MTT-S Society News

TC-2 Design Automation Committee October 2022–November 2024 Technical Report

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The Technical Committee 2 (TC-2) Design Automation Committee (originally established as MTT-1 CAD in 1968 by William J. Getsinger) focuses on advancing methods, software, and technologies for the modeling, simulation, and design optimization of high-frequency circuits and systems. Spanning frequencies from RF to terahertz, engineering innovation strongly depends on cutting-edge modeling techniques and design automation tools. These must accommodate emerging mathematical representations, design methodologies, advanced manufacturing processes, and novel materials to meet the demands of modern applications.

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The official Committee website, https://mtt.org/technical-committees/tc-2-design-automation-committe, provides detailed information about its mission and includes the profiles of its 29 members.

Unfortunately, in September 2023, the TC-2 community lost one of its most distinguished and influential members. Prof. John Bandler, whose work and contributions profoundly impacted the CAD and microwave theory and technology (MTT) communities, passed away. On behalf of this Committee and the entire MTT community, the authors of this article are honored to dedicate the final part of this contribution to his commemoration.

Following its mission, the TC-2 committee has focused primarily on promoting and disseminating knowledge in design automation, particularly in high-frequency modeling, characterization, and design, consistently with the commitments entrusted to it by the MTT community. Within this framework, over the past two years, TC-2 members have actively contributed to the IEEE community. The IEEE *Xplore* database lists 150 publications by TC-2 members, including 76 articles in IEEE Transactions publications. They have also contributed two books and delivered approximately 140 presentations at IEEE conferences, all included in the conference proceedings. In addition, TC-2 members have supported various initiatives, such as workshops, short courses, and focus/special sessions at international IEEE conferences. The next sections summarize the most significant events and activities supported and patronized by TC-2 members.

Conferences Patronized by TC-2

The 2023 IEEE MTT Society (MTT-S) International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO 2023) was held in Winnipeg, MB, Canada, in June 2023. The conference was organized by Prof. Vladimir Okhmatovski from the University of Manitoba and Prof. Jonatan Aronsson from CEMWorks. NEMO 2023 featured seven plenary talks, one workshop, one expert panel session, and 18 technical sessions with 97 technical papers presented. NEMO 2024 was held in Montréal, PQ, Canada, in August 2024. The conference was organized by Prof. Roni Khazaka (McGill University) and Prof. Peter Aaen (Colorado School of Mines).

TC-2 members José E. Rayas-Sánchez and Marco Pirola organized a special session titled "MTT-S TC-2 Special Session on Current Trends in Artificial Intelligence (AI), Machine Learning (ML), and Space Mapping Techniques for Microwave Design Automation." This session took place at the 2025 IEEE MTT-S Latin America Microwave Conference (LAMC 2025) in San Juan, Puerto Rico, from 22 to 24 January 2025. It featured five talks from renowned speakers and aimed to increase interest in CAD and exploratory data analysis (EDA) techniques for RF and microwave circuits, particularly within the Latin American community. It is sponsored by the new MTT-S TC Funding Support, led by the Technical Coordination and Future Directions Committee. Finally, TC-2 member Pirola will serve as the general chair for the upcoming Integrated Nonlinear Microwave and Millimeter-Wave Circuits conference, scheduled for April 2025 in Turin, Italy, featuring two days of oral and poster presentations and covering a broad range of topics on both traditional and emerging challenges in linear and nonlinear high-frequency CAD methodologies.

Regarding workshop organization, the activities led by the Young Professionals members of TC-2, the future backbone of our CAD community, were truly remarkable.

Focus, Special Sessions, Workshops, and Other Activities Patronized by TC-2

TC-2 member Q.J. Zhang co-organized the AI/Machine Learning Days at the 2023 IEEE MTT-S International Microwave Symposium (IMS 2023) in San Diego, CA, USA, in June 2023. The event featured an AI/ML bootcamp (reorganized for June 2024 in Washington D.C.), along with a workshop, special session, focus session, panel, and technical session, all focused on AI/ML technologies for microwave applications. TC-2 member Rayas-Sánchez was an organizer of an IMS 2023 Focus Session on AI and ML titled "Artificial Intelligence and Machine Learning Techniques for Signal/Power Integrity," where five excellent papers were presented and included the participation of IEEE Council on Electronic Design Automation (CEDA) Board of Governors (BoG) members.

Regarding workshop organization, the activities led by the Young Professionals (YPs) members of TC-2, the future backbone of our CAD community, were truly remarkable. In fact, thanks to their success, the recently launched electromagnetic modeling and optimization (EMO) and Measurement of Active Devices (MOMA) workshops are becoming permanent annual events. TC-2 members Feng and Q.J. Zhang organized the IEEE MTT-S Young Professionals Workshop on Electromagnetic Modeling and Optimization. First held in 2021 with TC-2's support, this virtual workshop provides a platform for YPs to share the latest advances in EMO and offers YPs a valuable opportunity to connect with senior experts in the field.

The EMO 2022 edition, chaired by Jianan Zhang from Southeast University, was a full-day workshop that featured morning, afternoon, and evening sessions. At the conclusion of the event, senior professionals Prof. Bandler, Prof. Zhizhang (David) Chen, Prof. Q.J. Zhang, and Prof. Qingsha Cheng provided their feedback on the presentations and addressed concerns raised by the YPs. The EMO 2023 edition, chaired by Weicong Na from the Beijing University of Technology, showcased presentations by 10 YPs. The event concluded with three Ph.D. students delivering 3-min presentations, followed by feedback and suggestions from senior professionals Prof. Rayas-Sánchez, Prof. Chen, Prof. Q.J. Zhang, and Prof. Cheng.

The most recent EMO edition, held in November 2024 and chaired by Jing Jin from Central China Normal University, included three sessions. The first session honored Prof. Bandler, with a focus on space mapping, while the other two featured presentations by YPs and 3-min contributions from Ph.D. students. As in previous editions, senior professionals, this time Prof. Rayas-Sánchez, Prof. Q.J. Zhang, and Prof. Cheng, provided valuable feedback and suggestions. Across all editions, the large number of online participants worldwide, coupled with positive feedback, reflects the event's success and guarantees its continuation in the years to come.

As for the MOMA workshop event, TC-2 members Gian Piero Gibiino and Justin King played a key role in its promotion and organization. Since its launch in 2022, three successful editions have been held, fostering collaboration, highlighting advancements in RF modeling, measurements, and optimization, and offering YPs valuable career development opportunities through expert mentorship and publishing platforms. The inaugural edition, held in October 2022, featured two paper sessions and two interactive panel discussions on technical trends and career guidance. Eight invited YP speakers presented on topics ranging from transistor-level to system-level modeling. Key highlights included advancements in GaN high-electron-mobility transistor modeling, digital predistortion techniques, and power amplifier (PA) optimization. With more than 200 attendees from around the globe, the event's success paved the way for successful editions in 2023 and 2024.

The session celebrated his profound contributions to CAD techniques for RF and microwave modeling and automated design optimization.

Figure 1. *Prof. Q.J. Zhang (Carleton University, Canada) delivers his keynote talk at LAMC 2023 in December 2023 in San Jose, Costa Rica.*

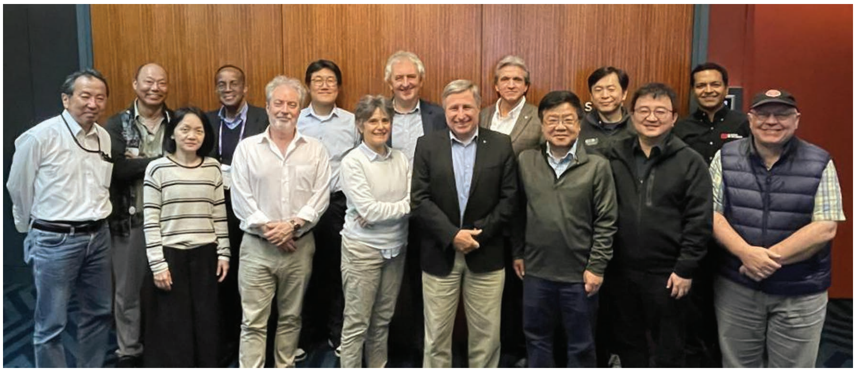

Figure 2. *A group photo of the CEDA BoG meeting on 23 June 2024 [4] during the 2024 Design Automation Conference in San Francisco, CA.*

The second edition, held in 2023, expanded to three sessions: two paper sessions on active device modeling and microwave measurements, and a panel discussion on strategies for early-career researchers entering fields that require significant hardware investment. This edition featured six presentations and five expert panelists, attracting a strong audience. Presenters were invited to submit their work to *IEEE Microwave Magazine*, with selected articles published in a special issue in January 2025, followed by another special issue in February 2025, which included contributions from the 2023 EMO workshop. Finally, the final and most recent MOMA workshop, held in October 2024, featured two technical sessions, each presenting three papers on active device modeling and measurement techniques. Continuing its emphasis on research dissemination and professional growth, also in this case, IEEE offered workshop presenters the opportunity to expand their work for publication in a future issue of *IEEE Microwave Magazine*.

It is also worth mentioning TC-2 member Q.J. Zhang, who served as guest editor for the Special Issue on AI and ML Technologies for Microwaves in *IEEE Transactions on Microwave Theory and Techniques* (November 2022), a field of growing relevance in our community. The call for papers received a strong response with 209 submissions, of which 45 were accepted and published in the November 2024 issue of *IEEE Transactions on Microwave Theory and Techniques*. These articles cover AI/ML applications in microwave modeling, optimization, and design of EM structures and passive circuits; nonlinear device modeling, PA behavior, and digital predistortion; solving challenges in EM inverse scattering, near-field scanning, and imaging; and AI/ML applications in radar sensing, signal processing, biomedical, and other fields. Also within the AI context, TC-2 member Q.J. Zhang was a keynote speaker at LAMC 2023, held in San Jose, Costa Rica, in December 2023,

Figure 3. *A group photo taken at the end of the IMS 2024 Memorial Special Session Honoring Prof. John Bandler, in Washington, DC.*

where he delivered the talk "AI and Machine Learning for Microwaves: Past, Present, and Future Trends" (see Figure 1).

The expertise and contributions of TC-2 members were further recognized through invitations to publish articles on design automation topics in *IEEE Transactions on Microwave Theory and Techniques* as well as in *IEEE Journal of Microwaves*. The first article, led by TC-2 member Feng, is titled "Artificial Neural Networks for Microwave Computer-Aided Design: The State of the Art" [1]. The second article, coauthored by TC-2 members Prof. Bandler and Rayas-Sánchez, is titled "An Early History of Optimization Technology for Automated Design of Microwave Circuits" [2]. The third article, led by Rayas-Sánchez, is titled "Microwave Modeling and Design Optimization: The Legacy of John Bandler" [3]. Finally, the participation of TC-2 member Rayas-Sánchez, as a delegate of TC-2 and the current IEEE MTT-S representative for CEDA, is also noteworthy. Rayas-Sánchez attended the CEDA BoG meetings held in June 2023 and 2024 in San Francisco, CA (see Figure 2), and detailed reports of his participation were sent to the MTT-S Inter-Society Committee. Among the outcomes of this collaboration, it is important to note that MTT-S conferences with EDA sessions are now promoted on the CEDA website.

Memorial Session

As previously mentioned, the final part of this article is dedicated to the memory of Prof. Bandler, a prominent and highly influential member of our community who sadly passed away on 28 September 2023. A memorial session in honor of Prof. Bandler, an esteemed TC-2 member and founding member of the former MTT-1 on CAD [3], was held at IMS in Washington, D.C., USA, on 19 June 2024 (see Figure 3). The session celebrated his profound contributions to CAD techniques for RF and microwave modeling and automated design optimization. Organized by TC-2 members Rayas-Sánchez and Q.J. Zhang, the session included reflections from distinguished colleagues such as Wolfgang J.R. Hoefer, James Rautio, Natalia K. Nikolova, Q.J. Zhang, Ming Yu, Vicente E. Boria-Esbert, Rayas-Sánchez, and Cheng. They shared both the technical achievements and personal memories of a man whose impact was far-reaching. The session concluded with final remarks from his beloved wife, Beth Bandler.

References

[1] F. Feng, W. Na, J. Jin, J. Zhang, W. Zhang, and Q.-J. Zhang, "Artificial neural networks for microwave computer-aided design: The state of the art," *IEEE Trans. Microw. Theory Techn.*, vol. 70, no. 11, pp. 4597–4619, Nov. 2022, doi: 10.1109/TMTT.2022.3197751.

[2] J. W. Bandler and J. E. Rayas-Sánchez, "An early history of optimization technology for automated design of microwave circuits," *IEEE J. Microwaves*, vol. 3, no. 1, pp. 319–337, Jan. 2023, doi: 10.1109/JMW.2022.3225012.

[3] J. E. Rayas-Sánchez et al., "Microwave modeling and design optimization: The legacy of John Bandler," *IEEE Trans. Microw. Theory Techn.*, vol. 73, no. 1, pp. 87–101, 2024. doi: 10.1109/TMTT.2024.3437198.

[4] "CEDA ExCom and BoG meetings at DAC 2024." IEEE CEDA. Accessed: Apr. 7, 2025. [Online]. Available: https://ieee-ceda.org/post/announcement/ceda-excom-and-bog-meetings-dac-2024#