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## I<sup>2</sup>mtc 2021 Special Issue in IEEE Transactions on Instrumentation and Measurement

Pawel Niewczas

Kristen M. Donnell

*Missouri University of Science and Technology, kmdgfd@mst.edu*

Melanie Ooi

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# I<sup>2</sup>MTC 2021 Special Issue in IEEE Transactions on Instrumentation and Measurement

**T**HE 38th IEEE International Instrumentation and Measurement Conference (I<sup>2</sup>MTC) was held as a virtual event during May 17–20, 2021. IEEE I<sup>2</sup>MTC is the flagship conference of the IEEE Instrumentation and Measurement Society (IMS) and one of the top international conferences in the areas of instrumentation and measurement. The conference has been held annually since 1986 and is dedicated to advances in measurement methodologies, measurement systems, instrumentation, and sensors in all areas of science and technology. The strong technical program, a great diversity of topics, and superb social aspects of the conference attract a large number of delegates from industry and academia every year.

I<sup>2</sup>MTC was originally planned to take place in Glasgow, Scotland, a city with a rich scientific heritage associated with renowned scientists and engineers including Lord Kelvin, inventor of the international system of absolute temperature, James Watt, inventor of the “Watt steam engine,” and John Logie Baird, inventor of an early version of the television. Currently, Glasgow is a host of four universities and many engineering companies and research institutions that are actively involved in the development and application of instrumentation and measurement, making it an ideal location for I<sup>2</sup>MTC 2021. Unfortunately, the COVID-19 pandemic that invaded our lives in early 2020 was still holding its grip over our normal ways of conducting business in 2021. Sadly, an early decision to hold I<sup>2</sup>MTC 2021 as a virtual event had to be taken by the conference organizing committee. This was the second successive time the conference had to be run virtually due to the pandemic.

Nevertheless, despite this setback, the conference was a complete success! The organizing committee worked tirelessly to compensate for the lack of physical interaction and came up with many novel ways of engaging the delegates and offer great conference experience. For example, all online presentations were delivered live, offering live interactions of the delegates with presenters/authors in the form of Q&A. The conference included live tutorials, plenary sessions, invited and regular presentations, poster presentations, live demos, TIM@I<sup>2</sup>MTC papers, conference paper awards, topical discussion panels, industry sessions, and a virtual tour of Glasgow. The delegates also had a chance to view pre-recorded presentations and short poster presentations “on demand” after the papers had been presented live. To further support engagement, delegates were able to attend poster sessions and meet with

colleagues virtually with the help of an online platform, Gather Town.

The motto of I<sup>2</sup>MTC 2021, “to measure is to know,” is most famously attributed to Lord Kelvin. This statement is so true today as measurement and observation of our world, from capturing the most faint gravitational wave signals due to colliding black holes at the ends of the Universe, robotic exploration of Mars, or ultra-accurate time measurements that are used in many day-to-day applications, expand our horizons of knowledge and our ability to conduct our affairs with ever-increasing efficiency. Consequently, the conference attracted a total of 389 papers that underwent a thorough review process. Of this number, six were withdrawn and 313 were accepted for inclusion in the technical program, with an acceptance rate of 81%. There were three Technical Program Co-Chairs who worked closely with three Special Session Co-Chairs, 52 Associate Technical Program Chairs and 296 reviewers to ensure a high-quality technical program. Approximately 44% of papers were from Europe, 41% from the Asia Pacific region, 10% from North America, 4% from Latin America, and 1% from the Middle East and Africa regions.

The program consisted of ten tutorials, 30 oral sessions (including special sessions), and five poster sessions, including a TIM@I<sup>2</sup>MTC session—providing the opportunity to existing authors to disseminate their papers already published in the Transactions. In addition, the conference included a virtual demonstration session, providing a unique opportunity for authors to show live demonstrations of their results. The development and delivery of the program was only possible due to the tireless efforts of the technical program chairs, special session organizers, and, crucially, paper reviewers.

In addition to the regular technical sessions, the program included plenary sessions that were delivered by truly outstanding speakers: Helen Margolis from the UK National Physical Laboratory, delivering a talk on *time measurements*; Sheila Rowan from Glasgow University, on *gravitation wave detection*; Sanjeev Gupta from the National Aeronautics and Space Administration (NASA) on *robots on Mars*; Erling Riis from Strathclyde University on *quantum sensing*; and Judy Amanor-Boadu on *VLSI processors*. In addition, the program included two invited scholastic seminars: Miles Padgett on *Lord Kelvin* and Reza Zoughi on *Do's and Don'ts of Journal Publication* as well as two fascinating Industry Sessions: *I&M in advanced manufacturing* and *quantum enabled I&M*. Finally, the conferences included highly engaging *panel meetings* and a *virtual tour of Glasgow*.

This Special Issue of the IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT (TIM) includes a

small cross-section of papers from the conference where the authors have extended the scope of their papers in terms of the overall technical content and research results beyond those published in the proceedings. A total of 62 articles were submitted for this Special Issue of IEEE TIM, with 27 articles accepted. The resulting acceptance ratio is 44%, which is an above-average result.

The articles included in the Special Section of TIM cover several broad and topical areas of instrumentation and measurement. Specifically, three articles are in the area of flow measurement; two articles are in the area of measurement for medical applications; four articles cover the area of measurement in the power sector; six articles are in the area of tomography and ultrasonic measurements; nine articles are in the area of various instrumentation systems, measurement for IoT applications, and advanced manufacturing; two articles focus on object localization; and, finally, one article focusses on the area of measurement in agriculture.

All technical contributions to this Special Issue are gratefully acknowledged. Special thanks go to the associate editors and reviewers of the articles for their dedication and commitment to the thorough review process. We also thank the Editor-in-Chief, Shervin Shirmohammadi, for his kind

invitation to the I<sup>2</sup>MTC authors to submit extended versions of their articles in IEEE TIM and his overall oversight of the editorial process. Last, but not least, we thank Reta Wehmeier for her day-to-day work on the publication of this special issue of TIM. It was a great privilege to serve as guest editors for the I<sup>2</sup>MTC 2021 Special Issue in IEEE TIM.

PAWEŁ NIEWCZAS  
Department of Electronic and Electrical  
Engineering  
University of Strathclyde  
Glasgow G1 1XQ, U.K.

KRISTEN M. DONNELL  
Department of Electrical and Computer  
Engineering  
Missouri University of Science and Technology  
St. Rolla, MO 65409 USA

MELANIE OOI  
School of Engineering  
University of Waikato  
3216 Hamilton, New Zealand



**Paweł Niewczas** (Member, IEEE) received the M.Sc. degree in electrical engineering from the Technical University of Lublin, Poland, in 1995, and the Ph.D. degree in optical current sensing from the University of Strathclyde, Glasgow, U.K., in 2000.

He is currently a Professor at the Department of Electronic and Electrical Engineering, University of Strathclyde, where he leads the Advanced Sensors Team, Institute for Energy and Environment. His main research interests center on the advancement of photonic instrumentation and measurement (I&M) methods and systems integration in applications that lie predominantly in power and energy sectors. He has carried out a unique portfolio of research programs, generally focusing on optical and fiber-based I&M techniques, addressing such issues as sensor design, fabrication, packaging, deployment, and delivering complete photonic I&M systems for measurements in challenging environments. The applications of his research include such areas as power system monitoring, control, and protection; wind turbine structural health monitoring; downhole pressure, temperature, voltage, and current measurement; and measurement in nuclear fission and fusion environments. He has published over 130 technical papers in this area, has eight patent applications, and holds six granted patents. He is a Co-Founder and Research and Development Director of the spin-out company Synaptec that specializes in photonic instrumentation for the energy grid.

Dr. Niewczas was an IEEE Distinguished Lecturer (DL) for the Instrumentation and Measurement Society (IMS) from 2007 to 2012 and 2013 to 2016, Technical Co-Chair (TCP) of the IEEE I<sup>2</sup>MTC 2021–2022, and an Associate Editor of the *MDPI Sensors Journal* (open access) from 2020 to 2022.



**Kristen M. Donnell** (Senior Member, IEEE) received the B.S.E.E. degree from Colorado State University, Fort Collins, CO, USA, in May 2001, the M.S.E.E degree from the University of Missouri–Rolla, St. Rolla, MO, USA, in December 2003, and the Ph.D. degree in electrical engineering from the Missouri University of Science and Technology (Missouri S&T), St. Rolla, in December 2010.

She is currently an Associate Professor with the Department of Electrical and Computer Engineering, Missouri S&T, and the Director of the Microwave Sensing ( $\mu$ Sense) Laboratory, Missouri S&T. Her current research interests include thermography, frequency selective surfaces, materials characterization, embedded sensing, and microwave and millimeter wave nondestructive testing. Prior to starting her Ph.D. work, she was employed by Raytheon Company, Tewksbury, MA, USA, from 2003 to 2006 as a Systems Engineer and Electrical Engineer.

Dr. Donnell has been involved with the IEEE Instrumentation and Measurement Society since 2007. She currently serves as the Vice President of the Finance Committee, the Chair of the Distinguished Lecturer Program, an Associate Editor for the IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, and a Technical Program Committee Co-Chair of the IEEE I<sup>2</sup>MTC for 2020–2023.



**Melanie Ooi** (Senior Member, IEEE) received the B.Eng. (Hons.), M.Eng.Sc. (research), and Ph.D. degrees from Monash University, Melbourne, Australia, in 2003, 2006, and 2011, respectively.

She is currently an Associate Professor (mechatronics) and Assistant Dean (research) at The University of Waikato, Hamilton, New Zealand, as well as an Adjunct Professor (computer science) at Sunway University, Subang Jaya, Malaysia. Her work in measurement uncertainty propagation has been adopted by the South African National Accreditation System in their guidelines document TG 50-02, since October 2017. In the recent three years, she has contextualized her research to focus on New Zealand's key strategic areas such as precision horticulture and agriculture, digital phenotyping, and technologies for early detection of biosecurity threats.

Dr. Ooi is the youngest female fellow appointed to the Institution of Engineering and Technology, U.K., and is a U.K. Chartered Engineer. She is an AdCom Member (2019–2022) of the IEEE Instrumentation & Measurement Society (I&MS), where she had also served as a Distinguished Lecturer from 2016 to 2017 and is the Asia–Pacific Liaison for Technical Committee 32 (TC-32) on Fault Tolerant Measurement Systems. She was a Guest Editor of the IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT in 2019, is currently a Technical Editor of *The Plant Phenome journal*, and the Editor-in-Chief of the *I&MS Newsletter*. She also serves as a member of the IEEE Technical Program Integrity Committee and the IEEE Public Visibility Committee. She has been acknowledged by several international awards, including the 2019 Rutherford Discovery Fellowship from New Zealand's Royal Society Te Apārangi, the 2017 Mike Sargeant Career Achievement Award from the Institution of Engineering and Technology, U.K., and the Outstanding Young Engineer Award of the Year 2014 from the IEEE Instrumentation and Measurement Society.