2024

IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization for RF, Microwave, and Terahertz Applications

General Chair:
- Roni Khazaka, *McGill University*

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- Peter Aaen, *Colorado School of Mines*

Technical Program Chairs:
- Natalia Nikolova, *McMaster University*
- Zhizhang Chen (Co-Chair), *Dalhousie University*

Student Paper Competition Chair:
- Q. J. Zhang, *Carleton University*

Finance Chair:
- Emad Gad, *University of Ottawa*

Multiscale and Multiphysics Modeling, Analysis, and Optimization of 3-D Heterogeneously Integrated Systems

Abstract: Heterogeneous integration (HI) is the assembly and packaging of individual components, such as CPUs, GPUs, memory, FPGAs, transceivers, and power regulators, which are separately manufactured using diverse technologies and different semiconductor processes onto a single substrate. HI has shown tremendous potential to overcome the limitations and shortcomings of current monolithic integration technology, and effectively combat the slow-down of Moore's law.

The modeling and simulation of a HI system is challenging since it requires a solution to the interacting physics of circuits, electromagnetics, thermodynamics, mechanics, etc., in a highly multiscaled, large-scale, and integrated structure across multiple domains from chiplets to package to system. In this talk, Prof. Jiao will present recent advances in fast solvers to tackle these challenges. Rapid, large-scale, first-principles accurate algorithms for multiscale multiphysics modeling and analysis will be presented. Machine intelligence will also be fused with domain expertise for significantly accelerated modeling, analysis, and optimization at system level.

Prof. Dan Jiao
Elmore Family School of Electrical and Computer Engineering
Purdue University

NEMO 2024

A Journey of Discovery in Numerical Microwave Electromagnetics

Abstract: The author has been involved in applied high frequency numerical electromagnetic analysis since the beginning of the field. Inspired by work on some of the first GaAs integrated circuits at GE Electronics Laboratory, Syracuse, NY, he learned electromagnetics with the intention of reducing and eliminating the multiple re-designs then required. This is the story, from the author's personal perspective of how electromagnetic analysis has developed and matured from the very beginning until today, when it is now a required part of the microwave design process.

Dr. Jim Rautio
Sonnet Software
USA

NFM◆ 2024

Domain Decomposition Methodology for Solving Maxwell's Equations at Scale

Abstract: The ever-increasing fidelity and accuracy needs of advanced electromagnetic (EM) applications have been pushing the problem sizes towards extreme scales. It puts a high premium on high-performance algorithms with optimal computational complexity. Moreover, there is an increasing demand for an integrated design and analysis environment, which requires new simulation tools to be well integrated into design processes. The focus of this research is to investigate first-principles modeling and analysis tools for these extremely large, multi-scale problems. Emphasis is placed on advancing parallel algorithms that are provably scalable, and facilitating a design-through-analysis paradigm for emerging and future complex systems. In recent years, domain decomposition (DD) methods have emerged as powerful tools for solving large, multi-scale EM problems. These methods feature divide-and-conquer in solution algorithms and plug-in-play in software architectures. Moreover, DD methods yield highly efficient and naturally parallelizable algorithms, particularly well-suited for distributed parallel computing systems. This presentation will provide a comprehensive review and discussion of recent advancements in DD methods for solving both differential and integral equations, with applications to large-scale EM problems.

Dr. Zhen Peng
Dept. of Electrical and Computer Engineering
University of Illinois Urbana-Champaign

NEMO 2024

Conference Schedule
Monday, August 12

Time	Event
8:00 am	Registration Opens
8:15 am – 8:30 am	Opening Remarks and Address from the IEEE Microwave Theory and Technology Society (MTT-S) President, Prof. Maurizio Bozzi
Session Mo-AM1: *Focused Session:* **Computational Methods for Metasurface Design and Simulation** *Chair:* Puyan Mojabi , *University of Manitoba*	
8:30 am – 8:50 am	**Radiation Pattern Tailoring Using Conformal Metasurface Radomes** Christopher J. M. Barker, Ashwin Iyer *University of Alberta*
8:50 am – 9:10 am	**Recent Advances in the Modeling of Reconfigurable Intelligent Surfaces: Mutual Coupling Effects and Multipath Propagation** Yuanzhi Liu, Costas Sarris *University of Toronto*
9:10 am – 9:30 am	**A Robust Microwave Sensor Featuring a Perfect Metasurface Absorber** Nazli Kazemi[#], Mohammad Abdolrazzaghi*, Petr Musilek[#], Elham Baladi^ *Polytechnique Montréal[#], University of Toronto*, University of Alberta[#]*
9:30 am – 9:50 am	**Linear to Circular Polarization Converting Beamsteerable Metasurfaces** Mahboubeh Taraji[#], Marco A. Antoniades^, Elham Baladi* *Toronto Metropolitan University[#], Polytechnique Montréal**
9:50 am – 10:10 am	**Implicit IE-GSTC Metasurface Solver: Review and Recent Progress** Mario Phaneuf, Puyan Mojabi *University of Manitoba*
10:10 am –10:30 am	Coffee Break

ANTEM 2024

Conference Schedule
Monday, August 12

Time	Event
Session Mo-AM2: **Fast Algorithms in Computational Electromagnetics** *Chairs:* Vladimir Okhmatovski, *University of Manitoba* Abdulkadir C. Yucel, *Nanyang Technological University* Yang Liu, *Lawrence Berkeley National Laboratory*	
10:30 am – 10:50 am	**Faber Polynomial based Local Propagators for Laser Applications** Wladimir Plotnikov, Dirk Schulz *TU Dortmund University*
10:50 am – 11:10 am	**Preconditioned Parallel Locally Corrected Nyström Discretization of CFIE Accelerated by H-Matrix** Omid Babazadeh^, Vladimir Okhmatovski^, Ian Jeffrey^, Constantine Sideris*, Emrah Sever [#] , Jin Hu* *University of Manitoba^* *University of Southern California** *Aselsan Inc.[#], Turkey*
11:10 am – 11:30 am	**Discontinuous Galerkin Time Domain Methods in Electromagnetics GPU-Accelerated Numerical Algorithms** Olivier Cotte, Dennis D Giannacopoulos *McGill University*
11:30 am – 11:50 pm	**Antenna-Circuit Co-Simulation via Clustering Model Order Reduction** Jacob Martire, Derek A McNamara, Emad Gad *University of Ottawa*
11:50 am – 12:00 pm	Discussion Mo-AM Sessions and Conference Announcements
12:00 pm – 1:00 pm	Lunch

MFM◆2024

Time	Event
Keynote: Multiscale and Multiphysics Modeling, Analysis, and Optimization of 3-D Heterogeneously Integrated Systems Dan Jiao, *Elmore Family School of Electrical and Computer Engineering, Purdue University*	
Session Mo-PM1: *Focused Session:* **Commercial EM Simulation Tools** **Chair:** C. J. Reddy, *Altair Engineering, USA*	
2:00 pm – 2:20 pm	**Efficient CAD of Large Rotational Symmetric Antennas with BOR FEM and Spherical Wave Expansion** Ralf Beyer^, Ralf Ihmels* *Mician GmbH^ (Germany), Mician Inc.* (Germany)*
2:20 pm – 2:40 pm	**Conformal Field Injection for Accurate FDTD Simulation of Off-Grid Planar Transmission Line Structures** Andreas Lauer, Thorsten Liebig, David Schäfer, Winfried Simon, Andreas Wien *IMST GmbH, Germany*
2:40 pm – 3:00 pm	**Recent Advances in Altair Feko** Shannon Mistry, C. J. Reddy *Altair, USA*
3:00 pm – 3:20 pm	**Leveraging Cloud Computing & GPU Acceleration for High Fidelity Wireless Channel Modeling in Dynamic Virtual Terrestrial Environments** Laila Salman *Ansys Canada Ltd.*
3:20 pm – 3:40 pm	**Recent Advances in Full-Wave Modelling of IC Packaging** Jonatan Aronsson *CEMWorks Inc., Canada*
3:40 pm- 4:00 pm	Coffee Break

NEMO 2024

Conference Schedule
Monday, August 12

Time	Event
Session Mo-PM2: **Optimization and Modeling Methods for Computer-aided Design** ***Chair*:** Qi-Jun (QJ) Zhang, *Carleton University*	
4:00 pm – 4:20 pm	**A Review of Space Mapping and AI-Based Surrogate for Microwave Device Optimization** Yu Deng* ,Qingsha S. Cheng*, Yu Kuang[#] *Southern University of Science and Technology*, China* *National University of Singapore*
4:20 pm – 4:40 pm	**High-order Stable Simulation of Nonlinear Circuits using Modified Inversion of the Laplace Transform** Bardia Bandali*, Emad Gad*, Michel Nakhla[#] *University of Ottawa*, Carleton University[#]*
4:40 pm – 5:00 pm	**Power-weighted Pretraining-based Feature Extraction for Model Adaptation of RF Power Amplifiers** Qing Luo, Xiao-Wei Zhu *Southeast University, China*
5:00 pm – 5:20 pm	**Multi-objective Design Optimization of a 22kW Class Inverter with Orthogonal Array Experiment and Multi-island Genetic Algorithm** Chang-Yong Song *Mokpo National University*
5:20 pm – 5:30 pm	Discussion Mo-PM Sessions and Conference Announcements (Conference Chairs)
6:30 pm – 8:30 pm	Reception *Hôtel Le Germain Montréal (Pavillon room)* *2050 Mansfield St, Montreal, Quebec H3A 1Y9*

NEMO 2024

Conference Schedule
Tuesday, August 13

Time	Event
8:15 am	Registration Opens
Session Tu-AM1: *Focused Session:* **Bridging the Gaps between Electromagnetic Modeling and Material Measurements – Part I** **Chairs:** Malgorzata Celuch, *QWED Sp. z o. o., Poland* Kamel Haddadi, *University of Lille*	
8:30 am – 8:50 am	**Reduction of Numerical Analysis Complexity of Structures Used for Material Characterization** Malgorzata Warecka, Rafal Lech, Piotr Kowalczyk *Gdansk University of Technology*
8:50 am – 9:10 am	**Estimation of Electric Conductivity of Copper Foils Employing Full Wave Simulation Based on 3D FEM and Shape Deformation** Adam Lamecki, Lukasz Balewski, Michael Mrozowski *EM Invent sp. z.o.o, Poland*
9:10 am – 9:30 am	**Modeling-Based Methodology for Electromagnetic Screening of Copper Foils for High-Frequency Applications** Malgorzata Celuch^, Thomas Devahif*, Tomasz Nalecz^, Janusz Rudnicki^ *QWED, Poland^* *Circuit Foil**
9:30 am – 9:50 am	**Development of LRRM and TRL Calibration Kits for On-Wafer Microwave Measurements at the Nanoscale** Daouda Seck^, Djamel Allal^, Kamel Haddadi* *LNE^* *University of Lille**
9:50 am – 10:10 am	**A Comparative Study of Deblurring Methods for Dielectric Resonator Scans of Material Surfaces** Justyna I. Koper^, Małgorzata Celuch^, Marzena Olszewska-Placha^, Przemysław Korpas* *QWED Sp. Z o. o., Poland^* *Warsaw University of Technology**
10:10 am – 10:30 am	Coffee Break

Conference Schedule
Tuesday, August 13

Time	Event
Session Tu-AM2: *Focused Session:* **Bridging the Gaps between Electromagnetic Modeling and Material Measurements – Part II** *Chairs:* Malgorzata Celuch, *QWED Sp. z o. o., Poland* Kamel Haddadi, *University of Lille*	
10:30 am – 10:50 am	**Comparison of the Transmission/Reflection Methods in Liquid Permittivity Measurements Supported by EM Simulations** Michał M. Kalisiak^, Wojciech Wiatr^, Arkadiusz Lewandowski^, Łukasz Usydus* *Warsaw University of Technology^* *Central Office of Measures, Poland**
10:50 am – 11:10 am	**Numerical Electromagnetic Modeling of a BCDR Test Fixture for Out of Plane Permittivity Measurements** Lukasz Nowicki, Malgorzata Celuch, Marzena Olszewska–Placha, Wojciech Gwarek *QWED Sp. z o. o., Poland*
11:10 am – 11:30 am	**Multipactor Modeling in 2D for Open Insight into the EM Behavior of Metalic Microwave Components** Malgorzata Celuch^, Thomas Devahif*, Tomasz Nalecz^, Janusz Rudnicki^ *QWED, Poland^* Circuit Foil*
11:30 am – 11:50 pm	**Evaluation of Discrepancies in Theoretical and Experimental RF Energy Harvesting Efficiency from Measured Diode Parameters** Xiaoqiang Gu, Maninder Bir Singh Gulshan*, Thomas Micallef#, Roni Khazaka*, Ke Wu# *University of Bristol^* *McGill University** *Polytechnique Montréal#*
11:50 am – 12:00 pm	Discussion Tu-AM Sessions and Conference Announcements (Conference Chairs)
12:00 pm – 1:00 pm	Lunch

MEMO 2024

Conference Schedule
Tuesday, August 13

Time	Event
1:00 pm – 2:00 pm	***Keynote:* A Journey of Discovery in Numerical Microwave Electromagnetics** Jim Rautio, *Sonnet Software, USA*
Session Tu-PM1: **Advancements in Electromagnetic and/or Multiphysics Inverse Problems** ***Chair:*** Ian Jeffrey, *University of Manitoba*	
2:00 pm – 2:20 pm	**Feature-based Magnetotelluric Inversion with the Variational Autoencoder Regularization** Hongyu Zhou, Rui Guo, Maokun Li, Fan Yang, Shenheng Xu *Tsinghua University, China*
2:20 pm – 2:40 pm	**Minimizing Transceivers through ML-Driven Time-Domain Inversion** Ben J. Martin, Ian Jeffrey, Colin Gilmore *University of Manitoba*
2:40 pm – 3:00 pm	**Prediction of Electromagnetic Scattering with a Small Dataset Based on Active Learning** De-Hua Kong*, Wen-Chi Huang*, Jia-Ning Cao*, Wen-Wei Zhang*, Chao-Fu Wang#, Ming-Yao Xia* *Peking University** *National University of Singapore#*
3:00 pm – 3:20 pm	**A Numerical Approach for Doppler Radars** Mohammad Marvasti, Halim Boutayeb *Université du Québec en Outaouais*
3:20 pm – 3:40 pm	**Multiphysics Design & Analysis of Silver-Based Low-Emissivity Coating Technology for Energy Saving Sustainable Windows Applications** Laila Salman *Ansys Canada Ltd.*
3:40 pm – 4:00 pm	Coffee Break

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Time	Event
Session Tu-PM2: **Advanced Methods for Antenna Analysis and Design** *Chair:* Zhizhang (David) Chen, *Dalhousie University*	
4:00 pm – 4:20 pm	**Multiphysics Modeling on Photoconductive Antennas for Terahertz Applications** Boxun Yan*, Pooja Bundel#, Chi-Hou Chan#, Mau-Chung Frank Chang* *University of California** *City University of Hong Kong#*
4:20 pm – 4:40 pm	**Capacity Based Design of Slot Array Antennas** Volodymyr Shyianov, Bamelak H. Tadele, Vladimir Okhmatovski, Faouzi Bellili, Amine Mezghani *University of Manitoba*
4:40 pm – 5:00 pm	**On The Circuit Modelling of Far-field Radiation** Zhen-yuan Zhang*, Natalia K. Nikolova*, Yang Jiang#, Ming Yu^ *McMaster University** *Shenzhen University#* *Southern University of Science and Technology^*
5:00 pm – 5:20 pm	**Radar Antennas Employing a Modified Dielectric GRIN Luneburg Lens** Mohammad Omid Bagheri*, Erik Yann Harmgarth*, Henrik Ramberg#, Erwin Biebl^, George Shaker* *University of Waterloo** *Fortify Co.#* *Technical University of Munich^*
5:20 pm – 5:30 pm	Discussion Tu-PM Sessions and Conference Announcements (Conference Chairs)
7:00 pm	Banquet *Hôtel Le Germain Montréal (Pavillon room)* *2050 Mansfield St, Montreal, Quebec H3A 1Y9*

NFM◆ 2024

Conference Schedule
Wednesday, August 14

Time	Event
8:15 am	Registration Opens
8:30 am – 9:20 am	IEEE MTT-S Speaker ***Talking about Talking: Making your Verbal Presentations Memorable and Compelling*** Erin Kiley, *Department of Mathematics, Massachusetts College of Liberal Arts*
9:20 am – 10:20 am	***Keynote:* Domain Decomposition Methodology for Solving Maxwell's Equations at Scale** Zhen Peng, *Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign*
10:20 am – 10:40 am	Coffee Break
Session We-AM: **Advances in the Electromagnetic Modeling of Devices and Systems** ***Chair:*** Derek A. McNamara, *University of Ottawa*	
10:40 am – 11:00 am	**On the Solution of the TD-EFIE Using a Problem-Independent Numerical Inverse Laplace Transformation Approach** Glenn Iwasa, Emad Gad, Derek A. McNamara *University of Ottawa*
11:00 am – 11:20 am	**Comprehensive End-to-End Solution Workflow for Additively Manufactured High-Power Light Weight Waveguide Filter** Laila Salman *Ansys Canada Ltd.*
11:20 am – 11:40 am	**Structured Inverse Eigenvalue Problems for Bandpass Microwave Filter Design** Adam Lamecki*, Michal Mrozowski[#] , Roberto Gomez-Garcia^ *EM Invent sp. z o.o., Poland** *Gdansk University of Technology[#]* *University of Alcala^*

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Conference Schedule
Wednesday, August 14

Time	Event
11:40 am – 12:00 pm	**Transfer Learning for Accelerating Microwave Filter Design** Olufemi Oluyemi, Paul Laforge, Abdul Bais *University of Regina*
12:00 pm – 12:20 pm	**Numerical Solver for Characterization of Semiconductor Devices** Mario Kupresak*, Johannes Hoffmann[#], Jasmin Smajic*, Juerg Leuthold* *ETH Zurich* * *The Federal Institute of Metrology (METAS)* [#]
12:20 pm – 12:40 pm	**Addressing Electromagnetic Modeling and Simulation Challenges for Silicon Interposers in 2.5D/3D IC Chip Design** Laila Salman *Ansys Canada Ltd.*
12:40 pm – 1:40 pm	Lunch
1:40 pm – 2:10 pm	Student Paper Competition Awards
2:10 pm – 2:30 pm	Closing Remarks and Announcements: Special Issues, NEMO 2025

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