



MTT-S Society News

MTT-S Technical Committee TC-4 Report

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The IEEE Microwave Theory and Technology Society (MTT-S) Technical Committee (TC-4) on Microwave Passive Components and Transmission Line Structures is a newly restructured technical committee, officially founded in January 2020, which merges, substantiates, coordinates, and reshapes all related research topics of interest previously scattered among other TCs. The fundamental mission of TC-4 is to lead, support, and develop all MTT-S technical activities and endeavors in the field of transmission lines and passive components, which cover nearly all aspects of basic elements, building blocks, and functional passives in any electromagnetic circuit and systems from

megahertz (MHz) through terahertz (THz). The current TC-4 roster consists of 27 members of all ages and

website at <https://mtt.org/technical-committees/tc-4-microwave-passive-components-and-transmission-line-structures-committee/>.

Our TC-4 fields of interest are concerned with the operation principles, modeling strategies, design methods, and implementation technologies of microwave passive components and transmission line structures in various planar and nonplanar forms over the MHz-through-THz frequency range. They involve different natural and artificial electric and/or magnetic materials, ranging from ideally lossless insulators and perfect conductors to lossy substrates and doped semiconductors and from uniform and isotropic dielectrics to heterogenous and aniso-



tropic materials. Technical activities are very much oriented but not limited to the following structures and components:

- transmission lines and guided-wave and leaky-wave structures
- microstrip lines, coplanar waveguides, striplines, slotlines, and other planar transmission lines

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- metallic or dielectric waveguides; substrate integrated waveguides (SIWs); and other nonplanar transmission lines
- metamaterials, metasurfaces, and artificial transmission lines
- passive microwave components and circuits such as couplers; power dividers/combiners; impedance matching circuits; and tunable and reconfigurable passive components.

The TC-4 technical activities and interests serve as a sort of “bread and butter” in support of all the MTT-S technical activities. The subjects of microwave passive components and transmission line structures date back to the very beginning of applied electromagnetics and RF engineering. Therefore, TC-4 is deemed to be very much a foundational technical committee for the MTT-S community, and our TC-4 work and contributions are well reflected in various technical activities and achievements across the entire MTT-S and community; for example, the development of active circuits such as amplifiers, oscillators, and mixers basically deals with how to adequately use the impedance matching techniques in conjunction with signal distributions from the perspective of circuits and systems.

Early Development

The first two years of TC-4 from January 2020 to December 2021 were an important period of growing up, and our early work was to establish this new committee from scratch with the short- and long-term considerations of membership. This was why we began with a few of the founding members from early technical committees on transmission lines, including the late Prof. Tatsuo Itoh, who suddenly passed away on 4 March 2021 [see Figure 1(a)]. The MTT-S lost a technical giant, and our TC-4 lost an irreplaceable mentor, who would be remembered forever for his legacies and contributions. In addition, we tragically lost Prof. Mojgan Daneshmand, who was one of the

victims of the Ukrainian plane crash that occurred in the early morning of 8 January 2020. This sad news was a big blow to the early restructuring of TC-4 as Prof. Mojgan Daneshmand was a very enthusiastic founding member, and she is missed dearly by all of us [see Figure 1(b)].

The establishment and expansion of TC-4 went through the recruitment of a balanced mixture of young and senior people in consideration of geographic activities and technical backgrounds. We recruited a significant number of young professionals from different regions/countries, and TC-4 has also preserved since its debut a very good percentage of female members, in line with the much-publicized goals and incentives of the MTT-S Technical Coordination and Future Directions Committee (TCFDC). About three months after its founding, all the members of TC-4 were completely assigned to be responsible for specific committee tasks, which was the fruitful result of direct personal exchanges and discussions between the chair and members based on professional experiences, technical interests, and organizational needs for an effective committee’s structure. Our website was up and running with all the required basic in-

formation and databases. Any newly recruited members were communicated their assigned responsibilities and tasks by the chair once possible. In fact, engaging each new member since the beginning with well-defined responsibilities is a good practice of TC-4. Each of them takes the lead, eventually jointly with one colleague for one of the committee operations while participating in up to three other tasks in collaboration with committee peers.

Technical Activities

It is important to note that the first two-year renaissance of this technical group was hampered by the extremely difficult period of the COVID-19 pandemic, which didn’t allow us to meet and exchange ideas in person. Nevertheless, TC-4 has organized and developed its technical activities since the first day of its establishment, and online committee meetings have been held on a regular basis for professional opportunities, membership development, and milestone discussions. In particular, TC-4 has been actively taking the leadership in the development of proposals for technical workshops, panels, and student design competitions, among many others for the

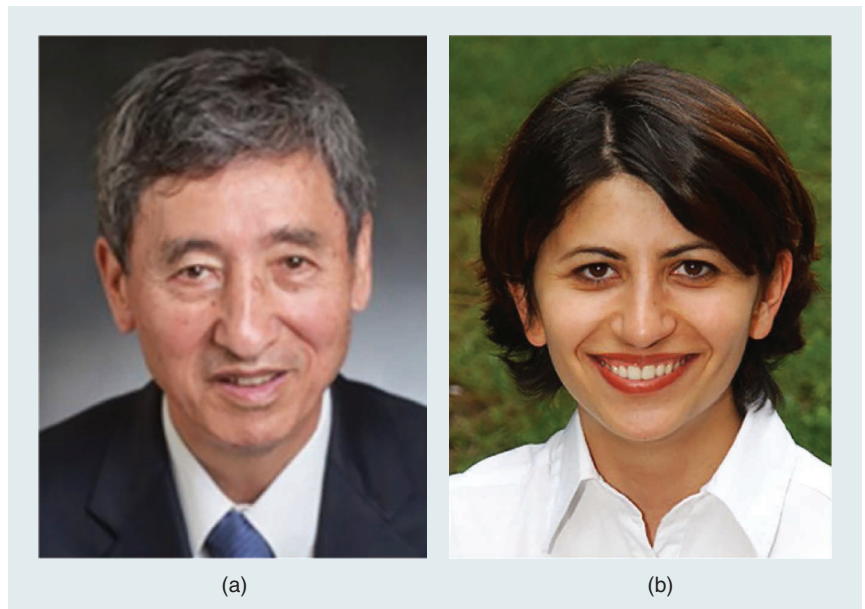


Figure 1. MTT-4 lost two founding members: (a) Prof. Tatsuo Itoh and (b) Prof. Mojgan Daneshmand.

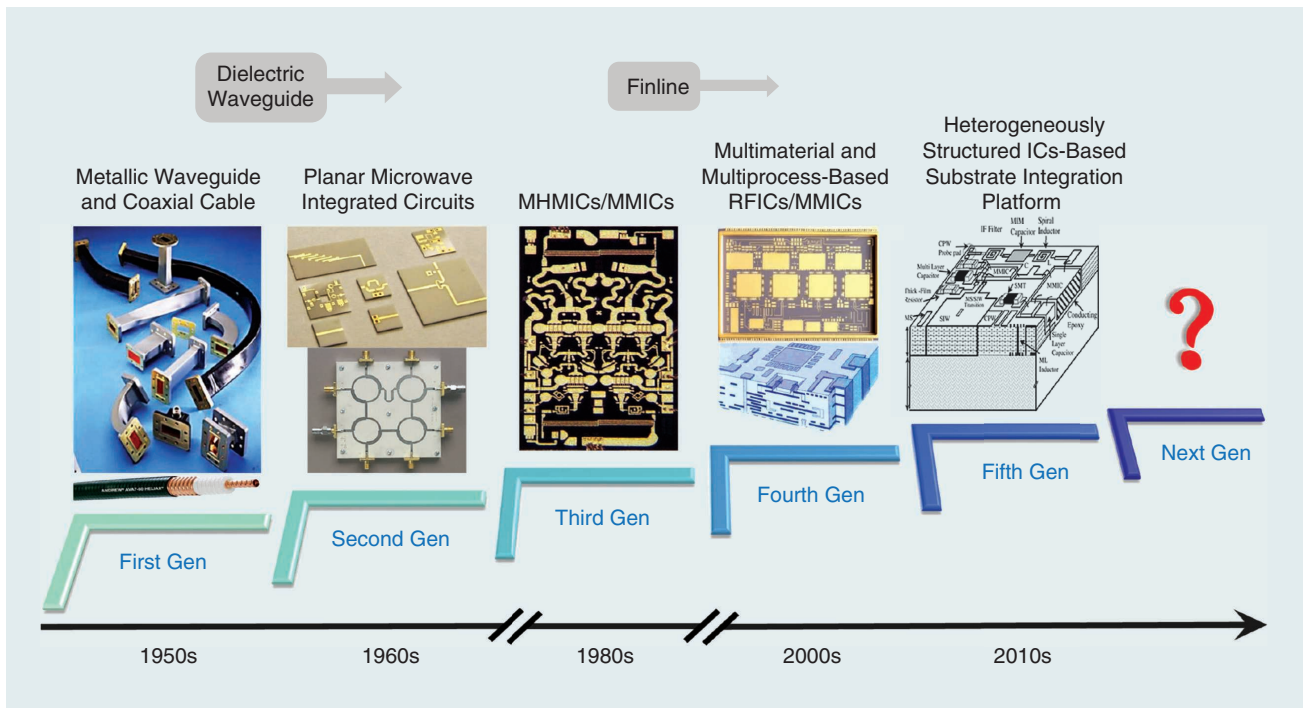


Figure 2. The generational evolution of guided-wave technologies. Gen: generation; MMIC: monolithic microwave integrated circuit; MHMIC, miniature hybrid-microwave IC; CPW: coplanar-waveguide; SIW: substrate integrated waveguide. MS: microstrip; SMT: surface-mount technology; ML: multilayer. (Source: Taken from [1].)

International Microwave Symposium (IMS) and other MTT-S events.

For example, several workshops were organized at IMS2021. In particular, the workshop titled “Past and Future of Microwave Passive Components (in Memory of the Late Professor Arthur A. Oliner),” organized by Aly Fathy, Ke Wu, Maurizio Bozzi, and Tetsuo Itoh, aimed to present a road map of microwave passive components and transmission lines, as illustrated

in Figure 2, starting from a historical overview and the state of the art and providing an outlook on the forthcoming technologies, solutions, and applications. This workshop also provided a special tribute to the late Prof. Itoh as his passing happened after the workshop’s organization but before the presentation at IMS2021.

Two other workshops involved TC-4 members as co-organizers and/or speakers at IMS2021 on topics fall-

ing in the field of interest of this technical committee: “Spatiotemporal Metastructures for Microwave Applications” (by George Eleftheriades) and “Advanced Micro-Scale Fabrication and Integration Techniques for Emerging Millimeter and Submillimeter-Wave Applications” (by Ke Wu). Moreover, one TC-4 workshop on additive manufacturing was successfully organized by Maurizio Bozzi and others during EuMW2020 in The Netherlands. Furthermore, an Inter-Society Technology Panel on system integration was successfully organized by Ke Wu during the IMS2021.

Among the other technical events organized by TC-4 members, Kaixue Ma was the general chair of the 13th UK-Europe-China Workshop on Millimeter-Wave and Terahertz Technologies (UCMMT2020). Other members were active in the organization of special sessions at international conferences (including IWS 2020, IMWS-AMP

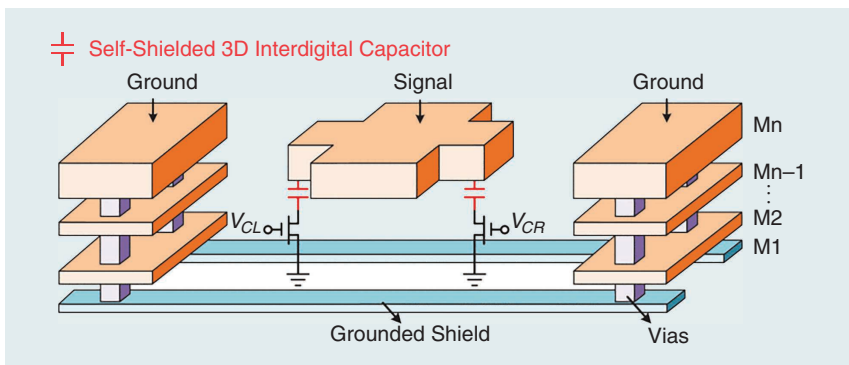


Figure 3. A high-resolution reconfigurable phase-tuning line using a self-shielded 3D interdigital capacitor. (Source: Taken from [2].)

(continued on page 88)

future. We are looking forward to seeing new generations of students at the 19th HEPA SDC, in San Diego, CA, USA, for IMS2023.

References

[1] "IMS2022 Student Design Competition," Institute of Electrical and Electronics Engineers, Piscataway, NJ, USA, 2022. [Online]. Available: <https://ims-ieee.org/SDC2022>

[2] "High Efficiency Power Amplifier Student Design Competition 2021," Institute of Electrical and Electronics Engineers, Piscataway, NJ, USA, 2021. [Online]. Available: https://mtt.org/hepa_student_design_competition_2021/

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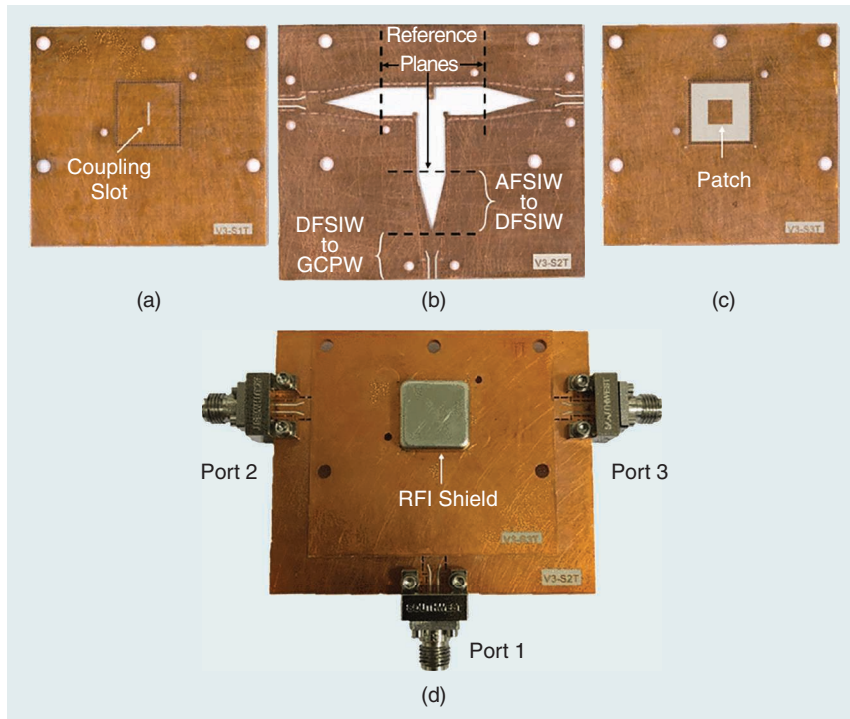


Figure 4. A fabrication-tolerant broadband air-filled SIW isolated power divider/combiner. (a) Layer S1. (b) Layer S2. (c) Layer S3. (d) The assembled circuit. DFSIW: dielectric-filled SIW; AFSIW: air-filled SIW; GCPW: grounded coplanar waveguide. (Source: Taken from [3].)

2021, IMFW 2021, URSI-GASS 2021, and IMArc 2021) and were invited to deliver invited and keynote talks for conferences and workshops (including RFIT, IMOC, PIMRC, IWMM, IMWS-AMP, IMArc, InCAP, and others).

Concerning the Speakers Bureau Program, Anthony Ghiotto and Somak Bhattacharyya delivered several talks on topics related to the activities of TC-4. Moreover, in the framework of the new initiative of Distinguished Microwave Instructors (DMIs), Wenquan (Cherry) Che and Xun Gong were active in the organization of the entire program, and Maurizio Bozzi gave a speech for students and young professionals on the historical evolution of microwave applications.

A number of TC-4 members have served on the editorial boards of IEEE journals. Maurizio Bozzi was a track editor of *IEEE Transactions on Microwave Theory and Techniques*; Xun Luo was a track editor of *IEEE Microwave and Wireless Components Letters*; Ke Wu was a topic editor of *IEEE Journal of Microwaves*; Tarek Djerafi was an associate editor of *IEEE Microwave and Wireless Components Letters*; and Abhishek Jia was an associate editor of *IEEE Sensors Journal*.

Finally, a good number of TC-4 members received prestigious awards and recognition in the past two years. Aly Fathy received the 2021

Distinguished Educator Award, and Ke Wu was awarded the 2022 IEEE MTT-S Distinguished Educator Award and the 2022 IEEE AP-S John Kraus Antenna Award. Xun Luo (Figure 3) and Anthony Ghiotto (Figure 4) received the 2022 Outstanding Young Engineer Award. Moreover, Wenquan (Cherry) Che was elevated to IEEE Fellow in 2022. Many additional awards, prizes, and recognitions have also been received by TC-4 members but are omitted for brevity.

This TC-4 report just gives a snapshot of who we are and what we have been doing over the first two years of our existence. With more technical activities energetically organized by our TC-4 members through various MTT-S events and projects, our TC-4 contributions and achievements in the Society can be felt everywhere. If you are interested in joining us in support of our mission and our activities, please don't hesitate to contact Dr. Maurizio Bozzi (maurizio.bozzi@unipv.it), who is currently the chair of TC-4, and/or Dr. Anthony Ghiotto (anthony.ghiotto@bordeaux-inp.fr), who is the vice-chair of TC-4.

References

- [1] K. Wu, M. Bozzi, and N. J. G. Fonseca, "Substrate integrated transmission lines: Review and applications," *IEEE J. Microw.*, vol. 1, no. 1, pp. 345–363, Jan. 2021, doi: 10.1109/JMW.2020.3034379.
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