2}, Joseph Falco{1}, Kenneth Kimble{1}  
{1}National Institute of Standards and Technology, United States; {2}National Institutes of Health, United  
States*

THURSDAY, NOVEMBER 4

14:00 – 15:00 UTC

D2P-12: OPTICAL SENSORS IV

SESSION CHAIR: Minghong Yang, Wuhan University of Technology

**D2P-12-1**

**Optical Fiber Multipoint Light Measurement System for the Investigation of Plant Cultivation Light Environment**

*Takumi Kondo{2}, Tadao Matsunaga{2}, Ei Endo{1}, Koutoku Ohmi{2}, Sang-Seok Lee{2}{1}Tottori Horticultural Experiment Station, Japan; {2}Tottori University, Japan*

**D2P-12-2**

**Synthesis of Fluorescent Nitrogen-Doped Carbon Spheres from Corncob Residue for the Detection of Fe (III) in Aqueous Solutions**

*Lindokuhle Magagula{3}, Nosipho Moloto{3}, Siziwe Gqoba{3}, Patricia Kooyman{1}, Tshwafo Motaung{2}, Ella Linganiso{3}{1}University of Cape Town, South Africa; {2}University of South Africa, South Africa; {3}University of the Witwatersrand, South Africa*

**D2P-12-3**

**CuFeSe<sub>2</sub> Quantum-Dot Based Infrared Photodetectors with Functionality in the Ambient**

*Tanuj Kumar, Anumol Sugathan, Krishnamachari Narasimhan, Anshu Pandey, Sushobhan Avasthi Indian Institute of Science, India*

**D2P-12-4**

**Vertical Coupling Into a Photonic Crystal Waveguide Using Band Folding Design**

*Reyhaneh Jannesari{2}, Florian Dubois{3}, Gerald Pühringer{2}, Gerald Stocker{1}, Andreas Tortschanoff{3}, Thomas Grille{1}, Bernhard Jakoby{2}{1}Infineon Technologies Austria AG, Austria; {2}Institute for Microelectronics and Microsensors, Johannes Kepler Universität Linz, Austria; {3}Silicon Austria Labs GmbH, Austria*

**D2P-12-5**

**Feasibility Study of Multi-Wavelength Optical Probe to Analyze Magnesium Implant Degradation Effects**

*Hafiz Wajahat Hassan, Anna Mathew, Haroon Khan, Olga Korostynska, Peyman Mirtaheri Oslo Metropolitan University, Norway*

**D2P-12-6**

**Research on a Miniature Optical Force Accelerometer**

*Junji Pu, Kai Zeng, Yulie Wu, Dingbang Xiao National University of Defense Technology, China*

**D2P-12-7**

**Optimization of Suspended Ladder BG Silicon Sensors for High Wavelength or Amplitude Sensitivity**

*Siim Heinsalu, Yuichi Matsushima, Hiroshi Ishikawa, Katsuyuki Utaka Waseda University, Japan*

14:00 – 15:00 UTC

**D2P-13: MICROFLUIDICS & BIOSENSORS III**

**SESSION CHAIRS:** Chirasree RoyChaudhuri, IEST & Loes Segerink, University of Twente/BIOS

**D2P-13-1**

**Single-Probe Heat-Pulse Microsensor for Water Transportation Measurement in Plant Shoots**

*Fumiya Ino, Wataru Kameda, Kyohei Terao, Hidekuni Takao, Fusao Shimokawa  
Kagawa University, Japan*

**D2P-13-2**

**A New Foundry-Based Open-Gate Junction Field-Effect Transistor (OG-JFET) as Electronic Sensing Platform (ESP) for Life Science Applications**

*Abbas Panahi{2}, Hamed Osouli Tabrizi{2}, Priyadarshini Mangannavar{1}, Oleg Chebotarev{1}, Andrew Fung{1}, Ebrahim Ghafar-Zadeh{2}  
{1}CMC Microsystems, Canada; {2}York University, Canada*

**D2P-13-3**

**Low-Cost Color Sensor for Automating Analytical Chemistry Processes**

*Shreya Malkurthi, Kirthi Vignan Reddy Yellakonda, Anushka Tiwari, Aftab Hussain  
International Institute of Information Technology, Hyderabad, India*

**D2P-13-4**

**A Wireless Passive Capacitively Coupled Contactless Conductivity Detection (WPC4D) for Microfluidic Flow Monitoring**

*Bao-Anh Hoang{2}, Hang Tran Thanh{4}, Ha Nguyen Thi Ngoc{3}, Thao Pham Ngoc{4}, Kien Do Trung{4}, Ngoc-Thanh Le{5}, Tran-Thuy Nguyen{1}, Trinh Chu Duc{4}, Tung Thanh Bui{4}, Loc Do Quang{4}  
{1}E Hospital, Vietnam; {2}University of Engineering and Technology, Vietnam National University, Vietnam; {3}Vietnam Academy of Science and Technology, Vietnam; {4}Vietnam National University, Vietnam; {5}Vietnam National University and E Hospital, Vietn*

**D2P-13-5**

**Acoustic Particle Manipulation Along Three Orthogonal Directions in Laser Engraved Microfluidic Channels**

*Andreas Fuchsluger{2}, Marcus Andreas Hintermüller{2}, Rafael Ecker{2}, Norbert Cselyuszk{3}, Mohssen Moridi{3}, Bernhard Jakoby{1}  
{1}Institute for Microelectronics and Microsensors, Johannes Kepler Universität Linz, Austria; {2}Johannes Kepler Universität Linz, Austria; {3}Silicon Austria Labs GmbH, Austria*

**D2P-13-6**

**Rapid MicroRNA Detection Using Paper-Based Isothermal Amplification**

*Jingjing Qian, Qinming Zhang, Joyce C. Lai, Yixuan Wang, Meng Lu  
Iowa State University, United States*

**14:00 – 15:00 UTC**

**D2P-14: EMERGING WEARABLE SENSORS & SYSTEMS III**

**SESSION CHAIRS:** Mohamed Irfan Mohamed Refai, University of Twente & Hung Cao, University of California Irvine

**D2P-14-1**

**A Wearable Human-Machine Interface Based on Triboelectric Sensors Technology**

*Chunkai Qiu, Fan Wu, Mehmet Rasit Yuce*

*Monash University, Australia*

**D2P-14-2**

**Effect of Stitch Pattern on the Electrical Properties of Wale-Wise Knitted Strain Sensors and Interconnects**

*Pei Zhi Chia, Ujjaval Gupta, Ying Yi Tan, Jun Liang Lau, Alvee Ahmed, Gim Song Soh, Hong Yee Low*  
*Singapore University of Technology and Design, Singapore*

**D2P-14-3**

**Design and Fabrication of Paper-Based Stretchable Sensor for Respiration Monitoring**

*Nishith Shagle<sup>{2}</sup>, Thanh Nguyen<sup>{2}</sup>, Trung Hieu Vu<sup>{1}</sup>, Hung Nguyen<sup>{1}</sup>, Hoang-Phuong Phan<sup>{1}</sup>, Van Thanh Dau<sup>{1}</sup>, Pingan Song<sup>{2}</sup>, Hao Wang<sup>{2}</sup>, Nam-Trung Nguyen<sup>{1}</sup>, Dzung Viet Dao<sup>{1}</sup>, Toan Dinh<sup>{2}</sup>,  
<sup>{1}</sup>Griffith University, Australia; <sup>{2}</sup>University of Southern Queensland, Australia*

**D2P-14-4**

**Development of Hysteresis-Free and Linear Knitted Strain Sensors for Smart Textile Applications**

*Beyza Bozali, Joris van Dam, Linda Plaude, Kaspar Jansen*

*Delft University of Technology, Netherlands*

**D2P-14-5**

**Self-Powered Wireless UV Sensor with Intervals of Wireless Transmission**

*Shunta Furumura<sup>{2}</sup>, Yasuhiro Hiraga<sup>{2}</sup>, Fumiyasu Utsunomiya<sup>{1}</sup>, Minoru Sudo<sup>{1}</sup>, Ami Tanaka<sup>{2}</sup>,  
Takakuni Douseki<sup>{2}</sup>*

*<sup>{1}</sup>ABLIC Inc., Japan; <sup>{2}</sup>Ritsumeikan University, Japan*

**D2P-14-6**

**Leaf-FIT: A Wearable Leaf Sensor for In-Situ and Real-Time Monitoring of Plant Phytohormones**

*Nafize Hossain, Tanzila Noushin, Shawana Tabassum*

*University of Texas at Tyler, United States*

**D2P-14-7**

**IoT-Based Reconfigurable Micropump for Drug Delivery Applications**

*Youssef Kotb<sup>{1}</sup>, Mariam Hegazy<sup>{1}</sup>, Kareem Abdelrahman<sup>{1}</sup>, Zahwa Nour<sup>{1}</sup>, Mohammed Al-Jebzi<sup>{1}</sup>,  
Omar Ibrahim<sup>{1}</sup>, Ahmed Gouda<sup>{3}</sup>, Mona Abdel-Mottaleb<sup>{2}</sup>, Mohamed Serry<sup>{2}</sup>*

*<sup>{1}</sup> American University in Cairo, Egypt; <sup>{2}</sup> Ain Shams University, Egypt; <sup>{3}</sup> Nawah Scientific, Egypt*

**D2P-14-8**

**Wearable Skin Vapor Sensing System for Continuous Monitoring of Various Health and Lifestyles**

*Bongmook Lee, Michael Lim, Veena Misra*

*North Carolina State University, United States*

**D2P-14-9**

**A Low-Power 54 $\mu$ W Adaptive Analog Front-End with Adaptive Intensity Control for an Organic PPG Sensor in Wearable Devices**

*Rajeev Kumar Pandey{1}, Paul C.-P. Chao{2}*

*{1}National Chiao Tung University, Taiwan; {2}National Yang Ming Chiao Tung University, Taiwan*

**D2P-14-10**

**Highly Sensitive Cone-Structured Porous Pressure Sensors for Respiration Monitoring Applications**

*Masoud Panahi, Simin Masihi, Anthony Hanson, Dinesh Maddipatla, Xingzhe Zhang, Valliammai Palaniappan, Binu Baby Narakathu, Bradley Bazuin, Massood Atashbar*

*Western Michigan University, United States*

**D2P-14-11**

**Noncontact Electrophysiology Monitoring Systems for Assessment of Canine-Human Interactions**

*Parvez Ahmmed{2}, Timothy Holder{2}, Marc Foster{2}, Ivan D Castro{1}, Aakash Patel{1}, Tom Torfs{1}, Alper Bozkurt{2}*

*{1}IMEC, Belgium; {2}North Carolina State University, United States*

**14:00 – 15:00 UTC**

**D2P-15: SENSORS IN INDUSTRIAL PRACTICES**

**SESSION CHAIR: James Brusey, Coventry University**

**D2P-15-1**

**Multi-Source Data Fusion Method Based on Nearest Neighbor Plot and Track Data Association**

*Shulian Zhao{1}, Yi Huang{2}, Ke Wang{2}, Tao Chen{1}*

*{1}China Automotive Engineering Research Institute Company, China; {2}Chongqing University, China*