



IMS2021 ATLANTA, GA | 6-11 JUNE 2021
International Microwave Symposium
CALL FOR PAPERS



The IEEE Microwave Theory and Techniques Society's 2021 International Microwave Symposium (IMS2021) will be held June 6-11, 2021 at the Georgia World Congress Center in Atlanta, Georgia. You are cordially invited to join us in Atlanta at the intersection of communications, aerospace, automotive,

IoT and other emerging technologies to learn the latest developments in MHz-to-THz theories, techniques, devices, systems and applications. IMS2021 is the centerpiece of Microwave Week 2021 which is comprised of three conferences including the RFC Symposium (www.rfic-ieee.org) and the ARFTG Conference (www.arftg.org)

New this year: IMS will be a hybrid conference – both face-to-face and virtual. More details will be reported soon.

Microwave Week, with more than 8000 participants and 600 industrial exhibits of state-of-the-art microwave products, is the world's largest gathering of radio-frequency (RF) and microwave professionals encompassing MHz to THz ranges and is the most important forum for the latest research advances and practices in the field. IMS2021 offers something for everyone, including the following:

- Technical Program – Oral/Poster Sessions, Workshops, Technical Lectures, and Panel/Rump Sessions
- Connected Future Summit (formerly 5G Summit) showcasing the next-generation wireless technologies for mobility, V2X and IoT
- RF Bootcamp intended for students, engineers, and managers from non-microwave engineering disciplines
- Job Fair for students offering employment opportunities within our exhibitor community
- Exhibitor workshops and application seminars featuring presentations by the preeminent technologists from our exhibitors, explaining the technology behind their products
- Special small business/entrepreneurs' area on the exhibitor floor
- Discounted pricing for students with a SUPERPASS offering access to all conference events

- Competitions for Best Industry Paper, Advanced Practices Paper, Student Paper Award, Three-Minute Thesis (3MT), Student Design Competitions and Student Demonstrations; a Student Demonstration event to showcase the prototypes developed by students and presented in the technical papers
- Project Connect for underrepresented minority engineering students, and the Ph.D. Student Initiative for new students
- Networking events for Amateur Radio (HAM) enthusiasts, Women in Engineering (WIE)/Women in Microwaves (WIM), and Young Professionals (YP)
- STEM Program featuring hands-on activities and exhibitions designed to help students in middle and high school expand their understanding of what it is to be an engineer
- Guest hospitality suite and tour programs for attendees and their guests
- New technical areas on RF to mm-wave physical layer security, quantum electronics and AI/ML for RF and microwave

Paper Submission: Authors are invited to submit technical papers describing original work on RF, millimeter-wave, and terahertz theory and techniques. The deadline for submission is 16 December 2020. A blind review process will be used to ensure anonymity for both authors and reviewers. Detailed instructions on submitting a blind-review compliant paper can be found at www.ims-ieee.org. Papers will be evaluated on the basis of originality, content, clarity, and relevance to IMS.



PAPER SUBMISSION INSTRUCTIONS:

1. All submissions must be in English.
2. Authors must adhere to the format provided in the template, which can be downloaded from www.ims-ieee.org.
3. For regular submissions, authors must submit their paper at www.ims-ieee.org by 11:59 PM Hawaii Standard Time on 9 December 2020. Late submissions will not be considered. The initial submission should be between three and four pages, must be in PDF format, must be double-blind compliant, and cannot exceed 2MB in size. Hardcopy and email submissions are not accepted.

Page Limit: For the initial submission deadline, the paper length should be three pages. Papers longer than three pages will not be considered. The final page length for the papers accepted for publication in the proceeding is three pages.

Paper Selection Criteria: Papers are reviewed by IMS2021 Technical Program subcommittees. The selection criteria will be:

- **Originality:** Is the contribution unique and significant? Does it advance the state of the art of the technology and/or practices? Are proper references to previous work by the authors and others provided?
- **Quantitative content:** Does the paper give a comprehensive description of the work with adequate supporting data?
- **Clarity:** Is the paper contribution and technical content presented with clarity? Are the writing and accompanying figures clear and understandable?
- **Interest to MTT-S membership:** Why should this work be reported at this conference?

Technical Areas: During the paper submission process, authors will choose a primary and two alternative technical areas (see the Technical Areas). The paper abstract should contain information that clearly reflects the choice of the area(s). Author-selected technical areas will be used to determine an appropriate committee for reviewing the paper. The technical areas are divided into five different categories that are used to organize the paper presentation schedule. It is permissible to choose primary and alternative technical areas that are in different categories.

Presentation Format: IMS offers three types of presentation formats. The authors' preference will be honored where possible, but the IMS2021 Technical Program Committee (TPC) reserves the right to place papers in the most appropriate technical area and presentation format.

1. Full-length (20-minute) papers report significant contributions, advancements, or applications in a formal presentation format with questions and answers (Q&A) at the end.
2. Short (10-minute) papers typically report specific refinements or improvements in the state of the art in a formal presentation format with Q&A at the end.
3. Interactive forum papers provide an opportunity for authors to present their theoretical and/or experimental developments and results in greater detail and in a more informal and conversational setting. Papers will be presented in a standard poster format. An IMS2021 poster template will be provided. In addition, authors have the opportunity to display hardware, perform demonstrations, and conduct discussions with interested IMS attendees.
4. Authors of accepted IMS2021 papers must submit a pre-recorded video of their paper presentation. Details of the video presentation will be communicated with the first author of the selected papers.

Notification: Authors will be notified of the decision by 10 February 2021 via the email address(es) provided with the initial paper submission. For accepted papers, an electronic version of the final manuscript (three to four pages, to be published in the Symposium proceedings) along with a copyright assignment to the IEEE must be submitted by 4 March 2021. Authors will be required to submit their presentation slides using the approved template by 20 May 2021, and these will be made available to all attendees at the conference. The submission instructions will also be provided through emails and can be accessed through the Symposium website. The Symposium proceedings will be recorded on electronic media and archived in IEEE Xplore.

Clearances: It is the authors' responsibility to obtain all required company and government clearances prior to submitting a paper. Authors are strongly urged not to

wait until the last day to start the paper submission process. Those unfamiliar with the process may encounter paper formatting or clearance issues that may take time to resolve. A statement certified by the submitting author that such clearances have been obtained and a completed IEEE copyright form must accompany the manuscript of each accepted paper. Details regarding clearances will be available during the paper submission process.

Student Superpass: IMS2021 enthusiastically invites participation from students at all levels to attend IMS2021. All students will be offered the opportunity to purchase a SUPERPASS allowing access to the IMS, RFIC, and ARFTG conferences, all workshops, short courses and panel sessions, Connected Future Summit (formerly 5G Summit), and most other events over the course of the week. Student SUPERPASS prices are significantly discounted to encourage student participation.

Student Paper Competition: Eligible students are encouraged to submit papers for the Student Paper Competition. These papers will be reviewed in the same manner as all other contributed papers. First, second, and third prizes will be awarded based on content and presentation. To be considered for an award, the student must be a full-time student during the time the work was performed, be the lead author, and personally present the paper at IMS. During the submission process, the student is required to provide the email address of the faculty advisor, who will be asked upon the selection of the paper to certify that the work is primarily that of the student. Please refer to www.ims-ieee.org for full eligibility details.

Industry and Advanced Practice Paper Competitions: Eligible authors from industry are encouraged to submit papers for the Industry Paper Competition. Additionally, any author who submits a paper on advanced practices may be entered into the Advanced Practice Paper Competition. A paper on advanced practices describes an innovative RF/microwave design integration technique, process enhancement, and/or combination thereof that results in significant improvements in performance and/or in time to production for RF/microwave components, subsystems, or systems. The papers will be evaluated using the same standards as all contributed papers. Please refer to www.ims-ieee.org for details.

Workshops, Technical Lectures, Focus and Special Sessions, Panel and Rump Sessions: Topics being considered for these areas include, but are not limited to, next-generation wireless systems (5G and beyond), emerging RF/microwave applications, latest technologies for RF/microwave measurements, and advances in RFIC technology. Please consult www.ims-ieee.org for a more detailed list of desired topics and instructions on how to prepare a proposal. Proposals must be received by 23 September 2020.

MicroApps and Exhibitor Workshops: Microwave Application Seminars (MicroApps) continue as a forum on the exhibition floor for IMS exhibitors to present the technology and special capabilities behind their commercial products. In addition, the Exhibitor workshops provide IMS exhibitors a unique opportunity to provide more in-depth presentations of technical topics to the attendees. Both events are open to all conference and exhibit attendees. Exhibitor workshops require a nominal fee while MicroApps are free of charge.

Student Design Competition: All eligible students or student teams are invited to consider taking part in the Student Design Competitions (SDCs) during the IMS2021. Please refer to www.ims-ieee.org for full eligibility details, a list of IMS2021 SDCs, and the rules for each SDC.

Student Demonstrations: All students who have submitted papers for oral or interactive forum are invited to participate in the Student Demonstrations during the IMS2021. This will be a unique opportunity for students to showcase prototype hardware that was presented during technical sessions. Please refer to www.ims-ieee.org for full eligibility details.

Three-Minute Thesis (3MT®) Workshop: For eligible students and young professionals, participants with accepted papers are invited to attend a full-day workshop on Sunday on presenting technical work for broader audiences. Following the workshop, students will be invited to enter the 3MT® competition. The 3MT® contestants will make a presentation of three minutes or less, supported only by one static slide, in a language appropriate to a non-specialist audience.

IEEE T-MTT Special Issue: Authors of all papers presented at IMS2021 can submit an expanded version of their IMS papers to the Special Issue of the IEEE Transactions on Microwave Theory and Techniques (IEEE T-MTT) devoted to the IMS2021. Please refer to www.ims-ieee.org for details.

TECHNICAL AREAS:

Electromagnetic Field, Device and Circuit Techniques

- 1 Field analysis and guided waves** – Novel guiding and radiating structures, new physical phenomena in transmission lines and waveguides, and new analytical methods for solving guided-wave and radiation problems.
- 2 Numerical techniques & CAD algorithms** – Finite-difference, finite-element, integral equation, and hybrid methods for RF, microwave, and THz applications. Simulation, modeling, uncertainty quantification, and design optimization; circuit-, EM-, multi-physics-, and statistics-based, including surrogate modeling, space mapping, and model order reduction techniques.
- 3 Instrumentation and measurement techniques** – Theoretically supported and experimentally demonstrated linear and nonlinear measurement techniques for devices and materials, error correction, de-embedding, calibration, and novel instrumentation.
- 4 MHz-to-THz device modeling** – Active and passive, linear and nonlinear device and structure modeling (physical, empirical, and behavioral) including characterization, parameter extraction, and validation.
- 5 Nonlinear circuit and system analysis, simulation, and design** – Distortion, stability and qualitative dynamics analysis; circuits and systems (C&S) simulation techniques and applications; behavioral modeling of nonlinear C&S (excluding PAs); and nonlinear C&S design and implementations.

Passive Components and Packaging

- 6 Transmission-line structures** – Novel transmission-line structures and devices, transmission-line equivalent circuits, artificial transmission lines and metamaterial structures, transmission-line applications for devices and systems.
- 7 Passive circuit elements** – Couplers, dividers/combiners, hybrids, resonators, and lumped-element approaches.
- 8 Planar passive filters and multiplexers** – Planar passive filters and multiplexers including lumped elements, theoretical filter and multiplexer synthesis methods.
- 9 Non-planar passive filters and multiplexers** – Resonators, filters and multiplexers based on dielectric, waveguide, coaxial, or other non-planar structures.
- 10 Active, tunable, and integrated filters** – Integrated (on Si, LTCC, LCP, MCM-D, GaAs, etc.), active, and tunable filters.
- 11 Microwave acoustic, ferrite, ferroelectric, phase-change, and MEMS components** – Surface and bulk acoustic wave devices including FBAR devices, bulk and thin-film ferrite components, ferroelectric-based devices, and phase-change devices and components. RF microelectromechanical and micromachined components and subsystems.
- 12 Packaging, MCMs, and 3D manufacturing techniques** – Component and subsystem packaging, assembly methods, inkjet printing, multi-chip modules, wafer stacking, 3D interconnect, and integrated cooling. Novel processes related to 3D printing or additive manufacturing techniques.

Active Devices

- 13 Semiconductor devices and process characterization** – RF, microwave, mm-wave, and THz devices on III-V, silicon and other emerging technologies. MMIC and Si RFIC manufacturing, reliability, failure analysis, yield, and cost.
- 14 Low-noise amplifiers, variable-gain amplifiers and receivers** – LNAs, VGAs, detectors, receivers, integrated radiometers, cryogenic amplifiers and models, and characterization methods for low-noise integrated circuits and components.
- 15 Signal generation, modulators, frequency conversion, and signal shaping ICs** – CW and pulsed oscillators in silicon and III-V processes including VCOs, DROs, YTOs, PLOs, and frequency synthesizers, signal modulators, and frequency conversion ICs in silicon and III-V processes, such as IQ modulators, mixers, frequency multipliers/dividers, switches, and phase shifters.
- 16 Mixed-signal and wireline ICs** – High-speed mixed-signal components and subsystems for transmission; equalization and clock-data recovery techniques for electrical backplanes and electro-optical interfaces. High-speed mixed-signal components and subsystems, including ADC, DAC and DDS technologies.
- 17 High-power MHz, RF and microwave amplifiers** – Advances in discrete and IC power amplifier devices and design techniques based on III-V and LD-MOS devices, demonstrating improved power, efficiency, and linearity for HF, UHF, VHF, RF and microwave bands (< 26 GHz). Power-combining techniques for SSPA and vacuum electronics.
- 18 Compound semiconductor power amplifiers** – Advances in IC power amplifier devices, design techniques and power combining based on III-V and other compound semiconductor devices demonstrating improved power, efficiency, and linearity for millimeter-wave bands; vacuum electronics for millimeter-wave.
- 19 Silicon power amplifiers** – Advances in RFIC and digital power amplifier design and power combining techniques based on silicon CMOS and SiGe processes, demonstrating improved power, efficiency, and linearity for RF, millimeter-wave, and sub-THz bands.
- 20 Linearization and transmitter techniques for power amplifiers** – Power amplifier design, characterization, and behavioral modeling; linearization and pre-distortion techniques; envelope-tracking, outphasing and Doherty transmitters for III-V and silicon technologies

- 21 Integrated transceivers, beamformers, imaging and phased-array chips and modules** – Design and characterization of complex III-V ICs, silicon ICs, heterogeneous systems, and related packaging in the RF to mm-wave including narrowband and wide-band designs. Innovative circuits and sub-systems for communications, radar, imaging, and sensing applications. Integrated on-chip antennas and on-package antennas.
- 22 Millimeter-wave and terahertz integrated circuits and systems** – Design and characterization of active components including LNAs, PAs, and frequency conversion ICs in silicon and III-V processes and/or packaging in the upper mm-wave and THz regimes; innovative THz circuits systems for communications, radar, imaging, and sensing applications. Demonstrations of on-chip antennas. Novel multi-feed antennas and antenna-electronics co-designs and co-integrations.
- 23 Microwave photonics and nanotechnology** – Integrated devices and 1D-2D material-based technology. Multidisciplinary field studying the interaction between microwaves, THz waves, and optical waves for the generation, processing, control, and distribution of microwave, mm-wave, and THz signals. Emerging RF applications of nanophotonics, nanoplasmonics, and nano-optomechanics; nanoscale metrology and imaging.

Systems and Applications

- 24 Phased Arrays, MIMO and Beamformers** – Technology advances combining theory and hardware implementation in the areas of phased-array antennas, integrated beamformers, spatial power combining, retrodirective systems, built-in self-test techniques, broadband arrays, digital beamforming, and multi-beam systems. New beamforming, beam-tracking, and spatial notching algorithms, signal processing, and demonstrations.
 - 25 Radar and Imaging Systems** – RF, millimeter-wave, and sub-THz radar and imaging systems, automotive radars, sensors for intelligent vehicular highway systems, UWB and broadband radar, remote sensing, radiometers, passive and active imaging systems, radar detection techniques, and related signal processing.
 - 26 Wireless, 5G & Beyond, and New Satellite Communication Systems** – RF, millimeter-wave, and sub-THz communication systems with hardware implementation for terrestrial, vehicular, satellite, and indoor applications, point-to-point links, backhaul and fronthaul applications, radio-over-fiber links, cognitive and software-defined radios, MIMO and full-duplex technologies, and simultaneous transmit and receive (STAR) systems.
 - 27 Wireless System Characterization and Architectures** – Wireless and 5G & Beyond enabling technologies including but not limited to beamforming techniques, MIMO, massive MIMO, multiple radio access technologies, centralized radio access networks, shared and novel spectrum use, waveform design, modulation schemes, and channel modeling.
 - 28 Sensing and RFID Systems** – Short range wireless and RFID sensors, gas and fluidic sensors, passive and active tags from HF to millimeter-wave frequency, RFID systems including wearables and ultra-low-power.
 - 29 Wireless Power Transmission** – Energy harvesting systems and applications, rectifiers, circuits, self-biased systems, combined data and power transfer systems
 - 30 MHz-to-THz instrumentation for biological measurements and healthcare applications** – Devices, components, circuits and systems for biological measurements and characterizations; biomedical therapeutic and diagnostic applications; systems and instrumentation for biomedical applications; wireless sensors and systems, and implantable and wearable devices for health monitoring and telemedicine.
 - 31 MHz-To-THz interaction of materials and tissues** – Electromagnetic field interaction at molecular, cellular, and tissue levels; electromagnetic characterization of biological materials and living systems; MRI and microwave imaging. Industrial and scientific, medical applications utilizing microwave power technology; microwave-enhanced chemistry; non-destructive evaluation / testing and material property measurements at nanometer to millimeter. Multi-modal and multi-physical imaging techniques, such as microwave-induced acoustic imaging.
- ### Emerging Technologies
- 32 Innovative systems and applications** – Emerging technologies and novel system concepts for RF/microwave applications such as 6G, Internet of Things (IoT), Internet of Space (IoS), wearable computing/communication systems, machine-to-machine (M2M) communication, intelligent transportation, smart cities, smart environment, heterogeneous integration and 3D ICs, silicon photonics and plasmonics.
 - 33 MHz-to-THz physical layer security** – Devices, circuits, and systems for secured communication and sensing from MHz to THz, addressing general security vulnerability due to electromagnetic emissions, hardware and software co-design for physical layer security, advanced devices and materials to enhance RF, mm-Wave, and THz physical layer security, trusted design, fabrication, packaging, and validation for RF, mm-Wave, and THz electronics;
 - 34 AI/ML for RF and Mm-Wave** – AI/ML algorithms, implementations, and demonstrations for spectrum sensing, mobile edge networking, and MIMO and array beam operations and management; AI/ML algorithms for design and optimization of RF/mm-Wave components, circuits, and systems; AI/ML algorithms for in-situ sensing, diagnostics, control, reconfiguration, and optimization of MHz to THz communication and sensing circuits and systems.
 - 35 Quantum devices, systems, and applications** – Cryogenic RF devices, circuits, and systems for general quantum device interfacing and quantum computing applications.



Important Dates

● 16 September 2020 (Wednesday)

PROPOSAL SUBMISSION DEADLINE

For workshops, short courses, focus and special sessions, panel and rump sessions

● 9 December 2020 (Wednesday)

PAPER SUBMISSION DEADLINE

All submissions must be made electronically.

● 3 February 2021 (Wednesday)

PAPER DISSEMINATION

Authors will be notified by email.

● 3 March 2021 (Wednesday)

FINAL MANUSCRIPT SUBMISSION DEADLINE

Manuscript and copyright of accepted papers

● 5 May 2021 (Wednesday)

WORKSHOP NOTES SUBMISSION DEADLINE

Electronic upload of workshop notes to the Workshop Organizers.

● 5 May 2021 (Wednesday)

VIRTUAL PRESENTATIONS SUBMISSION DEADLINE

● 19 May 2021 (Wednesday)

FINAL PRESENTATIONS SUBMISSION DEADLINE

Electronic upload of presentations in both PDF and PPT format

● 6–11 June 2021

MICROWAVE WEEK

IMS2021, RFIC 2021, ARFTG, and Exhibition

IMS2021 Technical Program Committee

EXECUTIVE COMMITTEE

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John Papapolymerou,
General Co-Chair
Hua Wang, *TPC Co-Chair*
Debabani Choudhury, *TPC Co-Chair*
George Ponchak, *Finance Chair*

PLENARY SESSION

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Dev Palmer, *Vice Chair*

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Publications Manager
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Wayne Shiroma, *Senior Advisor*
Tim Lee, *IMS2020 General Chair*
Ron Ginley, *IMS2021 General Chair*
Brian Floyd, *RFIC2021 General Chair*
Jon Martens, *ARFTG2021 General Chair*
Osama Shanaa, *RFIC2021, TPC Chair*

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Debabani Choudhury, *Co-Chair*
Gabriel Rebeiz, *Senior Advisor*
Jim Buckwalter, *Senior Advisor*

ELECTRONIC PAPER MANAGEMENT

Sandy Owens, *Chair*

WORKSHOPS

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Glenn Hopkins, *Co-Chair*
TBD, *Co-Chair*
Danilo Manstretta,
RFIC Liaison
Jon Martens, *ARFTG Liaison*

CONNECTED FUTURE SUMMIT

Shahriar Shahramian, *Chair*
Clay Couey, *Vice Chair*
Aida Vera Lopez, *Vice Chair*

TECHNICAL LECTURES

Jeffrey Nanzer, *Chair*
Steven Bowers, *Vice Chair*
Mona Hella, *RFIC Liaison*

RF BOOT CAMP

Larry Dunleavy, *Chair*
JoAnn Mistler, *Vice Chair*
Tushar Sharma, *Vice Chair*

PANEL SESSIONS

Ruonan Han, *Chair*
Rui Ma, *Vice Chair*

FOCUS/SPECIAL SESSIONS

Manos Tentzeris, *Chair*
Yong-Kyu Yoon, *Vice Chair*
Ommad Momeni, *Vice Chair*

INTERACTIVE FORUM

Prem Chahal, *Chair*
Taiyun Chi, *Vice Chair*

STUDENT PAPER COMPETITION

Edward Gebara, *Co-Chair*
Cagri Ulusoy, *Co-Chair*
Sangmin Yoo, *Co-Chair*

STUDENT DESIGN COMPETITIONS

Guoan Wang, *Co-Chair*
Azadeh Ansari, *Co-Chair*

STUDENT DEMONSTRATIONS

David Ricketts, *Chair*

ADVANCED PRACTICE/INDUSTRY PAPER COMPETITION

Steven Rosenau, *Chair*

THREE-MINUTE THESIS

John Bandler, *Co-Chair*
Erin Kiley, *Co-Chair*

MICROAPPS

Michael Trippe, *Chair*

INDUSTRY WORKSHOPS

Steve Nichols, *Chair*

Hackathon

Kathleen Tokuda, *Chair*

