

# Guest Editorial

## Guided Lightwaves for Sensors and Measurement Systems: Advanced Techniques and Applications

### I. INTRODUCTION

**T**HIS IEEE/OSA JOURNAL OF LIGHTWAVE TECHNOLOGY special issue on “*Guided Lightwaves for Sensors & Measurement Systems: Advanced Techniques and Applications*” is organized by the IEEE Instrumentation and Measurement Society. It aims to highlight the advancement of guided lightwaves in applications to sensors, instrumentation and measurement.

The special issue includes both comprehensive review articles and original technical contributions covering the rapid advancement of guided lightwaves in the applications to instrumentation and measurement. 13 tutorial/invited papers and 31 contributed papers will be published in this issue. The authors are from universities, government labs and industries.

We hope that this JLT Special Issue will provide an in-depth look at the topic areas and serve as a valuable reference for the current and future scientists, engineers, and technical applicators working in the related fields.

#### A. Invited Papers

13 invited papers (including 3 tutorial papers) were solicited to capture the state of arts in the areas covered by this special issue. These papers provide a comprehensive review of the advanced guided lightwave technology for fiber optical sensors & measurement systems in the oil and gas exploration, digital coherent optical monitoring technologies in telecommunications, microwave frequency measurement, optical beam shaping technologies, biomedicine detection and spectroscopy, to name a few, all rely on the state-of-the-art photonic guided lightwave technology in instrumentation and measurement.

The title and authors of these papers are listed below.

- 1) (JLT-22758-invited tutorial) “FBG for oil and gas exploration”, by Xueguang Qiao *et al.*
- 2) (JLT-22743-invited tutorial) “Multi-dimensional optical fiber sensing enabled by digital coherent optical technologies”, by Zhaohui Li *et al.*
- 3) (JLT-22847-invited tutorial) “Recent progress in liquid-crystal optical fibers and their applications in photonics”, by Tomasz R. Wolinski *et al.*
- 4) (JLT-22826-invited) “High-sensitivity instantaneous microwave frequency measurement based on a silicon photonic integrated fano resonator”, by Jianping Yao *et al.*

- 5) (JLT-22755-invited) “Mueller matrix polarimetry – an emerging new tool for characterizing the microstructural feature of complex biological specimen”, by Hui Ma *et al.*
- 6) (JLT-22789-invited) “Novel Type II Bragg grating structures in silica fibers using femtosecond lasers and phase masks”, by Stephen Mihailov *et al.*
- 7) (JLT-22817-invited) “Dynamic strain measurement based on high-speed single-end-access Brillouin optical correlation domain analysis”, by Zuyuan He *et al.*
- 8) (JLT-22829-invited) “Demodulation of a hydroacoustic sensor array of fiber interferometers based on ultra-weak fiber Bragg grating reflectors using a self-referencing signal”, by Ciming Zhou *et al.*
- 9) (JLT-22930-invited) “Optical microfiber sensors: Sensing mechanisms, and recent advances”, by Fei Xu *et al.*
- 10) (JLT-22963-invited) “Recent progress in all-fiber non-Gaussian optical beam shaping technologies”, by Kyunghwan Oh *et al.*
- 11) (JLT-23056 -invited) “Hollow core inhibited coupling fibers for biological optical sensing”, by Luca Vincetti *et al.*
- 12) (JLT-23074-invited) “Towards commercial polymer fiber Bragg grating sensors: Review and applications”, by Christophe Caucheteur *et al.*
- 13) (JLT-23310-invited) “Interface sensitized optical microfiber biosensors”, by Bai-Ou Guan *et al.*

### ACKNOWLEDGMENT

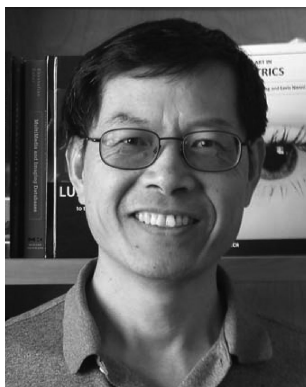
The guest editors thank the authors who submitted their papers to this special issue and the anonymous reviewers whose feedbacks ensure the high quality of the Journal, the JLT Editor-in-Chief Peter Winzer and Gabriella Bosco for their guidance, Doug Hargis and Sonal Parikh, the JLT publication team, for putting this issue together.

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Dr. Xiao is currently the Editor-in-Chief of IEEE JOURNAL OF RFID and steering committee member of IEEE/OSA JOURNAL OF LIGHTWAVE TECHNOLOGY. He is the recipient of multiple awards, including the Technical Award from the IEEE Instrumentation and Measurement Society (2014), and several prestige awards from his current and formal employers.



**Tuan Guo** (M'07–SM'17) received the Ph.D. degree in optics from Nankai University, China, in 2007. He was a Postdoctoral Fellow with the Department of Electronics, Carleton University, Canada and the Photonics Research Centre, The Hong Kong Polytechnic University. He joined the Jinan University as an Associate Professor in 2011 and was promoted to a Full Professor in 2014. He is a Professor with the Institute of Photonics Technology, Jinan University, China. His research activities include optical fiber sensors, fiber gratings, plasmonics, and biophotonics and photonics for renewable energy. He has authored more than 200 papers in peer-reviewed international journals (including *Nature Communications*, *Light: Science & Applications*, and 6 Tutorial / Invited Reviews), 1 Springer handbook chapter and presented more than 30 invited talks at international conferences. He holds 20 patents and pending patents.

Dr. Guo was a co-chair of the IEEE-IMS technical committee “Photonic Technology in Instrumentation and Measurement”, and a senior member of the Optical Society of America (OSA). He served as an Associate Editor for the IEEE/OSA JOURNAL OF LIGHTWAVE TECHNOLOGY, an Associate TPC Chair of the IEEE International Instrumentation and Measurement Technology Conference 2019 (Auckland, New Zealand), and TPC Section Chair of CLEO Pacific Rim Conference 2018 (Hong Kong, China). He is the recipient of the 2018 Technical Award of the IEEE Instrumentation and Measurement Society.



**Luigi Rovati** (M'92) received the first-class honors degree in electronic engineering and the Ph.D. degree in electronic engineering and computer science from the University of Pavia, Italy, in 1989 and 1994, respectively.

From 1995 to 2001, he was a Researcher and an Assistant Professor with the University of Brescia. He joined the Department of Information Engineering, University of Modena and Reggio Emilia, in 2001, where he is a Full Professor of Electronic Instrumentation and Measurement Science. His scientific activity was characterized by several stages all dedicated to the study, development, and characterization of innovative measurement instruments mainly based on optoelectronic techniques. Great care has been devoted to the theoretical aspects related to the detection of weak signals and analog processing in order to minimize the measurement uncertainty, and experimental aspects with regard to the implementation of systems for the metrological characterization of devices developed.



**Zuyuan He** (M'00–SM'11) received the B.S. and M.S. degrees in electronic engineering from Shanghai Jiao Tong University, Shanghai, China, in 1984 and 1987, respectively, and the Ph.D. degree in optoelectronics from the University of Tokyo, Tokyo, Japan, in 1999. He joined Nanjing University of Science and Technology, Nanjing, China as a Research Associate in 1987, and became a Lecturer in 1990. From 1995 to 1996, he was a Research Fellow studying optical information processing with the Research Center for Advanced Science and Technology (RCAST), University of Tokyo. In 1999, he became a Research Associate with the University of Tokyo, where he worked on the measurement and characterization of fiber optic components and systems, fiber optic reflectometry, fiber optic sensors, and multi-dimensional optical information processing. In 2001, he joined CIENA Corporation, Linthicum, MD, USA, as a Lead Engineer leading the Optical Testing and Optical Process Development Group. He returned to the University of Tokyo as a Lecturer in 2003, and became an Associate Professor in 2005 and a Full Professor in 2010. He is currently a Chair Professor and the Director with the State Key Laboratory of Advanced

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Dr. He is a senior member of OSA, and a member of the Institute of Electronics, Information, and Communication Engineers (IEICE) of Japan.