


# Introduction to the Winter 2023 Issue

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(Editorial)

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**ABSTRACT** Welcome to Volume 3 of IEEE JOURNAL OF MICROWAVES! In this issue we combine a complete set of regular contributions with Part 1 of a Microwave Theory and Technology Society 70th Anniversary commemoration, consisting of some twenty-one specially invited papers embodying this major milestone in the history of the organization. Several additional articles, including some major historic overviews, are to be released in our spring issue of JMW which contains Part 2 of this 70th Anniversary celebration. In order to make it possible to bring up all the anniversary issue papers contained in both parts one and two using a single database search, every special issue paper contains the index term: “MTT 70th Anniversary Special Issue.” The full set (covering two issues) of 70th anniversary papers can be accessed using a simple parenthesis-delineated search of the five-word phrase. Plans are also in place to combine all the on-line papers into a full-color print issue for distribution upon request. In addition to this very nice collection of quality papers, we celebrate six of our Outstanding Reviewers of 2021 and 2022 and announce our first IEEE JOURNAL OF MICROWAVES Best Paper prize.

**INDEX TERMS** Winter issue, opening editorial, MTT 70th Anniversary Special Issue, outstanding reviewers, reviewer recognition, best paper prize, editorial board.

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## I. INTRODUCTION

As we begin our third year of IEEE JOURNAL OF MICROWAVES we are very pleased to be adding several new features to our growing publication. In this issue we will be announcing our 2021/2022 outstanding reviewers and the winner of our IEEE JOURNAL OF MICROWAVES Best Paper award for 2021. We are also releasing part one of a two-part special issue celebrating the 70th anniversary of the founding of the MTT society (now officially the Microwave Theory and Technology society, updated this year from Microwave Theory and Techniques). Over the coming year, we will continue to bring you our special tutorial series pieces, editorials, and invited review and topical research papers. Our usage numbers<sup>1</sup> continue to accumulate at an accelerating

pace, and at the end of November topped 215,00 with a usage/article published<sup>2</sup> of 1100! The current cites per article sits at 6.36 on the IEEE Publishing Operations Production Portal (POPP) as of Dec. 1, 2022. We continue to be extremely pleased at how popular our authors are becoming and at how loyal is our small, but very dedicated pool of contributing researchers.<sup>3</sup>

Again, we hope more of you will decide to submit your research to us in the future, and we promise to do our utmost to make sure your experience is the best it can be. As we have stated many times before, we welcome feedback and direct communication from both our authors and our readers, so do

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<sup>1</sup>Usage count is the number of times an individual article is either accessed directly online or downloaded to a user through IEEE Xplore. This usage count is recorded in the separate Publishing Operations Production Portal (POPP) Analytics database and updated at the start of each calendar month.

<sup>2</sup>Our total usage (download) count per article published to date currently sits at 1090 on the POPP system. For all of 2021 we averaged 1348 downloads/article published which placed us third out of 272 established IEEE journals. Our 2022 ranking will not be available until January 2023, but our statistics to date look like they will keep us in the top half dozen of all IEEE journals, if not in as strong a position as we had in 2021.

<sup>3</sup>Our recidivism rate (number of repeat authors out of all our listed authors) was a remarkable 34% (310 repeat authors out of 913 unique authors) as of December 2022.

not hesitate to write to any of our Editorial Board members or to our EiC directly at any time. We promise a quick, if not a satisfying, response!

## II. REGULAR ISSUE CONTENT

Our January 2023 issue is divided into two parts. The first part includes our regular paper contributions which have been flowing in at a very steady rate for the last two years.<sup>4</sup> The second portion represents Part 1 of our MTT 70th Anniversary special issue, described in detail in Section III.

We lead off our regular paper contributions with a submission from one of our most prolific contributing authors (13 manuscripts to date), Professor Martin Vossiek and his team at Friedrich-Alexander University, Erlangen-Nürnberg, Germany: “Improved Threat Detection in Walk-Through Security Scanning using an Optimized Polarimetric Target Decomposition Method.” The paper presents a new approach to short distance radar scanning for security applications using polarimetric multiple-input multiple-output (MIMO) imaging in the 4–12 GHz frequency range. This is a truly exciting paper and is not to be missed.

Our second regular manuscript is from Professor Bruno Clerckx et al., at Imperial College, London, U.K., and is titled: “Closed-Loop Wireless Power Transfer with Adaptive Waveform and Beamforming: Design, Prototype, and Experiment.” This paper, tackles the problem of enhancing wireless power transfer efficiency for example in battery-less Internet of Things (IoT) applications, through waveform shaping rather than by receiver or transmitter improvements. The authors design, optimize, and verify a closed-loop adaptive waveform and beamforming approach to significantly improve the end-to-end dc power-to-receiver efficiency.

The third paper, “A Novel Design Methodology to Realize a Single Byte Chipless RFID Tag by Loading a Square Open-Loop Resonator with Micro-Metallic Cells,” comes to us from researchers at National University of Sciences and Technology in Islamabad, Pakistan and University of Jeddah in Saudi Arabia. The paper describes a novel geometric resonator-based RFID tag with 8-bit capacity operating in the 6–10 GHz frequency range.

“Analyzing and Optimizing the EIRP of a Phase-Tunable Amplifier-Antenna Array,” from Veli-Pekka Kutinlahti, Anu Lehtovuori, and Ville Viikari at Aalto University, Helsinki, Finland, demonstrates improvement over progressive phase shift methods in increasing the effective isotropic radiated power (EIRP) of an amplifier-antenna array using analysis and optimization of measured load-pull data.

The next five papers are all focused on various filters and applications of aforesaid. Three of these: “Improved TM Dual-Mode Filters with Reduced Fabrication Complexity”;

“Quasi-Elliptical Stub-Based Multi-Resonance Waveguide Filters with Low Manufacturing Complexity for mm-Wave Applications”; and “Dielectric TM-Mode Y-Shaped Doublet Structure,” are all from the group of Professor Michael Höft at Kiel University in Germany, who have now contributed 11 manuscripts to JMW. These papers involve 3-D filters for waveguide applications and include TM (transverse magnetic) dual mode designs demonstrated up to 90 GHz; stub-loaded, very high Q, TE (transverse electric) mode cavities for 110–170 GHz; and ceramic-based, TM-mode, Y-shaped structures comprising a class of dielectric resonator filters.

“Flexible Lumped Microwave Passive Components and Filters on Cellulose Nanofibril Substrates,” from Shuoyang Qiu and a team mostly at University of Wisconsin-Madison, USA, and including renowned EE Professor Linda Katehi, currently at Texas A&M University, describes a set of passive elements (inductors and capacitors) that can be fabricated and survive on flexible biodegradable cellulose substrates. They demonstrate simple filters with bend radii less than 15 mm for use at 4 and 5 GHz. This is a really nice paper with major implications for large scale disposable wearable and then disposable, circuits.

Our last filter paper entitled, “MMIC GaAs Isolators and Quasi-Circulators with co-Designed RF Filtering Functionality,” from Andrea Ashley at University of Colorado-Boulder, USA, and noted Professor Dimitra Psychogiou of University of Cork, Ireland, examines GaAs MMIC isolators and circulators with built-in filter functionality. They present an assortment of state-of-the-art resonator structures at X-band, including a frequency selective isolator and circulator, and their use as filter elements.

The final regular submission to JMW this issue is from Yuji Komatsuzaki at Mitsubishi Electric Corp., Japan, Rui Ma and Mouhacine Benosman at Mitsubishi Electric Research Labs, Cambridge, MA, USA, and Chouaib Kantana at University of Gustave Eiffel in Paris, France. The article is titled “A System Approach for Efficiency Enhancement and Linearization Technique of Dual-Input Doherty Power Amplifier,” and discusses an optimization approach to maximize output power, while maintaining broad linearity in Doherty power amps.

We hope you enjoy these regular papers in addition to our special issue papers which follow.

## III. MTT 70TH ANNIVERSARY SPECIAL ISSUE PAPERS

Due to the large number of contributions and the restricted time schedule for input and review of our special issue papers, we have been forced to break our MTT 70th Anniversary special issue into two parts. The first part will appear here in this winter release of IEEE JOURNAL OF MICROWAVES, and the second part will appear after our regular papers in our spring issue of JMW (vol. 3, no. 2). Several of the longer, and much anticipated historical articles did not make it into Part 1, but will appear in Part 2 in April. After all of the special issue papers have appeared on-line as part of the first two issues in volume 3 of IEEE JOURNAL OF MICROWAVES, we are hoping to collect the articles, re-order them, add a new dedicated

<sup>4</sup>We have been receiving approximately 75 unsolicited manuscripts per year with an accept rate of approximately 40%. About 30 manuscripts per year are invited and typically six to ten are special series and editorial pieces. For 2021 and 2022 we had a total of 229 submissions and published 143 of these (includes regular, invited and special series manuscripts).

introductory editorial, and then generate an archival quality, full-color print issue (similar to our Inaugural release [1]) that we will distribute at the June 2023 International Microwave Symposium as well as through the postal service to a select number of direct requestors. Details for how to receive one of these special print copies will appear on our website as well as in our July issue.

The special issue papers that appear in this issue cover a wide range of microwave subjects and include historical perspectives, overview papers on specific subfields, tutorial articles, and current research on topics of growing interest and applicability.

We open with a series of papers that highlight health and health monitoring applications of microwaves. With most of the world's industrialized nations now having to contend with an increasingly older-age population distribution and a shrinking number of young and affordable healthcare service providers, not to mention the growing concerns over international pandemics, microwave applications in medicine and health monitoring have taken on a new level of importance. Familiar pioneers within our own community, such as Arye Rosen [2] and K. J. Ray Liu [3], amongst many others, have shown us unique ways of applying microwave and even millimeter-wave techniques to solve specific problems within the healthcare community. Liu in particular gives us a great example of how to leverage existing and ubiquitous wireless infrastructure, now in almost every home, and use it to keep tabs on an elderly person living alone to provide a warning of sudden falls [4]. This type of microwave sensing and communications re-use can be applied to the existing and rapidly expanding fields of radio frequency identification (RFID), Internet of Things (IoT), 5G and 6G wireless systems, and the burgeoning areas of commercial radar, both in the transportation sector and in tracking and motion sensing. Our first several papers in this special issue Part 1 all involve devices, applications, and systems that could be applied broadly in support of this general development arena. All are from recognized experts and institutions.

We lead off our special issue Part 1 with a comprehensive overview of microwaves in medicine from highly recognized experts J-C Chiao, Changzhi Li, Jenshan Lin, Robert Caverly, James Hwang, and Harel and Arye Rosen. "Applications of Microwaves in Medicine" reviews microwave-based wearables, energy transfer in tissues, remote sensing for health monitoring, and medical therapies. With almost 600 references, it is a major review of large swaths of the microwave health science field and is an excellent article to bring new researchers up to speed on both historic and current developments.

We follow this comprehensive review with a unique look at microwave-tissue interactions at the microscopic level. "Millimeter-wave Induced Heating of Cutaneous Nerves and Capillaries" is an important early look at radio frequency (RF) heating in tissue on a subwavelength scale. It comes to us from Zain Haider, Julien Modolo, Micaela Liberti, Francesca Apollonio, and noted microwave absorption specialist, Maxim

Zhadobov from University of Rennes, France and Sapienza University of Rome, Italy.

In our only regular submission to the special issue, we have included SMU's J-C Chiao et al., "A Flexible Tuned Radio-Frequency Planar Resonant Loop for Noninvasive Hydration Sensing," which describes a non-invasive method of measuring and monitoring water content changes in tissue, specifically skin. Hydration monitoring is an important diagnostic for human health and one where microwave devices can play a significant and unique role.

More on the design and function of microwave-based wearables and their associations with RFID and 6G communications devices and systems is contained in a very comprehensive overview, "Microwave-Enabled Wearables: Underpinning Technologies, Integration Platforms, and Next-Generation Roadmap," by Mahmoud Wagih and a large team of co-authors from Europe, Asia, and the US. The review is extremely broad-based and contains over 300 references.

The fifth paper in our series of health science related subjects is from the well-regarded team of Victor and Olga Borić-Lubecke at University of Hawaii and colleagues, and investigates the use of wireless systems in providing opportunities to monitor cardiovascular and respiratory functions. The paper is titled: "Physiological Motion Sensing via Channel State Information in NextG Millimeter-Wave Communications Systems."

Essential to all wireless advances in the coming years are low energy, eco-friendly devices that will become the backbone of the Internet of Things (IoT) applications. Our next paper from a large group of researchers in Europe and the USA with corresponding author Jasmin Grosinger from Graz University of Technology in Austria, reviews these next generation IoT devices, and especially those using energy harvesting and with ultra-low power. Their paper: "Next-Generation IoT Devices: Sustainable Eco-Friendly Manufacturing, Energy Harvesting, and Wireless Connectivity," is extremely comprehensive and has almost 200 references.

Finally, although not directly addressing health applications, the paper by Ashkan Azarfar, Nicolas Barbot, and Etienne Perret from University of Grenoble Alpes, France, investigates a new type of motion modulated backscatter communication technique using RFID devices and principles to monitor the movement of objects at a distance. The concept can certainly be added to the toolset of devices and techniques that is already being applied for patient and personal safety monitoring. The paper is titled: "Motion-Modulated Chipless RFID."

We now move away from medical applications and into the regime of ultra-high frequency circuits and systems with two THz review papers from a prestigious group of terahertz experts, mostly from teams in Germany, which have been focusing on high frequency communications and terahertz time-domain spectroscopy applications.

The first paper, from corresponding author Jan Balzer et al., "THz Systems Exploiting Photonics and Communications

Technologies,” goes into significant depth on current applications and future uses of THz time domain techniques as well as the growing interest in THz communications systems. The second paper, initiated by well-known THz communications leader and researcher, Thomas Kaiser at University of Duisberg-Essen, and multiple colleagues, reviews THz measurement techniques, especially those associated with imaging and communications. The paper is titled: “THz Measurements, Antennas, and Simulations: From the Past to the Future.” A third THz focused paper from Thomas Kaiser et al., highlighting sources and detectors, is in the queue for our April special issue Part 2.

Continuing with THz devices, in this case sources, the paper by Ben Williams’ group at UCLA, USA (with fabrication by John Reno at Sandia National Laboratories, NM, USA), describes a new class of THz quantum cascade lasers with broad tunability across the 2-5 THz regime. The paper is titled: “Wavelength Scaling of Widely-Tunable Terahertz Quantum-Cascade Metasurface Lasers.”

We have all benefitted from the enormous progress that has been made over the past six decades on computational techniques in electromagnetics largely enabled by exponential advances in computing power. Our next two articles cover some of these important development areas.

In “An Early History of Optimization Technology for Automated Design of Microwave Circuits,” noted authors John Bandler and José Rayas-Sánchez cover the detailed history of numerically-based microwave circuit optimization techniques going back to William Getsinger’s pioneering efforts in the 1960s and through to current day. The paper is filled with many nice historic photos and contains over 250 references. The Bandler/Sánchez article is followed by computational electromagnetics pioneer Wolfgang Hoefler’s, “A Brief History of Computational Electromagnetics in Microwave Engineering - A Personal Retrospective,” which goes into some detail regarding the development and use of numeric techniques and the people who pioneered them over the course of 70 years of MTT history.

As we move on to the second half of our special issue papers, we are very pleased to bring you an article from EE Professor Ali Hajimiri’s group at Caltech covering the emerging field of “shape-shifting” (*editor’s designation*) arrays. In “Frontiers in Flexible and Shape-Changing Arrays,” Austin Fikes et al. review their ground breaking work on prescribing the shape and induced performance changes for phased arrays on a flexible substrate. They discuss the challenges of optimizing performance on a real-time shape-changing substrate with applications from wearables to large purposeful shape-shifting aperture arrays.

Keeping to the theme of microwave antennas, our own Ke Wu of Montréal Polytechnic University, Canada, and Dongze Zheng and Chi Hou Chan, from City University of Hong Kong, China, contributed “Leaky-Wave Structures and Techniques for Integrated Front-End Antenna Systems,” which focuses on leaky-wave antenna theory and applications, and contains more than 230 references.

IEEE Fellows Joan Ferron Martin and Francisco Medina teamed up to contribute a paper for our special issue on differential-mode (balanced) transmission lines. The paper contains extensive theoretical background and both historic and current applications and is titled “Balanced Microwave Transmission Lines, Circuits, and Sensors.” This comprehensive overview is extremely extensive (more than 40 pages) and has over 250 references.

Our next two contributions focus on recently developed and extremely useful high power devices based on GaN. In “GaN Integrated Circuit Power Amplifiers: Developments and Prospects,” Reza Nikandish from University of Cork, Ireland, takes us through the history as well as current and future prospects of GaN power devices and amplifiers. Reza’s article is followed by another GaN paper from newly elected National Academy of Engineering Fellow Zoya Popovic and her group at University of Colorado Boulder, USA. “V - and W - Band Millimeter-Wave GaN MMICs” provides a detailed overview of state-of-the-art GaN MMIC circuits, their development, performance, and applications.

We now move into the very popular microwave field of transmission lines and filters with another feature article from transmission line expert Professor Ke Wu, this time with colleague Kang Zhou of Eastern Institute for Advanced Study, Ningbo, China. The article, “Substrate Integrated Waveguide Multiband Bandpass Filters and Multiplexers: Current Status and Future Outlook,” reviews a wide variety of substrate integrated filters and applications, especially SIW (substrate integrated waveguide) structures that were pioneered by Professor Wu.

Microwave acoustic wave devices has been a burgeoning commercial field since their introduction into mobile phones in the 1990s. In this next special issue contribution from Amelie Hagelauer at Fraunhofer EMFT in Munich, Germany, and multiple colleagues from both university and industry, the history, latest developments, and applications of acoustic wave devices – up to millimeter frequencies – is presented. The article is very complete and will give the reader a nice summary of this now popular field, and includes over 150 references. The article is titled “From Microwave Acoustic Filters to Millimeter-Wave Operation and New Applications.”

Southeast University’s Tie Jun Cui in Nanjing, China, and colleagues at Peking University, Beijing, provided a very interesting summary of their EMIS (electromagnetic inverse scattering) and adaptive learning technique to reconstruct poorly resolved images in “Towards Intelligent Electromagnetic Inverse Scattering using Deep Learning Techniques and Information Metasurfaces.”

It is appropriate that our final contribution to our MTT 70th Anniversary special issue Part 1 is also from prolific JMW contributor and noted radar expert Martin Vossiek and his group at Friedrich-Alexander University, Erlangen-Nürnberg, Germany. Their paper is a tutorial piece on sequential sampling impulse radar and is appropriately titled “A Tutorial on the Sequential Sampling Impulse Radar Concept and Selected Applications.”

In order to make it possible to bring up all the papers in both Part 1 and Part 2 of the special issue on IEEEExplore or other article search engines, every paper contains the index term “MTT 70th Anniversary Special Issue.” By grouping all five words in parentheses the entire set of published special issue papers can be accessed in a single search.

We hope you find these special issue articles, as well as our regular contributions, both interesting and useful. We will bring you the remaining special issue manuscripts in our spring issue, and hopefully all thirty or so special issue papers re-ordered, repaginated, and with a dedicated introduction, in a planned full color printed compendium with a targeted availability of June 2023. Please visit our website: <http://www.mtt.org/publications/journal-of-microwaves> for updates on this special print release.

#### IV. 2021/2022 OUTSTANDING REVIEWERS

As promised in our Spring 2022 Editorial [5], we begin this year with a very special tribute to our “Outstanding Reviewers” of 2021-2022. Over the last few months we asked authors and topic editors to search through their past papers and nominate particular reviews that made a real difference to the quality of a particular manuscript or the ability of an editor to make a decision on the true merits of a submitted paper. After considerable effort, we also convinced both the MTT Society Awards Committee and the IEEE Technical Activities Board Awards and Recognition Committee chairs that we could/should recognize individuals who have gone above and beyond in evaluating manuscripts. Especially important to this EiC were the recommendations of authors – many of whom had lots of extra work to do after receiving their reviewer comments – in suggesting reviews that really helped them improve their submissions. It might surprise you to hear that the authors who had to do the most work to satisfy their reviewers were the ones who made the majority of the nominations.

In all cases, reviewer identities were kept completely anonymous (only the EiC knew the actual names) and the final evaluations of all nominees was completed with the full set of our JMW Topic Editors.

Out of some 400 reviewers who completed one or more paper evaluations, we selected five outstanding individuals who have submitted extremely helpful reviews, based either on author or editor recommendations. We also recognize the reviewer who has done the most evaluations for us: Professor **Jeffrey Nanzer** of Michigan State University, East Lansing, MI, USA. The citations for outstanding individual reviews are: Professor **Vicente E. Boria** from iTEAM-DCOM, Universitat Politècnica de València, Spain; Professor **Sean Victor Hum**, from University of Toronto, Canada; Dr. **Nabil El-Hinnawy** at Tower Semiconductor, Newport Beach, CA, USA; Dr. **Emily Naviasky** a graduate student at University of California Berkeley, USA, when she performed her review and now, with IBM T.J. Watson Research Center, Yorktown Heights, NY, USA; and graduate student **Ir. Marie Mertens** from Katholieke Universiteit Leuven, Leuven, Belgium and Polytechnique Montréal, Canada.

Each of these individuals has received a special certificate of appreciation from the MTT Society and their names will appear in an upcoming issue of MICROWAVE MAGAZINE and in our MTT Newsletter. A very wholehearted “*Thank You and Well Done,*” from the entire IEEE JMW team!

#### V. 2021 BEST PAPER PRIZE

Starting this past summer, an awards committee with representatives from all twenty-six Technical Committees<sup>5</sup> within the Microwave Theory and Technology Society (MTT-S) was established, and began to consider all papers published in the IEEE JOURNAL OF MICROWAVES during the calendar year 2021 for our first “Best Paper Prize.” More than one hundred manuscripts were reviewed, and the committee selected two finalists to be presented to the larger MTT-S awards committee, which oversees this selection process. The winning paper is [6], “Microwave and Millimeter Wave Power Beaming,” by authors Christopher T. Rodenbeck, Paul I. Jaffe, Bernd H. Strassner II, Paul E. Hausgen, James O. McSpadden, Hooman Kazemi, Naoki Shinohara, Brian B. Tierney, Christopher B. DePuma and Amanda P. Self. After appearing in our Inaugural Issue in January 2021, this paper rose to the top 20 of all papers in IEEEExplore in usage counts during April 2021 and currently boasts more than 15,000 views and almost 40 IEEEExplore citations, the most of any of our 2021 papers (remember we are not indexed on any databases except IEEEExplore at this time). The corresponding author, Dr. Chris Rodenbeck, is at the US Naval Research Laboratory in Washington, DC and the other authors are affiliated with Sandia National Laboratories, Albuquerque, NM; Air Force Research Laboratory, Kirkland Air Force Base, NM; Raytheon Technologies Corp., Dallas, TX and Thousand Oaks, CA; and Kyoto University in Japan. A link to the paper can be found in the references. Congratulations to all the authors for an excellent contribution to IEEE JOURNAL OF MICROWAVES.

There was a second paper that the committee also considered to be worthy of our 2021 Best Paper prize, and it receives a heartfelt Honorable Mention. The paper is [7]: “Microwaves in Quantum Computing,” by Joseph C. Bardin, Daniel H. Slichter, and David J. Reilly. The corresponding author, Joseph Bardin, is at Google LLC, Goleta, CA, and the Department of Electrical and Computer Engineering, University of Massachusetts Amherst, Amherst, MA, USA. Daniel Slichter is at the National Institute of Standards in Boulder, CO, and David Reilly is from the department of physics at University of Sydney, Sydney, Australia. This paper also rose to the IEEE Xplore top 20 in April 2021 and currently has almost 7000 views and 26 citations on Xplore.

Although the MTT Society rules dictate that there can be only one Best Paper prize each cycle, both of these outstanding contributions merit the citation. They are both papers on

<sup>5</sup>The current 26 MTT technical committees are listed on the IEEE JOURNAL OF MICROWAVES web page: <https://mtt.org/publications/journal-of-microwaves/>, under: Editorial Board (at the very bottom of the page), and they are detailed on the MTT Society web pages under Technical Coordination Committees (<https://mtt.org/technical-committees-list/>).

topics of growing interest to the microwave community. They were also exceptionally comprehensive, extremely well written, well organized, and well received. Our 2022 Best Paper prize will be deliberated upon this summer and an announcement will follow early in 2024.

## VI. OUR EDITORIAL TEAM

Most of our twenty-four Topic Editors have been serving since April 2020 – we just completed our 34th monthly telecon. They were chosen from the Chairs, vice-Chairs, and key participants of all twenty-six active technical committees within the Microwave Theory and Technology Society. In addition to technical expertise and academic, governmental, and industrial backgrounds, we also have significant publications experience and leadership skills on our Editorial Board, which includes three former and three current IEEE journal Editors-in-Chief, a former MTT-S AdCom President, and twelve current and former IEEE journal Associate Editors. Many have AE experience on multiple journals. Our efforts are also aided by a senior Administrative Editor, Kara McArthur, a very experienced Assistant Editor, Sharri Shaw, and an experienced production editor, Joanna Gojlik. Photos and short bios of our team can be found at the end of this editorial.

## ACKNOWLEDGMENT

This issue we would like to acknowledge exceptional help and support from Louis Vacca and Joanna Gojlik for getting our very first special issue completed and published and for arranging for the printing of same. We also want to thank Samantha Jacobs for her exceptional support of our Author Portal process. Samantha has been responding at all times of the day and all days of the week to the few glitches that have come up with this very new author input process – we were only the ninth journal in IEEE (out of 270+) to switch over. This EiC would also like to especially thank Professor Ke Wu for all his work, advice, and support on leading the concept, development of, and solicitations for papers comprising this special issue celebrating the 70th Anniversary of the Microwave Theory and Technology Society (1952–2022).

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## EDITORIAL BOARD

### EDITOR-IN-CHIEF



**PETER H. SIEGEL** (Life Fellow, IEEE) received the B.A. degree in astronomy from Colgate University, Hamilton, NY, USA, in 1976 and the M.S. degree in physics and the Ph.D. degree in electrical engineering from Columbia University, New York, NY, USA, in 1978 and 1983, respectively. He was a Research Fellow and Engineering Staff with the NASA Goddard Institute for Space Studies, New York, NY, USA, from 1975 to 1983; a Staff Scientist with the National Radio Astronomy Observatory, Central Development Labs, Charlottesville, VA, USA, from 1984 to 1986; a Technical Group Supervisor and Senior Research Scientist with the Jet Propulsion Laboratory (JPL), National Aeronautics and Space Administration (NASA), Pasadena, CA, USA, from 1987 to 2014; and a Faculty Associate of electrical engineering and Senior Scientist of biology with the California Institute of Technology (Caltech), Pasadena, CA, from 2002 to 2014. At JPL, he founded and led for 25 years, the Submillimeter Wave Advanced Technology (SWAT) Team, a Group of more than 20 scientists and engineers developing THz technology for NASA's near and long-term space missions, which included delivering key components for four major satellite missions and leading more than 75 smaller research and development programs for NASA and the U.S. Department of Defense. At Caltech, he was involved in new biological and medical applications of THz, especially low-power effects on neurons and most recently millimeter-wave monitoring of blood chemistry. He was an IEEE Distinguished Lecturer and the Vice-Chair and Chair of the IEEE MTT-S THz Technology Committee. He is currently an Elected Member of the MTT-S AdCom. He has more than 300 articles on THz components and technology and has given more than 250 invited talks on this subject throughout his career of 45 years in THz. He is currently the CEO of THz Global, a small research and development company specializing in RF bio-applications, a Senior Scientist Emeritus of biology and electrical engineering with Caltech, and a Senior Research Scientist Emeritus and a Principal Engineer JPL, NASA. Dr. Siegel has been recognized with 75 NASA technology awards, ten NASA team awards, NASA Space Act Award, three individual JPL awards for technical excellence, four JPL team awards, and IEEE MTT-S Applications Award in 2018. He is honored to continue the responsibilities in 2022, as the Founding Editor-in-Chief of IEEE JOURNAL OF MICROWAVES, which he hopes will invigorate the microwave field. Among many other functions, he was the Founding Editor-in-Chief of IEEE TRANSACTIONS ON TERAHERTZ SCIENCE AND TECHNOLOGY, from 2010 to 2015, and the Founder, in 2009, Chair through 2011, and has been a elected General Secretary since 2012, of the International Society of Infrared, Millimeter, and Terahertz Waves (IRMMW-THz), the world's largest non-profit society devoted to THz science and technology. Dr. Siegel is also an appointed Editorial Board Member of IEEE ACCESS through 2025.

## TOPIC EDITORS (ALPHABETICALLY)

### TC-3 & TC-24 TOPIC EDITOR: MICROWAVE MEASUREMENTS & MICROWAVE/MM-WAVE RADAR, SENSING, AND ARRAY SYSTEMS



**SHERIF S. AHMED** (Senior Member, IEEE) received the M.Sc. degree in microwave engineering from the Technical University of Munich, Munich, Germany, in 2007, and the Ph.D. (Dr. Ing.) degree from the University of Erlangen-Nürnberg, Erlangen, Germany, in 2013. He is currently an Adjunct Professor with Stanford University, Stanford, CA, USA, and assembles more than 15 years of professional industry experience in various R&D roles. He has coauthored more than 25 research papers, more than 20 patents, and a book on advanced microwave imaging methods. Dr. Ahmed was the recipient of the University Academic Award of the Technical University of Munich in 2007, Innovation Award of Rohde & Schwarz (R&S) in 2009 and 2018, and IEEE MTT Microwave Prize Award of 2013. He is also the Chair of the IEEE

N42.59 Standard for Measuring the Imaging Performance of Active mmWave Systems for Security Screening of Humans. His R&D focus extends to microwave and mmWave imaging, stand-off THz sensing, multistatic radars, advanced signal-processing techniques, terahertz technology, and last but not least, automotive radar design and characterization. Over the past decade, he pioneered the body scanner technology with the first fully electronic multistatic millimeter wave imaging systems, which are being deployed worldwide today at airport checkpoints. In the recent years, he has been advancing the qualifications of automotive radars, toward autonomous driving capabilities.

#### TC-11 TOPIC EDITOR: MICROWAVE LOW-NOISE TECHNIQUES

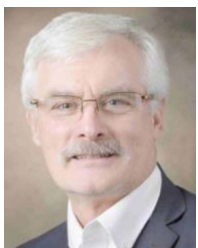


**JOSEPH BARDIN** (Senior Member, IEEE) received the Ph.D. degree in electrical engineering from the California Institute of Technology, Pasadena, CA, USA, in 2009. In 2010, he joined the Department of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA, USA, where he is currently a Full Professor. His research group currently focuses on low temperature integrated circuits with applications in radio astronomy and the quantum information sciences. In 2017, he joined the Google Quantum

AI Team, as a Visiting Faculty Researcher and in addition to his university appointment, he is currently a Staff Research Scientist with this team.

Dr. Bardin was the recipient of the 2011 DARPA Young Faculty Award, 2014 NSF CAREER Award, 2015 Office of Naval Research YIP Award, 2016 UMass Amherst College of Engineering Barbara H. and Joseph I. Goldstein Outstanding Junior Faculty Award, 2016 UMass Amherst Award for Outstanding Accomplishments in Research and Creative Activity, and 2020 IEEE MTT-S Outstanding Young Engineer Award.

#### TC-20 TOPIC EDITOR: HF-VHF-UHF TECHNOLOGIES AND APPLICATIONS



**ROBERT H. CAVERLY** (Life Fellow, IEEE) received the Ph.D. degree in electrical engineering from Johns Hopkins University, Baltimore, MD, USA, in 1983. Since 1997, he has been a Faculty Member with the Department of Electrical and Computer Engineering, Villanova University, Villanova, PA, USA, where he is currently a Full Professor. He was a Professor for more than 14 years with the University of Massachusetts Dartmouth, Dartmouth, MA, USA. He has authored or coauthored more than 100 journal and conference

papers and is the author of two books, *Microwave and RF Semiconductor Control Device Modeling* and *CMOS RFIC Design Principles* from Artech House. His research interests include the characterization of semiconductor devices, such as PIN diodes and FETs in the microwave and RF control environment.

Dr. Caverly is currently the Editor-in-Chief of IEEE MICROWAVE MAGAZINE and a member of the MTT-S AdCom and was the General Chair of the 2020 IEEE Radio and Wireless Week.

#### TC-28 TOPIC EDITOR: BIOLOGICAL EFFECTS AND MEDICAL APPLICATIONS



**J.-C. CHIAO** (Fellow, IEEE) received the B.S. degree from the Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan, in 1988, and the M.S. and Ph.D. degrees in electrical engineering from the California Institute of Technology, Pasadena, CA, USA, in 1991 and 1995, respectively. He was a Research Scientist with the Optical Networking Systems and Testbeds Group, Bell Communications Research; an Assistant Professor of electrical engineering with the University of Hawaii at Mānoa, Honolulu, HI, USA; and a

Product Line Manager and Senior Technology Advisor with Chorum Technologies. From 2002 to 2018, he was the Janet and Mike Greene endowed Professor and Jenkins Garrett Professor of electrical engineering with the University of Texas – Arlington, Arlington, TX, USA. He is currently the Mary and Richard Templeton Centennial Chair Professor of electrical and

computer engineering with Southern Methodist University, Dallas, TX, USA. He has authored or coauthored and edited numerous peer-reviewed technical journal and conference papers, book chapters, proceedings, and books. He holds 16 patents in RF MEMS, MEMS optical, liquid crystal, nano-scale fabrication, and wireless medical sensor technologies. His research works have been covered by media extensively, including *Forbes*, *National Geographic Magazine*, National Public Radio, and CBS Henry Ford Innovation Nation.

Dr. Chiao was the recipient of the Lockheed Martin Aeronautics Company Excellence in Engineering Teaching Award, Tech Titans Technology Innovator Award, Research in Medicine Award in the Heroes of Healthcare, IEEE Region five Outstanding Engineering Educator Award, IEEE Region five Excellent Performance Award, 2012–2014 IEEE MTT Distinguished Microwave Lecturer Award, 2017–2019 IEEE Sensors Council Distinguished Lecturer Award, and 2011 Edith and Peter O'Donnell Award in Engineering by The Academy of Medicine, Engineering and Science of Texas. He has been the Chair of several international conferences, including 2018 IEEE International Microwave Biomedical Conference (IMBioC). He was the Chair of the IEEE MTT-S Technical Committee ten Biological Effect and Medical Applications of RF and Microwave, Technical Program Chair of the 2019 IEEE International Wireless Symposium, and an Associate Editor for IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES. He is the Founding Editor-in-Chief of IEEE JOURNAL OF ELECTROMAGNETICS, RF, AND MICROWAVES IN MEDICINE AND BIOLOGY.

#### TC-23 & TC-25 TOPIC EDITOR: WIRELESS COMMUNICATIONS & WIRELESS POWER TRANSFER AND ENERGY CONVERSION



**ZHIZHANG (DAVID) CHEN** (Fellow, IEEE) received the B.Eng. degree in radio engineering from Fuzhou University, Fuzhou, China, the master's degree in radio engineering from Southeast University, Nanjing, China, and the Ph.D. degree in electrical engineering from the University of Ottawa, Ottawa, ON, Canada. In 1993, he was an NSERC Postdoctoral Fellow with McGill University, Montreal, QC, Canada. He is currently with the College of Physics and Information Engineering, Fuzhou University, on leave from the

Department of Electrical and Computer Engineering, Dalhousie University, Halifax, NS, Canada, where he is currently a Professor and the former Head of the Department of Electrical and Computer Engineering. He has been an Adjunct or a Visiting Professor with the University of Nottingham, Nottingham, U.K.; École Nationale Supérieure des Télécommunications de Bretagne, Plouzané, France; Shanghai Jiao Tong University, Shanghai, China; Fuzhou University, Fuzhou, China; Hong Kong University of Science and Technology, Hong Kong; and University of Electronic Science and Technology of China, Chengdu, China. He has authored or coauthored more than 450 journal and conference papers in computational electromagnetics, RF/microwave electronics, antennas, and wireless technologies. He was one of the originators of the unconditionally stable methods that have been highly cited and used. His current research interests include time-domain electromagnetic modeling techniques, antennas, wideband wireless communication and sensing systems, and wireless power technology. His team also developed several nonlinear ultra-wideband receivers and planar wireless power transfer transmitting and receiving structures.

Dr. Chen was the Guest Editor of IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, *IEEE Microwave Magazine*, IEEE JOURNAL OF ELECTROMAGNETICS, RF AND MICROWAVES IN MEDICINE AND BIOLOGY, and *International Journal of Numerical Modeling* (Wiley) and an Associate Editor for IEEE JOURNAL OF MULTISCALE AND MULTIPHYSICS COMPUTATIONAL TECHNIQUES. He was also the founding Chair of the joint Signal Processing and Microwave Theory and Techniques Chapter of IEEE Atlantic Canada, Chair of the IEEE Canada Atlantic Section, and a member of the Board of Directors for IEEE Canada during 2000–2001. He is currently the Track Editor of IEEE TRANSACTIONS ON MICROWAVE AND TECHNIQUES, a Topic Editor of IEEE JOURNAL OF MICROWAVES, and an elected member of the Ad-Com of IEEE Antennas and Propagation Society. He was the recipient of the 2005 Nova Scotia Engineering Award, 2006 Dalhousie Graduate Teaching Award, 2007 and 2015 Dalhousie Faculty of Engineering Research Award, 2013 IEEE Canada Fessenden Medal, and Dalhousie University Professorship. He is a Fellow of the Canadian Academy of Engineering, and Engineering Institute of Canada.

**TC-24 & TC21 TOPIC EDITOR: MICROWAVE/MM-WAVE RADAR, SENSING, AND ARRAY SYSTEMS & TERAHERTZ TECHNOLOGY AND APPLICATIONS**


**KEN B. COOPER** (Senior Member, IEEE) received the A.B. degree in physics from Harvard College, Cambridge, MA, USA, in 1997, and the Ph.D. degree in physics from the California Institute of Technology, Pasadena, CA, USA, in 2003. Following postdoctoral research in superconducting microwave qubits, he has been an RF Microwave Engineer with Jet Propulsion Laboratory (JPL), NASA, since 2006, where he has been recognized with the Lew Allen Award for Excellence, Ed Stone Award for an Outstanding

Research Publication, and a Principal designation for the development of active THz sensors, systems, and techniques. His work with JPL has included the development of scanning 340 GHz and 670 GHz imaging radars for concealed object detection, a compact 95 GHz Doppler radar and 270/560 GHz spectrometer for cometary jet observation, and differential absorption radars at 170 GHz and 560 GHz for humidity sounding on Earth and Mars.

**TC-12 TOPIC EDITOR: MICROWAVE HIGH-POWER TECHNIQUES**


**STEVE C. CRIPPS** (Life Fellow, IEEE) received the master's and Ph.D. degrees from Cambridge University, Cambridge, U.K., in 1970. After working for several years with the Pioneering Gallium Arsenide (GaAs) Group, Plessey Research, he emigrated USA, where he worked for 15 years in various engineering and management positions with Watkins Johnson, Loral, and Celeritek. In 1996, he returned to the U. K., as an independent consultant before taking on an academic post with Cardiff University, Cardiff, U.K., where he is currently a

Distinguished Research Professor. He has authored several bestselling books on RFP design and is a regular contributor to *IEEE Microwave Magazine* with his popular "Microwave Bytes" column. Dr. Cripps was the recipient of the 2008 IEEE Microwave Application Award.

**TC-22 & TC-10 TOPIC EDITOR: MICROWAVE PHOTONICS & SIGNAL GENERATION AND FREQUENCY CONVERSION**


**AFSHIN S. DARYOUSH** (Fellow, IEEE) received the B.S. degree in electrical engineering and applied physics from Case Western Reserve University, Cleveland, OH, USA, in 1981, and the M.S. and Ph.D. degrees in electrical and computer engineering from Drexel University, Philadelphia, PA, USA, in 1984 and 1986, respectively. He is currently a Professor of electrical and computer engineering with Drexel University, where he has developed courses in devices, circuits, and sub-systems employed in microwaves, photonics, and

antennas. He also conducts research in microwave photonics applied to telecommunications and biomedical engineering that resulted in more than 300 technical articles, 21 patents, and eight book chapters. In 2011, he became a Member of the Franklin Institute's Committee on Science and the Arts.

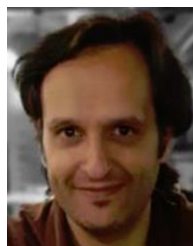
Dr. Daryoush was the recipient of the Drexel University's Graduate Teaching Award in 2000, IEEE Philadelphia Section's Franklin Key Award in 2015, and Drexel University's Alumni Award in 2018. After receiving the Microwave Prize in 1986, his 13 articles have been recognized as the best student papers in various IEEE conferences. He has also been organizing various IEEE conferences since 1993, particularly is the TPC Chair of Radio Wireless Symposium 2008 (RWS 2008) and Chair of the Radio and Wireless Week 2009 (RWW2009), Microwave Photonics 2010 (MWP 2010), Benjamin Franklin Symposium on Microwave and Antenna Sub-Systems 2014 (BenMAS 2014), and International Microwave Symposium 2018 (IMS 2018).

**TC-29 TOPIC EDITOR: MICROWAVE AEROSPACE SYSTEMS**


**NELSON J. G. FONSECA** (Senior Member, IEEE) received the M.Eng. degree in electrical engineering from Ecole Nationale Supérieure d'Electrotechnique, Electronique, Informatique, Hydraulique et Télécommunications (ENSEEIH), Toulouse, France, in 2003, the M.Sc. degree in electrical engineering from the Ecole Polytechnique de Montreal, Montreal, QC, Canada, in 2003, and the Ph.D. degree in electrical engineering from Institut National Polytechnique de Toulouse – Université de Toulouse, Toulouse,

France, in 2010. He is currently an Antenna Engineer for the Antenna and Sub-Millimetre Wave Section, European Space Agency, Noordwijk, The Netherlands. Since November 2020, he has held an Honorary Appointment as a Professional Fellow with the University of Technology Sydney, Sydney, NSW, Australia. He has authored or coauthored more than 270 papers in peer-reviewed journals and conferences and holds more than 50 patents issued or pending. His research interests include multiple beam antennas for space missions, beam-former theory and design, ground terminal antennas, transfer of technology from and to terrestrial systems, including 5G networks, and novel manufacturing techniques.

Dr. Fonseca was the Chair of the 38th ESA Antenna Workshop in 2017, and Co-Chair of the 2018 IET Loughborough Antennas and Propagation Conference (LAPC 2018). He was an Associate Editor for IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES from 2020 to 2022 and the Co-Guest Editor of a focused issue on microwave aerospace systems in *IEEE Microwave Magazine* in 2022. He is currently an Associate Editor for *IET Microwaves, Antennas and Propagation* and IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION and the Topic Editor of IEEE JOURNAL OF MICROWAVES. He is also the Chair of the newly founded IEEE MTT-S Technical Committee 29 (TC-29) on Microwave Aerospace Systems. He has been a Board Member of the European School of Antennas and Propagation since January 2019, and is also the coordinator of the ESA/ESoA course on antennas for space applications, for which he was voted best lecturer by the participants of the 2020 edition. He is an elected EurAAP Regional Delegate representing Benelux for the term 2021–2023. He was the recipient of several prizes and awards, including the Best Young Engineer Paper Award at the 29th ESA Workshop on Antennas in 2007, ESA Teamwork Excellence Award in 2020, Best Applied Technology Antenna Paper Award at EuCAP 2022, and multiple ESA Technical Improvement Awards.

**TC-5 TOPIC EDITOR: FILTERS**


**ROBERTO GÓMEZ-GARCÍA** (Senior Member, IEEE) received the Dipl.-Eng. degree in telecommunication engineering and the Ph.D. degree in electrical and electronic engineering from the Polytechnic University of Madrid, Madrid, Spain, in 2001 and 2006, respectively. Since 2006, he has been an Associate Professor with the Department of Signal Theory and Communications, University of Alcalá, Alcalá de Henares, Spain. He has been for several research stays with C2S2 Department, XLIM Research Institute, University of Limoges, Limoges, France; Telecommunications Institute, University of Aveiro, Aveiro, Portugal; U.S. Naval Research Laboratory, Microwave Technology Branch, Washington, DC, USA; and Purdue University, West Lafayette, IN, USA. He is also an Adjunct Part-Time Professor with the University of Electronic Science and Technology of China, Chengdu, China, and was an Invited Professor with the Gdansk University of Technology, Gdansk, Poland, during 2019–2020. He has authored or coauthored more than 100 papers in international journals and more than 140 papers in international conferences in his research field, which include the design of fixed/tunable high-frequency filters and multiplexers in planar, hybrid, and monolithic microwave-integrated circuit technologies, multifunction circuits and systems, software-defined radio and radar architectures for telecommunications, remote sensing, and biomedical applications.

Dr. Gómez-García was a member of the Technical Review Board for several IEEE and EuMA conferences. He is a member of the IEEE MTT-S Filters (MTT-5), IEEE MTT-S RF MEMS and Microwave Acoustics (MTT-6), IEEE MTT-S Wireless Communications (MTT-23), IEEE MTT-S Biological Effects and Medical Applications of RF and Microwave (MTT-28), and IEEE



CAS-S Analog Signal Processing Technical Committees. He was the recipient of the 2016 IEEE Microwave Theory and Techniques Society (MTT-S) Outstanding Young Engineer Award. He was an IEEE CAS-S Distinguished Lecturer during 2020–2021. He was an Associate Editor for IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES from 2012 to 2016 and IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS—PART I: REGULAR PAPERS from 2012 to 2015. He was the Senior Editor of IEEE JOURNAL ON EMERGING AND SELECTED TOPICS IN CIRCUITS AND SYSTEMS from 2016 to 2017. He was the Guest Editor of several special/focus issues and sections in IEEE and IET journals. In addition to his role on IEEE JOURNAL OF MICROWAVES, he is the Editor-in-Chief of IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS, an Associate Editor for the IEEE JOURNAL OF ELECTROMAGNETICS, RF AND MICROWAVES IN MEDICINE AND BIOLOGY, IEEE ACCESS, *IET Microwaves, Antennas, and Propagation*, and *International Journal of Microwave and Wireless Technologies*, and the MTT-S Newsletter Working Group Chair.

#### TC-6 TOPIC EDITOR: RF MEMS AND MICROWAVE ACOUSTICS



**SONGBIN GONG** (Senior Member, IEEE) received the B.S. degree in electrical engineering from the Huazhong University of Science and Technology, Wuhan, China, in 2004, and the Ph.D. degree in electrical engineering from the University of Virginia, Charlottesville, VA, USA, in 2010. He is currently an Associate Professor and Intel Alumni Fellow with the Department of Electrical and Computer Engineering and Holonyak Micro and Nanotechnology Laboratory, University of Illinois at Urbana-Champaign (UIUC), Urbana, IL,

USA.

His research interests include the design and implementation of MEMS and acoustic devices, components, subsystems for RF front ends, and hybrid microsystems based on the integration of MEMS devices with circuits or photonics for signal processing. He was the recipient of the 2014 Defense Advanced Research Projects Agency Young Faculty Award, 2017 NASA Early Career Faculty Award, 2019 Dean's Award for Excellence in Research at UIUC, and 2019 IEEE Ultrasonics Early Career Investigator Award. Along with his students and postdocs, he was the recipient of the Best Paper Awards from the 2017 and 2019 IEEE International Frequency Control Symposium and the 2018 and 2019 IEEE International Ultrasonic Symposium, and the 2nd place in the Best Paper Competition at the 2018 International Microwave Symposium. He was an Associate Editor for IEEE TRANSACTIONS ON ULTRASONICS, FERROELECTRICS, AND FREQUENCY CONTROL and *Journal of Microelectromechanical Systems*, and also the Technical Committee Chair of MTT-6 RF-MEMS and Microwave Acoustics of the IEEE Microwave Theory and Techniques Society.

#### TC-7 TOPIC EDITOR: MICROWAVE SUPERCONDUCTIVITY AND QUANTUM TECHNOLOGIES



**MICHAEL C. HAMILTON** (Senior Member, IEEE) received the B.S.E.E. degree from Auburn University, Auburn, AL, USA, in 2000, and the M.S.E.E. and Ph.D. degrees in electrical engineering from The University of Michigan, Ann Arbor, MI, USA, in 2003 and 2005, respectively. He joined the Department of Electrical and Computer Engineering, Auburn University, Auburn, AL, USA, as an Assistant Professor in 2010 and was promoted to a Professor in 2019. His research group with Auburn University, he is currently the

Director of the Alabama Micro/Nano Science and Technology Center. In 2022, he joined the Google Quantum AI Team as a Visiting Faculty Researcher. From 2006 to 2010, he was a Member of Technical Staff with MIT-Lincoln Laboratory, where he worked on instrument-level and system-level projects for next-generation geostationary imaging for weather satellite systems, testing, and modeling of highly scaled and environmentally-optimized CMOS devices subjected to extreme environmental (cryogenic) conditions, and modeling, design, fabrication and test of advanced technologies for high-frequency RF sample-and-hold and analog digital conversion circuits based on fully-depleted silicon-on-insulator transistors and CCD structures. His research interests include superconducting electronics technologies,

micro/nano fabrication, packaging, and integration of high-speed systems, signal and power integrity of densely integrated systems, application of micro and nanostructures for enhanced performance of RF and microwave systems and packaging for extreme environments, including cryogenic and quantum systems. He is also the Auburn University IEEE Student Chapter Faculty Advisor and is the Chair of MTT-7 Technical Committee on Microwave Superconductivity and Quantum Technologies.

#### TC-21 TOPIC EDITOR: TERAHERTZ TECHNOLOGY AND APPLICATIONS



**DMITRY KHOKHLOV** received the M.S., Ph.D., and Doctor of Science (Russian analog of the Habilitation degree in Germany) degrees from M.V. Lomonosov Moscow State University, Moscow, Russia, in 1980, 1982, and 1992, respectively. Since 1982, he has been with the Department of Physics, M.V. Lomonosov Moscow State University, in positions from a Junior Research Fellow up to Full Professor, since 1997, and the Head of the Chair of General Physics and Condensed Matter Physics, since 2006. He has authored or coauthored

more than 350 research/conference papers, edited one research monograph, and filed two patents. His research interests include physics of narrow-gap semiconductors, development of sensitive detectors of terahertz radiation, photoelectric phenomena under terahertz excitation, organic semiconductors, and several other areas. In 2008, he was elected as a Correspondent Member of the Russian Academy of Sciences. Since 2013, he has been the Head of the Expert Council on Condensed Matter Physics of the Russian Foundation for the Basic Research. Since 2015, he has also been the Head of the Expert Council on International Research Projects of the same Foundation. He has been active in teaching and he has developed several lecture courses for undergraduate and graduate students and supervised more than 30 M.Sc. students and about 15 Ph.D. dissertations. He is also the Principal Investigator of more than 15 research grants from different Russian national agencies.

#### SPECIAL SERIES TOPIC EDITOR



**ALLISON MARSH** (Senior Member, IEEE) received the B.S. degree in engineering from Swarthmore College, Swarthmore, PA, USA, and the Ph.D. degree in history of science, medicine, and technology from Johns Hopkins University, Baltimore, MD, USA. She is currently an Associate Professor of history and the Co-Director of the Ann Johnson Institute for Science, Technology and Society, University of South Carolina, Columbia, SC, USA. Her research focuses on how the general public comes to understand complex engineering

ideas through informal education, specifically in museum settings. She sees history as a Trojan Horse to get people interested in learning more about how engineering affects society. Before coming to the University of South Carolina, she was Curator and the Winton M. Blount Research Chair with Smithsonian National Postal Museum, Washington, DC, USA.

Dr. Marsh is the Contributing Editor to *IEEE Spectrum* and writes the monthly "Past Forward" column. In 2014, she was the recipient of the IEEE-USA, Award for Distinguished Literary Contributions furthering Public Understanding and Advancement of the Engineering Profession for work publicizing the Smithsonian's orphaned engineering collections. She is a vocal Advocate for women in STEM and is pioneering the Women in Microwaves oral history project in conjunction with the IEEE History Center.

#### TC-1 TOPIC EDITOR: FIELD THEORY AND COMPUTATIONAL EM

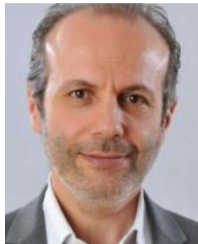


**FRANCISCO MESA** (Fellow, IEEE) received the B.Sc. and Ph.D. degrees in physics from the University of Seville, Seville, Spain, in 1998 and 1991, respectively. From 1992 to 1997, he was an Assistant Professor with the Department of Applied Physics, University of Seville, where he was promoted to an Associate Professor in 1997 and a Full Professor in 2010. Between 1992 and 2004, he enjoyed four stays in U.S. universities, the first one with the Polytechnic Institute of Brooklyn, New York City, NY, USA, and three more with the

University of Houston, Houston, TX, USA. From July to December 2019, he was a Visiting Researcher with the Royal Institute of Technology (KTH), Stockholm, Sweden. Since 1988, he has been a member of the Microwave Group, University of Seville. During the first years of his research, he worked on computational electromagnetism and on the diverse theoretical aspects of wave propagation involving these structures. Later, he worked on the modeling of metamaterials and periodic planar structures, contributing to the development of analytic (or quasi-analytic) equivalent circuits to characterize such structures and to find physically insightful explanations of some exotic phenomena. He has recently worked on higher symmetries applied to electromagnetic propagation and on the design of geodesic lenses.

Prof. Mesa was an Associate Editor for IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES from 2013 to 2016, and a member of the IEEE MTT-S Technical Committee MTT-1 (Field Theory and Computational EM).

#### TC-26 TOPIC EDITOR: RFID, WIRELESS SENSORS, AND IOT



**PAOLO MEZZANOTTE** (Member, IEEE) was born in Perugia, Italy, in 1965. He received the Ph.D. degree from the University of Perugia, Perugia, Italy, in 1997. Since 2007, he has been an Associate Professor with the University of Perugia, where he has been involved in teaching the classes on radiofrequencies engineering and systems and circuits for IoT. Since 2014, he has been the Vice-Head of the Department of Engineering, University of Perugia. His research interests include the development of microwave circuits on bio-compatible

substrates and enabling technologies for IoT. His current h-index is 24. His research activities are testified by more than 170 publications in the most important specialized journals and at the main conferences of the microwave scientific community. He is an Associate Editor for *ACES Journal*. From January 2017 to December 2019, he was the Chair of the IEEE Technical Committee MTT-24- RFID Technologies.

#### TC-13 TOPIC EDITOR: MICROWAVE CONTROL TECHNIQUES



**CHRISTOPHER D. NORDQUIST** (Senior Member, IEEE) received the B.S., M.S., and Ph.D. degrees in electrical engineering from Pennsylvania State University, University Park, PA, USA, in 1997, 1998, and 2002, respectively. At Pennsylvania State University, he was an Undergraduate and Graduate Research Assistant from 1995 to 1998 and the National Defense Science and Engineering Graduate Fellow from 1998 to 2001, where he explored heterogeneous integration of compound semiconductor devices through self-assembly. In

2002, he joined Sandia National Laboratories, Albuquerque, NM, USA, where he is currently a Distinguished Member of Technical Staff with the Department of RF/Optoelectronics. His research interests and activities include the design, fabrication, integration, and application of emerging micromachined, and solid-state RF and microwave devices. In this context of exploring new approaches that target key future needs, he has explored the application of a broad range of advanced technology sets, including Si, GaAs, InP, GaN, MEMS, and advanced materials. He has coauthored more than 80 journal and conference publications and holds nine patents in these areas.

Dr. Nordquist is a Senior Member of the IEEE Electron Device and Microwave Theory and Technology Societies. He is currently the Chair of the IEEE MTT-13 Technical Committee on Microwave Control Materials and is on the Editorial Board of IEEE JOURNAL OF MICROWAVES. He was also the Technical Program Co-Chair for the 2018 IEEE International Microwave Workshop in Advanced Materials, on the IEEE CSICS Program Committee from 2004 to 2006, a reviewer for several IEEE journals, and was a key contributor to Sandia's 2011 R&D100 Award-Winning Microresonator Filters and Frequency References Team.

#### TC-9 TOPIC EDITOR: MICROWAVE AND MILLIMETER-WAVE SOLID-STATE DEVICES



**DAVID S. RICKETTS** (Senior Member, IEEE) received the B.S. and M.S. degrees in electrical engineering from Worcester Polytechnic Institute, Worcester, MA, USA, and the Ph.D. degree in electrical engineering from Harvard University, Cambridge, MA, USA. He is currently a Full Professor of electrical and computer engineering with North Carolina State University (NCSU), Raleigh, NC, USA. Prior to moving to academia, he spent more than eight years in industrial R&D in the development of integrated circuits in mixed-signal,

RF and power management applications. His work has appeared in *Nature* and numerous IEEE conferences and journals, and was selected for the 2008 McGraw-Hill Yearbook of Science and Engineering. He is the author of two books: *The Designer's Guide to Jitter in Ring Oscillators* and *Electrical Solitons*. His research interests include physics, material science, and circuit design, investigating the ultimate capabilities of microelectronic devices, and how these are harnessed by differing circuit topologies to produce the highest performing systems.

Prof. Ricketts is the Track Editor of IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, Topic Editor of IEEE JOURNAL OF MICROWAVES, and the Chair of the MTT Technical Committee 9 on Microwave Devices. He was the recipient of the NSF CAREER Award, DARPA Young Faculty Award, and George Tallman Ladd Research Award. As an educator, he was the recipient of the 2009 Wimmer Faculty Teaching Fellow at Carnegie Mellon University, Pittsburgh, PA, USA, 2013 Harvard University Bok Center Teaching Award, and the 2021 William F. Lane Outstanding Teaching Award at NCSU. Since 2015, he has been teaching experiential hands-on workshops on building a QAM Radio and a FMCW RADAR across the globe at all of the main microwave conferences.

#### TC-8 TOPIC EDITOR: RF NANOTECHNOLOGY



**LUCA ROSELLI** (Fellow, IEEE) joined the University of Perugia, Perugia, Italy, in 1991. In 2000, he founded the spin-off WiS Srl, Foligno, Italy. He was involved in electronic technologies for the Internet of Things for six years. He is currently a Qualified Full Professor with the University of Perugia, where he teaches applied electronics and coordinates the High Frequency Electronics Laboratory. He has authored more than 280 papers (H-i 28, i10 82, and has more than 3000 citations in Google Scholar) and Green RFID Systems (Cambridge Univ. Press, 2014). His current research interests include HF electronic systems with special attention to RFID, new materials, and wireless power transfer.

Dr. Roselli was a Member of the Board of Directors of ART Srl, Urbino, Italy, from 2008 to 2012. He is a member of the list of experts of the Italian Ministry of Research, the past Chair of the IEEE Technical Committees MTT-24-RFID, Vice Chair of 25-RF Nanotechnologies, 26-Wireless Power Transfer, ERC Panel PE7, and Advisory Committee of the IEEE-WPTC, and Chairman of the SC-32 of IMS. He is also the Co-Chair of the IEEE Wireless Sensor Network Conference. He organized the VII Computational Electromagnetic Time Domain in 2007 and the first IEEE Wireless Power Transfer Conference in 2013. He is an Associate Editor for *IEEE Microwave Magazine*. He is involved with the boards of several international conferences. He is also a Reviewer for many international journals, including PROCEEDINGS OF THE IEEE, IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES, and IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS.

### TC-16 TOPIC EDITOR: MICROWAVE AND MILLIMETER-WAVE PACKAGING, INTERCONNECTS, AND INTEGRATION



**KAMAL K. SAMANTA** (Senior Member, IEEE) received the graduation degree in science (physics) and engineering (ECE), the double master's degree in management (R&D) and technology (mmW), and the Ph.D. degree in microwave engineering from the University of Leeds, Leeds, U.K. He has extensive experience of about 25 years and led a multidisciplinary government. He performed scientific and industrial research and technology/product development activities for a wide range of industries, including satellite/space, defense/security, atomic reactor/green energy, high power, semiconductor, and wireless communications, covering frequency MHz to THz and power from  $\mu\text{W}$  (MMICs) to megawatts (SSPAs). His developed products (space-qualified and military- and consumer-grade) include advanced multilayer/3D components (with antennas/filters), devices, circuits (GaN/GaAs/Si, MMICs/MCM), and systems. He was a Chief/Senior Principal/Lead R&D Engineer, Scientist, and Consultant. He was with Thales Aerospace, U.K. (Radar, EW, and ESM systems), European Aeronautics Defense and Space Astrium (Airbus), U.K., (GaN, HPA, Satellite Comm), Indian Space Research Organization, (satellite payload circuits, Tx/Rx), IPR, Department of Atomic Energy (2MW, 64 active phased array system), Milmega (GaN SSPAs), and RFMD and Filtronics Comp Semiconductor (MF MMICs: pt-to-pt radios, PAs). He is currently with Sony Europe B V, U.K., as the Chief Technologist, microwave and mmW, and Technical Lead for the next-generation front-end modules (5G/beyond). He has authored or coauthored more than 75 peer-reviewed publications (first/sole authored) and has delivered more than 45 invited talks, including keynotes/panels at IEEE MTT-S conferences. His research interests include multidisciplinary and multiphysics research and development of novel active/passive devices, multilayer/3D miniaturized components, monolithic integrated circuits (GaAs/SiGe/GaN/InP, PAs), and cost-effective multichip and system-on-package modules, and leading industrial solutions.

Dr. Samanta was the recipient of the Commonwealth Fellowship, Best International Researcher Award, and Engineering Excellence Award from IET, London, U.K., (2004/2005). He is a Fellow of IET and Life Fellow of IETE, and a Chair/member of IEEE MTT-S Technical Committees: MTT-16 (packaging/integration), MTT-14 (integrated circuits), MTT-12 (high power), and TC-5 (filters). He is on the TPC of main IEEE MTT-S conferences and was a Guest Editor of special issues published in IEEE microwave journals and magazine. He was/is an Associate Editor for IEEE MICROWAVE AND WIRELESS COMPONENTS LETTERS during 2013–2018, *IEEE Microwave Magazine*, IET MAP, and IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES.

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### TC-27 TOPIC EDITOR: CONNECTED AND AUTONOMOUS SYSTEMS



**HASAN SHARIFI** (Senior Member, IEEE) received the bachelor's and master's degrees in electrical engineering and the Ph.D. degree in the areas of microelectronics and nanotechnology from Purdue University, West Lafayette, IN, USA, in 1994, 1997, and 2007, respectively. He is currently a Manager of the Department of RF and EO/IR Subsystems, HRL Laboratories, Malibu, CA, USA. Before joining HRL, he was a Research Staff Member with Birc Nanotechnology Center, Purdue University, West Lafayette, from 2005 to 2009,

where he worked on CMOS-based RF integrated circuits and advanced heterogeneous integration and packaging. He has authored or coauthored more than 70 journal and refereed conference papers and holds more than 40 issued patents. His research interests include design, fabrication, and integration of RF/millimeter wave components and subsystems for next-generation phased-array radar, EW and communication systems and low-cost, high-performance EO/IR imaging sensors. He was the recipient of a number of awards, including special and extraordinary merit awards from Purdue University and HRL Labs. He was the Technical Program Committee and Editor of the IEEE Silicon Monolithic Integrated Circuits in RF Systems Conference. He is Member of Microwave Theory and Techniques and Advanced Packaging Societies.

### TC-14 TOPIC EDITOR: MICROWAVE AND MM-WAVE INTEGRATED CIRCUITS



**ALBERTO VALDES-GARCIA** (Senior Member, IEEE) received the B.S. degree (Hons.) in electronic systems engineering from the Monterrey Institute of Technology, Toluca, Mexico, in 1999, and the Ph.D. degree in electrical engineering from Texas A&M University, College Station, TX, USA, in 2006. In 2000, he joined Motorola Broadband Communications, Nogales, Mexico, as an RF Design Engineer. In 2006, he joined IBM Research, Yorktown Heights, NY, USA, where he is currently a Principal Research Staff Member, Manager of

the RF Circuits and Systems Group. In 2013, he was an Adjunct Assistant Professor with Columbia University, New York, NY, USA. He holds more than 75 issued U.S. patents and has authored or coauthored more than 100 peer-reviewed publications. He is the Co-Editor of the book *60 GHz Technology for Gbps WLAN and WPAN: From Theory to Practice* (Wiley, 2011). His research interests include mm-wave systems for communications and imaging applications.

Dr. Valdes-Garcia is the winner of the 2005 Best Doctoral Thesis Award presented by the IEEE Test Technology Technical Council. He was the recipient of the 2007 National Youth Award for Outstanding Academic Achievements presented by the President of Mexico, co-recipient of the 2010 George Smith Award presented by the IEEE Electron Devices Society, 2017 Lewis Winner Award for Outstanding Paper presented by IEEE International Solid-State Circuits Conference, and 2017 IEEE JOURNAL OF SOLID-STATE CIRCUITS Best Paper Award. Within IBM, he has been twice a co-recipient of the Pat Goldberg Memorial Award to the best paper in computer science, electrical engineering, and mathematics published by IBM Research in 2009 and 2017. He was inducted into the IBM Academy of Technology in 2015 and was recognized as an IBM Master Inventor in 2016 and 2019. He was with the IEEE 802.15.3c 60 GHz Standardization Committee, from 2006 to 2009. Since 2009, he has been a Technical Advisory Board Member of Semiconductor Research Corporation, where he was the Chair of the Integrated Circuits and Systems Sciences Coordinating Committee, in 2011 and 2012, respectively. Since 2016, he has been a Member of the IEEE MTT-S Microwave and Millimeter-Wave Integrated Circuits Technical Committee, where he was the Chair during 2020–2021. In 2013, he was selected by the National Academy of Engineering for its Frontiers of Engineering Symposium.

### TC-4 TOPIC EDITOR: MICROWAVE PASSIVE COMPONENTS AND TRANSMISSION LINE STRUCTURES



**KE WU** (Fellow, IEEE) received the B.Sc. degree (Hons.) in radio engineering from the Nanjing Institute of Technology (now Southeast University), Nanjing, China, in 1982, the D.E.A. (Hons.) and Ph.D. (Hons.) degrees in optics, optoelectronics, and microwave engineering, from the Institut National Polytechnique de Grenoble, University of Grenoble, Grenoble, France, in 1984 and 1987, respectively. He is currently the Endowed Industrial Research Chair of Future Wireless Technologies and a Professor of electrical engineering with the

École Polytechnique de Montréal (University of Montreal), Montreal, QC, Canada, where he is also the Director of the Poly-Grames Research Center. He was the Canada Research Chair in RF and millimeter-wave engineering and the Founding Director of the Center for Radiofrequency Electronics Research of Quebec. He held/holds visiting/ honorary professorships with various universities around the world and has graduated more than 76 Ph.D. and 95 M.Sc. students. He has authored or coauthored more than 1400 refereed papers, and a number of books and book chapters and filed more than 80 patents.

Prof. Wu was the General Chair of the 2012 IEEE MTT-S International Microwave Symposium and the 2016 President of the IEEE Microwave Theory and Techniques Society (MTT-S). He was an Inaugural North-American representative in the General Assembly of the European Microwave Association. He was the recipient of many awards and prizes, including the inaugural IEEE

MTT-S Outstanding Young Engineer Award, 2004 Fessenden Medal of IEEE Canada, 2009 Thomas W. Eadie Medal from the Royal Society of Canada, Queen Elizabeth II Diamond Jubilee Medal, 2013 Award of Merit of Federation of Chinese Canadian Professionals, 2014 IEEE MTT-S Microwave Application Award, 2014 Marie-Victorin Prize (Prix du Quebec), 2015 Prix d'Excellence en Recherche et Innovation of Polytechnique Montréal, 2015 IEEE Montreal Section Gold Medal of Achievement, 2019 IEEE MTT-S Microwave Prize, 2021 EIC Julian C. Smith Medal, 2022 IEEE MTT-S Outstanding Educator Award, and 2022 IEEE AP-S John Kraus Antenna Award. He was also an IEEE MTT-S Distinguished Microwave Lecturer and is a Fellow of the Canadian Academy of Engineering, the Royal Society of Canada, and National Academy of Science and Engineering of Germany.

#### TC-2 TOPIC EDITOR: DESIGN AUTOMATION



**QIJUN ZHANG** (Fellow, IEEE) received the Ph.D. degree in electrical engineering from McMaster University, Hamilton, ON, Canada, in 1987. During 1988–1990, he was a Research Engineer with Optimization Systems Associates Inc., Dundas, ON, Canada, developing advanced optimization software for microwave modeling and design. In 1990, he joined the Department of Electronics, Carleton University, Ottawa, ON, Canada, where he is currently a Chancellor's Professor. He is an author of the book *Neural Networks for RF and*

*Microwave Design* (Boston, MA, USA: Artech House, 2000) and a Co-Editor of *Modeling and Simulation of High-Speed VLSI Interconnects* (Boston, MA, USA: Kluwer, 1994) and *Simulation-Driven Design Optimization and Modeling for Microwave Engineering* (London, U.K.: Imperial College Press, 2013). He has more than 300 publications in his research areas, which include modeling, optimization, and neural networks for high-speed/high-frequency electronic design.

Dr. Zhang is a Fellow of the Canadian Academy of Engineering, and the Engineering Institute of Canada. He was an Associate Editor for IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES during 2020–2022, an Associate Editor for *International Journal of RF and Microwave Computer-Aided Engineering* during 2010–2018 and the General Chair of the IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization in 2015.

#### ASSISTANT EDITOR



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#### ADMINISTRATIVE EDITOR



**KARA MCARTHUR** received the B.A. degree in sociology and completed graduate work in health-care ethics from Rice University, Houston, TX, USA. She is currently on two Institutional Review Boards, an oncology IRB and a community IRB in the Dominican Republic. She is an American Medical Writers Association certified Medical Editor and writer. She has more than 20 years of experience in scholarly publishing, including as the Founding Managing Editor of the *Engineering in Medicine and Biology Society's* first Gold Open

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#### PRODUCTION EDITOR



**JOANNA GOJLIK** received the B.A. degree in journalism/professional writing from The College of New Jersey, Ewing, NJ, USA, the M.A. degree in liberal studies from the University of North Carolina at Greensboro, Greensboro, NC, USA, and the Professional Certificate in editing from New York University, New York, NY, USA. Since 2004, she has been with the IEEE Publications Operations Department, where she is currently a Journals Production Manager. Over the years, she has managed a large portfolio of

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