

# **2024 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL 2024)**

**Hiroshima, Japan  
25-28 March 2024**



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# Technical Program: 25 March 2024

*\*All times appear in Japan Standard Time (JST) GMT+9)*

8:30 – 9:30

**Registration**

**Room:** Setouchi Foyer

9:30 – 11:30

**Tutorial: Towards Chip-integrated Sagnac Gyroscopes**

Kerry Vahala, *Caltech*

**Room:** Setouchi I

**Session Chair:** Tamio Ikehashi, Waseda University, Japan

11:30 – 13:00

**Lunch**

**Room:** Setouchi III

9:30 – 11:30

**Tutorial: Exploring the Mechanical Design of MEMS Gyroscopes: A Focus on the AM Mode Split Architecture**

Gabriele Gattere, *STMicroelectronics*

**Room:** Setouchi I

**Session Chair:** Tamio Ikehashi, Waseda University, Japan

15:00 – 15:30

**Coffee Break**

**Room:** Setouchi Foyer

5:30 – 17:30

**Tutorial: MEMS Inertial Sensors and Their Application to Navigation**

Yasushi TOMIZAWA, *Toshiba*

**Room:** Setouchi I

**Session Chair:** Tamio Ikehashi, Waseda University, Japan

18:00 – 20:00

**Ideal Aeromith Welcome Reception**

**Room:** Suite Des Fleurs

*\*Open to everyone*

# Technical Program: 26 March 2024

*\*All times appear in Japan Standard Time (JST) GMT+9)*

7:30 – 8:30

**Registration**

**Room:** Setouchi Foyer

8:30 – 8:45

**Opening Remarks**

**Room:** Setouchi I

8:45 – 9:25

**Keynote: The Last Navigator**

Steve Thomas, *Emmy Award-winning TV Host of This Old House, Renovation Nation, & Save Our History*

**Room:** Setouchi I

Session Chair: Joan Giner, Bosch Sensortec

9:25 – 10:25

**A1L-A: Sensor Compensation & Self Calibration**

**Room:** Setouchi I

**Session Chair:** Paola Carulli, STMicroelectronics

9:25

**6044: North Finding IMU with Electromagnetic MEMS Gyroscope and Mode Reversal Technique.....1**

Ryuta Araki, Ryohei Uchino, Takafumi Moriguchi

Sumitomo Precision Products Co., Ltd., Japan

9:45

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Theo Miani<sup>{1}</sup>, Lokesh Gurung<sup>{1}</sup>, Guillermo Sobreviela-Falces<sup>{1}</sup>, Douglas Young<sup>{1}</sup>, Colin Baker<sup>{1}</sup>, Ashwin Seshia<sup>{2}</sup>

<sup>{1}</sup>Silicon Microgravity Ltd, United Kingdom; <sup>{2}</sup>University of Cambridge, United Kingdom

10:05

**6006: Auxiliary Gyroscope Approach for Balanced Performance via Gyro Self-Calibration.....9**

John Liu

Jet Propulsion Laboratory, United States

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**Room:** Setouchi I

**Session Chair:** Diego Serrano, Panasonic

# Technical Program: 26 March 2024

10:55 – 11:25

**Coffee Break & Exhibits**

**Room:** Setouchi II

11:25 – 12:05

**Keynote: Progress in the Development of Space Inertial Sensor for TianQin Project**

Ze-Bing Zhou. *Huazhong University of Science and Technology*

**Room:** Setouchi I

**Session Chair:** Zhipeng Ma, Zhejiang University

12:05 – 12:45

**A2L-A: Optical Sensors**

**Room:** Setouchi I

**Session Chair:** Edward Ohad Zohar, Smart Systems Pte Ltd.

12:05

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Huazhong University of Science and Technology, China

12:25



*Sensors Letters Paper*

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Patrick Tritschler<sup>{1}</sup>, Torsten Ohms<sup>{1}</sup>, Peter Degenfeld-Schonburg<sup>{2}</sup>, Fabian Zschocke<sup>{2}</sup>, André Zimmermann<sup>{3}</sup>

<sup>{1}</sup>Bosch Sensortec GmbH, Germany; <sup>{2}</sup>Robert Bosch GmbH, Germany; <sup>{3}</sup>University of Stuttgart, Germany

12:45 – 14:10

**IAI Lunch Break**

**Room:** Setouchi III

# Technical Program: 26 March 2024

14:10 – 15:40

**A3L-A: Packaging & Stress Mitigation**

**Room:** Setouchi I

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

14:10

**Invited: Technical Challenges and Possible Solutions for Development of CMOS-MEMS and Piezoelectric MEMS Accelerometers.....N/A**

Sheng-Shian Li, Institute of NanoEngineering and MicroSystems, Department of Power Mechanical Engineering, National Tsing Hua University, Hsinchu

14:40

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Derin Erkan, Erdinc Tatar

Bilkent University, Turkey

15:00

 *Sensors Letters Paper*

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Muhammad Salman Al Farisi, Yang Wang, Yoshihiro Hasegawa, Mitsuhiro Shikida

Hiroshima City University, Japan

15:20

 *Sensors Letters Paper*

**6079: Investigating the Effects of Stress on Die Deformation and on Cross-Axis Offset Drift in Mode-Split MEMS Gyroscopes.....N/A**

Wolfram Mayer<sup>{2}</sup>, Burkhard Kuhlmann<sup>{1}</sup>, Tobias Hiller<sup>{3}</sup>, Thorsten Balslink<sup>{3}</sup>, Ulrich Kunz<sup>{3}</sup>, André Zimmermann<sup>{4}</sup>

<sup>{1}</sup>Bosch Sensortec GmbH, Germany; <sup>{2}</sup>Bosch Sensortec GmbH, University of Stuttgart, Germany;

<sup>{3}</sup>Robert Bosch GmbH, Germany; <sup>{4}</sup>University of Stuttgart, Germany

15:40 – 16:10

**Poster Lightning Round I**

**Room:** Setouchi I

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

16:10 – 16:25

**Wrap Up**

**Room:** Setouchi I

# Technical Program: 26 March 2024

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**Coffee Break & Exhibits**

**Room:** Setouchi II

16:55 – 18:00

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**Room:** Setouchi II

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<sup>{1}</sup>Bosch Sensortec GmbH, Germany; <sup>{2}</sup>University of Rostock, Germany

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Minhdao Nguyen, Roger Sengphanith, Jeffrey Onners

Naval Information Warfare Center Pacific, United States

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Nanjing University of Science and Technology, China

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<sup>{1}</sup>Qilu Aerospace Information Research Institute, China; <sup>{2}</sup>State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, China; <sup>{3}</sup>State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CA

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<sup>{1}</sup>Agency for Defense Development, Korea; <sup>{2}</sup>Inha University, Korea; <sup>{3}</sup>Korea Advanced Institution of Science and Technology, Korea; <sup>{4}</sup>Korea Advanced Institution of Science and Technology & Nextreme Inc., Korea

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{1}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, China; {2}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, UCAS, China; {3}State Key Laboratory of Transducer Tec

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{1}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, China; {2}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, UCAS, China; {3}State Key Laboratory of Transducer Tec

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{1}Silicon Microgravity Ltd, United Kingdom; {2}University of Cambridge, United Kingdom

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Tronics Microsystems, France

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{1}Suzhou Raysen Microsystem Technology Co., Ltd, China; {2}Tsinghua University, China

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{1}Huazhong University of Science and Technology, China; {2}Shanghai University, SIMIT, China; {3}University of Leuven, Belgium; {4}University of Macau, China; {5}University of York, United Kingdom



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{1}QiLu Aerospace Information Research Institute, China; {2}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, China; {3}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CA

18:00 – 19:30

**Patron & Exhibitor Appreciation Social**

**Room:** Setouchi II

\*Open to everyone

# Technical Program: 27 March 2024

*\*All times appear in Japan Standard Time (JST) GMT+9)*

7:30 – 8:30

**Registration**

**Room:** Setouchi Foyer

8:30 – 8:45

**Opening Remarks & IEEE Sensors Council President Address**

**Room:** Setouchi I

8:45 – 9:25

**Keynote: Quantum Inertial: Rising from the Trough of Disillusionment**

John Burke, *Office of the Undersecretary of Defense (OUSD (R&E)) (S&T)*

**Room:** Setouchi I

**Session Chair:** Diego Emilio Serrano, Panasonic

9:25 – 10:55

**B1L-A: Quantum/Atomic Sensors**

**Room:** Setouchi I

**Session Chair:** Susannah Jones, Defence Science and Technology Laboratory

9:25

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Patrick Everitt, Q-CTRL

9:55

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Tsinghua University, China

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Australian National University, Australia; Australian National University, Canada

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{1}Thales UK, United Kingdom; {2}University of Southampton, United Kingdom

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**Coffee Break & Exhibits**

**Room:** Setouchi II

11:25 – 11:45

**INERTIAL 2025 Announcement**

**Room:** Setouchi I

**Session Chair:** Joan Giner, INERTIAL 2025 General Chair

11:45 – 12:45

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**Room:** Setouchi I

**Session Chair:** Sheng-Shian Li, National Tsing Hua University

11:45

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Diego Emilio Serrano

Panasonic Massachusetts Laboratory, United States

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Mehran Hosseini Pishrobat, Derin Erkan, Erdinc Tatar

Bilkent University, Turkey

12:25



*Sensors Letters Paper*

**6077: Split Is Not Dead: A Case Study on the Performance Gap Between MEMS Automotive-Grade Gyroscopes and High-End Applications.....N/A**

Marco De Pace{2}, Paolo Frigerio{2}, Carlo Valzasina{3}, Luca Falorni{3}, Pietro Peliti{1}, Valentina Zega{2}, Giacomo Langfelder{2}

{1}Northrop Grumman Italia, Italy; {2}Politecnico di Milano, Italy; {3}STMicroelectronics, Italy

12:45 – 14:10

**Lunch**

**Room:** Setouchi III

# Technical Program: 27 March 2024

14:10 – 15:40

**B3L-A: Advanced System Architectures**

**Room:** Setouchi I

**Session Chair:** Marius Gheorghe, Ideal Aeromsmith

14:10

**Invited: Vibrating Beam MEMS Accelerometers for Gravimetry and Inertial Navigation.....N/A**

Ashwin A. Seshia, University of Cambridge and Silicon Microgravity Ltd.

14:40

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Andrea Buffoli{2}, Philippe Robert{1}, Giacomo Langfelder{2}

{1}CEA-Leti, France; {2}Politecnico di Milano, Italy

15:00



*Sensors Letters Paper*

**6072: AutoML for On-Sensor Tiny Machine Learning.....N/A**

Mahesh Chowdhary, Derek Lilienthal, Swapnil Sayan Saha, Krishna Chaitanya Palle Hayagreeva

STMicroelectronics, United States

15:20



*Sensors Letters Paper*

**6075: The Extended Kalman Filter with Reduced Computation Time for Pedestrian Dead Reckoning.....N/A**

Shunsei Yamagishi, Lei Jing

University of Aizu, Japan

15:40 – 16:10

**Poster Lightning Round II**

**Room:** Setouchi I

**Session Chair:** Zhipeng Ma, Zhejiang University

16:10 – 16:25

**Wrap Up**

**Room:** Setouchi I

16:25 – 16:55

**Coffee Break & Exhibits**

**Room:** Setouchi II

# Technical Program: 27 March 2024

16:55 – 18:00

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**Room:** Setouchi II

**Session Chair:** Zhipeng Ma, Zhejiang University

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{1}QiLu Aerospace Information Research Institute, China; {2}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CAS, China; {3}State Key Laboratory of Transducer Technology, Aerospace Information Research Institute, CA

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MEI Micro, Inc., United States

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Naval Postgraduate School, United States

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{1}Kyoto University, Japan; {2}Tamagawa Mobile Equipment Company Ltd., Japan; {3}Tamagawa Seiki Company Ltd., Japan

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{1}Exail, France; {2}Gustave Eiffel University, France

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{1}Tohoku University, Japan; {2}Toshiba Corporation, Japan

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{1}Rafael Advanced Defense Systems, Israel; {2}Tel Aviv University, Israel

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{1}Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China;  
{2}Shanghai University, Shanghai Key Laboratory of Chips and Systems for Intelligent Connected Vehicle, China; {3}Shanghai University, SIMIT, China; {4}Sh

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{1}Politecnico di Milano, Italy; {2}TDK-InvenSense Italy S.r.l., Italy

# Technical Program: 27 March 2024

18:30 – 20:30

**Gala Dinner Cruise**

Hiroshima Harbor: Moto Ujina Pier 2

# Technical Program: 28 March 2024

*\*All times appear in Japan Standard Time (JST) GMT+9)*

7:30 – 8:30

**Registration**

**Room:** Setouchi Foyer

8:30 – 8:45

**Opening Remarks**

**Room:** Setouchi I

8:45 – 9:25

**Keynote: Inertial Sensor Applications for Satellites and a Luna Lander**

Shin-ichiro Sakai, *Japan Aerospace Exploration Agency (JAXA)*

**Room:** Setouchi I

**Session Chair:** Takashiro Tsukamoto, Tohoku University

9:25 – 10:25

**C1L-A: Test & Calibration**

**Room:** Setouchi I

**Session Chair:** Erdinc Tatar, Bilkent Üniversitesi

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{1}NASA Glenn Research Center, United States; {2}NASA Langley Research Center, United States

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Jason Bingham, Michael Walker II

Sandia National Laboratories, United States

10:05



*Sensors Letters Paper*

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Marius Gheorghe, John Neal

Ideal Aerosmith Inc., United States

10:25 – 10:55

**Coffee Break & Exhibits**

**Room:** Setouchi II



# Technical Program: 28 March 2024

10:55 – 12:45

**C2L-A: MEMS Sensors**

**Room:** Setouchi I

**Session Chair:** Ryuta Araki, Sumitomo Precision Products

10:55

**Invited: Technologies for High Performance MEMS IMU Sensors.....N/A**

Anssi Blomqvist, Murata Electronics Oy, Vantaa, Finland

11:25

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<sup>{1}</sup>Chemnitz University of Technology, Germany; <sup>{2}</sup>Fraunhofer Institute for Electronic Nano Systems ENAS, Germany; <sup>{3}</sup>Tohoku University, Japan

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Panasonic Massachusetts Laboratory, United States

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<sup>{1}</sup>Chemnitz University of Technology, Germany; <sup>{2}</sup>Fraunhofer Institute for Electronic Nano Systems ENAS, Germany; <sup>{3}</sup>Tohoku University, Japan

12:25



**Sensors Letters Paper**

**6076: Combining Lissajous Frequency Modulation with 250-nm Piezoresistive Sensing in MEMS Gyroscope: Theoretical Advantages and Practical Challenges.....N/A**

Matteo Gianollo<sup>{2}</sup>, Marco Gadola<sup>{2}</sup>, Giada Bettini<sup>{2}</sup>, Christian Padovani<sup>{2}</sup>, Philippe Robert<sup>{1}</sup>, Giacomo Langfelder<sup>{2}</sup>

<sup>{1}</sup>CEA-Leti, France; <sup>{2}</sup>Politecnico di Milano, Italy

# Technical Program: 28 March 2024

12:45 – 14:10

**Lunch**

**Room:** Setouchi III

14:10 – 15:10

**C3L-A: Late News**

**Room:** Setouchi I

**Session Chair:** Xudong Zou, University of Chinese Academy of Sciences

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**6081: Molded Foaming 3D MEMS Vapor Cell for Weak Magnetic Detection.....179**

Ziji Wang, Ruochen Tie, Jintang Shang  
Southeast University, China

15:10 – 15:40

**Closing Remarks/Award Ceremony**

**Room:** Setouchi I