

# **2025 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL 2025)**

**Lindau, Germany  
4-7 May 2025**



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## TECHNICAL PROGRAM: MAY 4, 2025

*\*All times appear in Central European Summer Time (CEST) UTC+2)*

8:00 – 9:00

**Registration**

**Room:** Foyer

9:00 – 10:45

**Tutorial: From Precision to Insight: The Synergy of Inertial Sensors and Advanced Algorithms**

Jussi Collin, Nordic Inertial Oy, Finland

**Room:** Salon Baden

**Session Chair:** Erdinc Tatar, *Bilkent University, Turkey*

10:45 – 11:15

**Coffee Break**

**Room:** Lakeside Terrace

11:15 – 13:00

**MEMS Accelerometer Technology Review: Progress towards Navigation-grade**

John Reinke, Honeywell, USA

**Room:** Salon Baden

**Session Chair:** Erdinc Tatar, *Bilkent University, Turkey*

13:00 – 14:30

**Lunch Break**

**Room:** Restaurant "Seeblick"

14:30 – 16:15

**Tutorial: Quantum Technologies for Classical Navigators**

Tim Freegarde, University of Southampton, UK

**Room:** Salon Baden

**Session Chair:** Erdinc Tatar, *Bilkent University, Turkey*

18:00 – 20:00

**Ideal Aerosmith Welcome Reception**

**Room:** Lakeside Terrace

*\*Open to everyone*

## TECHNICAL PROGRAM: MAY 5, 2025

*\*All times appear in Central European Summer Time (CEST) UTC+2)*

7:30 – 8:30

**Registration**

**Room:** Foyer

8:30 – 9:00

**Opening Remarks**

**Room:** Salon Baden/Württemberg

9:00 – 9:45

**Keynote: Quantum sensors and their application**

Joerg Wrachtrup, University of Stuttgart, Germany

**Room:** Salon Baden/Württemberg

**Session Chair:** Andrei M. Shkel, *University of California, Irvine, USA, IEEE TCSS Chair*

9:45 – 10:15

**Exhibitors Lightning Round 1**

**Room:** Salon Baden/Württemberg

10:15 – 10:45

**Coffee Break & Exhibits**

**Room:** Hotel Halle/Salon Belle Epoque

10:45 – 12:05

**Calibration & Compensation of MEMS Inertial Sensors**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Caroline Coutier, *CEA Leti* & Marius Gheorghe, *Ideal Aerosmith*

10:45

**3019: One-Port Quality Factor Measurement of High-Q MEMS Gyroscope Utilizing Negative Impedance Converter...1**

Yang Zhao, Guoming Xia, Meijia Xu, Jinyang Huang, Qin Shi, Anping Qiu

*Nanjing University of Science and Technology, China*

11:05

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Maxime Duquesnoy, Amandine Andrieux-Ledier, Raphaël Lévy, Jérémy Bonhomme, Lucas Hudeley, Pierre Lavenus, Jean Guérard, Olivier Le Traon

*Office National d'Études et de Recherches Aéronautiques ONERA, France*

11:25

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Mehran Hosseini-Pishrobat, Erdinc Tatar

*Bilkent University, Turkey*

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Charles Duruaku{2}, Zayed Ahmed{2}, Erfan Ghaderi{2}, Abdul Qader Ahsan Qureshi{1}, Behraad Bahreyni{2}

*{1}CMC Microsystems, Canada; {2}Simon Fraser University, Canada*

12:05 – 12:35

**Posters 1 Lightning Round**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Brian Grantham, *University of Alabama in Huntsville* & Roman Forke, *Fraunhofer Institute for Electronic Nano Systems ENAS*

12:35 – 14:05

**Lunch Break**

**Room:** Restaurant "Seeblick"

## TECHNICAL PROGRAM: MAY 5, 2025

14:05 – 14:35

### Exhibitors Lightning Round 2

Room: Salon Baden/Württemberg

14:35 – 15:55

### MEMS Accelerometers & Gravimeters

Room: Salon Baden/Württemberg

Session Chairs: Tobias Hiller, *Bosch Sensortec* & Toshiyuki Tsuchiya, *Kyoto University*

14:35

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Matthew Reed<sup>{1}</sup>, Francis Neill<sup>{1}</sup>, Colin Baker<sup>{2}</sup>

<sup>{1}</sup>*Silicon Microgravity, United Kingdom*; <sup>{2}</sup>*Silicon Microgravity Limited, United Kingdom*

14:55

#### 3052: State-Space Control of Force-Feedback MEMS Accelerometers with 115-dB Dynamic Range...20

Alessandro Ticozzi<sup>{2}</sup>, Matteo Gianollo<sup>{1}</sup>, Marco Bestetti<sup>{1}</sup>, Marco Gadola<sup>{1}</sup>, Giacomo Langfelder<sup>{2}</sup>

<sup>{1}</sup>*Civitanavi Systems, Italy*; <sup>{2}</sup>*Politecnico di Milano, Italy*

15:15

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<sup>{1}</sup>*Bosch Sensortec GmbH, Germany*; <sup>{2}</sup>*Robert Bosch GmbH, Germany*

15:35

#### 3103: Frequency Noise Optimization by Operating a Vibrating Beam Accelerometer in the non-Linear Regime...N/A

Theo Miani, Guillermo Sobreviela, Lokesh Gurung, Colin Baker, Aswhin Seshia

*Silicon Microgravity Limited, United Kingdom*

15:55 – 16:25

### Coffee Break, Exhibits, & Poster Session 1

Room: Hotel Halle/Salon Belle Epoque

15:55 – 17:30

### Poster Session 1

Room: Hotel Halle/Salon Belle Epoque

Session Chairs: Brian Grantham, *University of Alabama in Huntsville* & Roman Forke, *Fraunhofer Institute for Electronic Nano Systems ENAS*

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*Tsinghua University, China*

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Ferdinand Auerswald<sup>{1}</sup>, Dmytro Pukhkaiev<sup>{2}</sup>, Uwe Aßmann<sup>{2}</sup>

<sup>{1}</sup>*Bosch Sensortec GmbH, Germany*; <sup>{2}</sup>*Technische Universität Dresden, Germany*

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Zhanqiang Hou, Gao Liu, Mi Zeng, Xi Chen, Dingbang Xiao, Xuezhong Wu

*National University of Defense Technology, China*

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<sup>{1}</sup>*Aerospace Information Research Institute, CAS / University of Chinese Academy of Sciences, China*; <sup>{2}</sup>*Aerospace Information Research Institute, Chinese Academy of Sciences, China*

## TECHNICAL PROGRAM: MAY 5, 2025

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Shihao Du{1}, Tianqi Guo{2}, Jianlin Chen{2}, Fang Chen{1}

{1}Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China; {2}Shanghai University, China

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Sandia National Laboratories, United States

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{1}Fraunhofer Institute for Electronic Nano Systems ENAS, Germany; {2}Fraunhofer Institute for Electronic Nano Systems ENAS / Chemnitz University of Technology, Germany; {3}Technische Universität Chemnitz, Germany

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Jing Liu, Jürgen Gut

Bosch Sensortec GmbH, Germany

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Tsinghua University, China

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Xingyin Xiong{2}, Zongwei Li{2}, Zeyu Wang{1}, Xiaoyuan Yu{1}, Shengru Zhou{2}, Kedu Han{2}, Changchun Yang{2}

{1}Institute of Geology and Geophysics, CAS, University of Chinese Academy of Sciences, China; {2}Institute of Geology and Geophysics, Chinese Academy of Sciences, China

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Haesung Yu, Inseop Lee, Juhyun Oh, Chang-Ky Sung, Taegyoo Lee, Cheonjoong Kim

Agency for Defense Development, Korea

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Mark Kantor{1}, Nicola Molinazzi{1}, Tsvi Shmilovich{1}, Slava Krylov{2}

{1}EZMEMS, Israel; {2}Tel Aviv University, Israel

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Alexandra Zobova, Maxim Drizovsky, Omer Halevy, Neta Melech, Shmuel Livne, Slava Krylov

Tel Aviv University, Israel

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Zhejiang University, China

17:30 – 18:30

**Industry appreciation event and open posters**

**Room:** Hotel Halle/Salon Belle Epoque

## TECHNICAL PROGRAM: MAY 6, 2025

7:30 – 8:30

**Registration**

**Room:** Foyer

8:30 – 9:15

**Keynote: Ingenuity Mars Helicopter: Navigating the Martian Skies**

Håvard F. Grip, *Jet Propulsion Laboratory, California Institute of Technology*

**Room:** Salon Baden/Württemberg

**Session Chair:** Joan Giner, *Bosch Sensortec, Germany*

9:15 – 9:45

**Posters 2 Lightning Round**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Ohad Zohar, *RFE PTE LTD, Singapore* & Joerg Wagner, *University of Stuttgart, Germany*

9:45 – 10:35

**Applications of Inertial Sensors**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Anssi Blomqvist, *Murata* & Ryuta Araki, *Sumitomo Precision*

9:45

**3108: Continuous Physiological Monitoring Using Mechano-Acoustic Sensing for Chronic Disease Management (INVITED)...N/A**

Tzeno Galchev

*Analog Devices Inc.*

10:15

**3105: Lightweight Wearable Headband with Flexible-Hybrid Electronics for Head-Kinematic Monitoring and Mild Traumatic Brain Injury Risk Detection...N/A**

Jeneel Pravin Kachhadiya{3}, Jaden Romero{2}, Shuting Kou{2}, Yang Wan{1}, Haneesh Kesari{1}, Ron Szalkowski{2}, Joseph Andrews{3}

{1}Brown University, United States; {2}Team Wendy, United States; {3}University of Wisconsin-Madison, United States

10:35 – 11:05

**Coffee Break & Exhibits**

**Room:** Hotel Halle/Salon Belle Epoque

11:05 – 11:25

**Announcement from Sensors Council**

**Room:** Salon Baden/Württemberg

11:25 – 13:05

**IMUs, INs & Components for Inertial Navigation**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Cristiano Marra, *iNGage* & Aleksandra Efimovskaya, *Microsoft*

11:25

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*Analog Devices, United States*

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*Sony Corporation, Japan*

## TECHNICAL PROGRAM: MAY 6, 2025

12:05

**3080: Synergistic Design of Resonant Elements and Force Multipliers to Boost the Sensitivity in Resonant Sensing Applications...N/A**

Erfan Ghaderi, Emad Esmaeili, Mikhail A. Kanygin, Behraad Bahreyni

*Simon Fraser University, Canada*

12:25

**3076: Mode-Split MEMS Gyroscopes Under Bending Stress: Detection Mode Coupling and the Relation to Cross-Axis Sensitivity...N/A**

Wolfram Mayer{2}, Burkhard Kuhlmann{1}, Andrea Guerrieri{1}, Tobias Hiller{4}, Andre Zimmermann{3}

*{1}Bosch Sensortec GmbH, Germany; {2}Bosch Sensortec GmbH / Universität Stuttgart, Germany; {3}Hahn-Schickard Gesellschaft für Angewandte Forschung e.V. / Universität Stuttgart, Germany; {4}Robert Bosch GmbH, Germany*

12:45

**3077: Enhancing the Performance of Sintered Fused Silica Cylindrical Shell Resonators Through Wet Etching...N/A**

Yahya Atwa, Hamza Shakeel

*Queen's University of Belfast, United Kingdom*

13:05 – 14:15

**IAI Lunch Break**

**Room:** Restaurant "Seeblick"

14:15 – 16:05

**Progress on Portable Atomic/Quantum Sensors**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Patrick Everitt, *Q-CTRL* & Mike Larsen, *Northrop Grumman, USA*

14:15

**3107: Quantum Inertial Sensors for Gravimetry and Inertial Navigation in the Field (INVITED)...N/A**

Matthew Cashen

*Vector Atomic, United States*

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Vincent Menoret{3}, Cyrille Des Cognets{2}, Quentin D'Armagnac de Castanet{3}, Vincent Jarlaud{3}, Bruno Desruelle{1}, Philippe Bouyer{4}, Baptiste Battelier{2}

*{1}Exail, France; {2}Laboratoire Photonique, Numérique et Nanosciences, France; {3}Laboratoire Photonique, Numérique et Nanosciences / Exail, France; {4}University of Amsterdam, Netherlands*

15:05

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Benjamin Tennstedt, Steffen Schön

*Leibniz Universität Hannover, Germany*

15:25

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*Georgia Institute of Technology, United States*

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*Q-CTRL, Australia*

16:05 – 16:35

**Coffee Break, Exhibits, & Poster Session 2**

**Room:** Hotel Halle/Salon Belle Epoque

## TECHNICAL PROGRAM: MAY 6, 2025

16:05 – 17:40

### Posters Session 2

**Room:** Hotel Halle/Salon Belle Epoque

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Bingchen Zhu{1}, Zheng Wang{2}, Zhaoyang Zhai{1}, Xudong Zou{1}

{1}Aerospace Information Research Institute, CAS / University of Chinese Academy of Sciences, China; {2}Qilu Aerospace Information Research Institute, Chinese Academy of Sciences, China

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{1}U.S. Army Combat Capabilities Development Command Army Research Laboratory, United States; {2}University of Alabama in Huntsville, United States

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{1}Humink, France; {2}Office National d'Études et de Recherches Aérospatiales ONERA, France

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{1}Centre de Nanosciences et de Nanotechnologies / CNRS-Université Paris-Saclay, France; {2}GEEPS Laboratory, CentraleSupélec, France; {3}IEMN, Université de Lille, France; {4}Office National d'Études et de Recherches Aérospatiales ONERA, France; {5}Vmico, France

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Universität der Bundeswehr München, Germany

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{1}East China Institute of Photo-Electron IC, China; {2}Nanjing University of Science and Technology, China

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{1}Laboratoire Photonique, Numérique et Nanosciences, France; {2}Laboratoire Photonique, Numérique et Nanosciences / Exail, France

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Ayumu Takahashi, Masaki Shimofuri, Amit Banerjee, Jun Hirotani, Toshiyuki Tsuchiya

Kyoto University, Japan

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{1}Microsystems Laboratory, University of California Irvine, United States; {2}Politecnico di Milano, Italy; {3}University of California Irvine, United States

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{1}CMC Microsystems, Canada; {2}Simon Fraser University, Canada

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Hankyong National University, Korea

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Hankyong National University, Korea

## TECHNICAL PROGRAM: MAY 6, 2025

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{1}Northrop Grumman Corporation, United States; {2}NTA, Inc., United States; {3}U.S. Army Combat Capabilities Development Command Aviation & Missile Center, United States

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Jianjun Ma, Bin Zhou, Qi Wei, Rong Zhang  
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{1}Laboratoire Charles Fabry, Institut d'Optique Graduate School, CNRS-Université Paris-Saclay, France; {2}Thales AVS France SAS, France; {3}Thales Research & Technology, France

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Yukun Ma, Haonan Li, Rong Zhang, Fengtian Han  
*Tsinghua University, China*

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#### **What even is quantum anyway? (INVITED)**

Max Carey, *Aquark Technologies, UK*

**Room:** Salon Baden/Württemberg

**Session Chair:** Giacomo Langfelder, *Politecnico di Milano, Italy*

19:00 – 21:30

#### **Conference Banquet and Awards Ceremony**

**Location:** Max & Moritz Brewery

*Buses will transport you to and from the hotel. The first bus leaves at 6:30 pm, the next 3 leave at 6:45 pm and 6:50 pm. To come back to the hotel, the first bus leaves at 9:00 pm, and the rest leave at 9:30 pm. Please wear your name badges for entry.*

## TECHNICAL PROGRAM: MAY 7, 2025

7:30 – 8:30

**Registration**

**Room:** Foyer

8:30 – 9:15

**Keynote: Fabricating the Future: My Journey in Silicon Photonics**

Avi Feshali, *Independent, USA*

**Room:** Salon Baden/Württemberg

**Session Chair:** Erdinc Tatar, *Bilkent University, Turkey*

9:15 – 10:30

**Late News**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Patrick Fedeli, *ST Microelectronics* & Behraad Bahreini, *Simon Fraser University*

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Antti Ontronen{1}, Masahiro Ishii{2}, Chika Sakamoto{2}, Seiji Umezawa{2}, Yasuhiro Aida{2}

{1}Murata Electronics Oy, Finland; {2}Murata Manufacturing Co., Ltd., Japan

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Danmeng Wang, Daryosh Vatanparvar, Andrei Shkel

*Microsystems Laboratory, University of California Irvine, United States*

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John Liu

*Jet Propulsion Laboratory, United States*

10:00

**3093: Stochastic Modeling of Interferometric Optical Gyroscopes for High-End Applications: Experimental Validation...168**

Teresa Natale{2}, Lorenzo Attivissimo{1}, Salvatore Di Girolamo{1}, Mario Lucchesini{1}, Fabrizio Berton{1}, Pietro Peliti{1}, Pedro Bossi Núñez{2}, Ludovico Dindelli{2}, Vittorio M. N. Passaro{2}, Francesco Dell'Olio{2}

{1}Northrop Grumman Italia, Italy; {2}Politecnico di Bari, Italy

10:15

**3091: Electrostatic Calibration of MEMS Accelerometers...172**

Ardalan Armin, Toby Alexander, Chris Fell

*Collins Aerospace, United Kingdom*

10:30 – 11:00

**Coffee Break & Exhibits**

**Room:** Hotel Halle/Salon Belle Epoque

11:00 – 11:15

**INERTIAL 2026 Announcement**

**Room:** Salon Baden/Württemberg

11:15 – 12:55

**MEMS Gyroscopes for Navigation Applications**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Julien Auger, *Safran* & Xudong Zou, *UCAS, China*

## TECHNICAL PROGRAM: MAY 7, 2025

11:15

### **3071: Tuning Fork Vibratory MEMS Gyroscope with Optical Drive and Sense Modes Detection...176**

Eldad Yichie{1}, Ido Peleg{1}, Ronen Maimon{1}, Naftaly Krakover{1}, Danny Kassie{1}, Tamar Tepper-Faran{1}, Slava Krylov{2}  
{1}Rafael Advanced Defense Systems Ltd., Israel; {2}Tel Aviv University, Israel

11:35

### **3062: Whole-Angle Gyroscopes on Mass-Production Process: Dual Foucault Pendulum vs Disk Resonant Gyroscope...180**

Davide Pavesi{3}, Carolina Viola{2}, Claudia Comi{3}, Alberto Corigliano{3}, Pietro Peliti{1}, Fabrizio Berton{1}, Luca Falorni{4}, Gabriele Gattere{4}, Riccardo Nastri{3}, Stefano Zoia{1}, Paolo Frigerio{3}, Giacomo Langfelder{3}, Valentina Zega{3}  
{1}Northrop Grumman Italia, Italy; {2}Northrop Grumman Italia / Politecnico di Milano, Italy; {3}Politecnico di Milano, Italy; {4}STMicroelectronics, Italy

11:55

### **3018: Robust Double Mass MEMS Gyroscope with Large Drive Amplitude for North-Finding...184**

Yang Zhao, Qin Shi, Guoming Xia, Meijia Xu, Jinyang Huang, Anping Qiu  
Nanjing University of Science and Technology, China

12:15

### **3067: Near Nav-Grade Safran MEMS Gyro Improves SWaP with New ASIC and Ceramic Packaging...188**

Jean-Daniel Emerard{1}, Julien Auger{1}, Frederic Fretouly{1}, Baptiste Soyer{1}, Jean-Sebastien Macé{1}, Philippe Ullah{1}, Thierry Baurèche{1}, Rob Compton{2}, Alexandre Lenoble{1}  
{1}Safran Electronics & Defense, France; {2}Safran Federal Systems, United States

12:35

### **3102: Real-Time Detection and Dynamic Compensation of Mismatch in Rate-Integrating MEMS Gyroscopes Using Virtual Rotation...N/A**

Takashiro Tsukamoto{1}, Fumito Miyazaki{2}, Taichi Uchiumi{1}, Yasuchi Tomizawa{2}, Shuji Tanaka{1}  
{1}Tohoku University, Japan; {2}Toshiba Corporation, Japan

12:55 – 14:00

#### **Lunch Break**

**Room:** Salon Baden/Württemberg

14:00 – 15:10

#### **Learning & Correction in Inertial Sensors**

**Room:** Salon Baden/Württemberg

**Session Chairs:** Andrea Buffoli, iNGage SAS & Lia Li, Zero point motion

14:00

### **3109: HALOVS: Highly Accelerated Learning of Vibratory Systems (INVITED)...N/A**

Sunil Bhawe  
Defense Advanced Research Projects Agency, United States

14:30

### **3065: Olfactory Inertial Odometry: Sensor Calibration and Drift Compensation...192**

Kordel France, Ovidiu Daescu, Anirban Paul, Shalini Prasad  
University of Texas at Dallas, United States

14:50

### **3032: Measuring Angular Rate and Substrate Stress from the Same Sensing Piezoresistors: A Path Towards Compensating Drift Induced by Package Deformation?...196**

Gabriele Laita{2}, Francesco Tubaro{2}, Andrea Buffoli{1}, Philippe Robert{1}, Giacomo Langfelder{2}  
{1}CEA-Leti, France; {2}Politecnico di Milano, Italy

15:10 – 15:30

#### **Closing Session: Conference adjourns**

**Room:** Salon Baden/Württemberg