Qi Shutong

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EDUCATION

University of Toronto (UofT)

Ph.D. Student, Electrical and Computer Engineering Research topic: Physics-Informed Machine Learning for Electromagnetic and Multiphysics Modeling

Beihang University (BUAA) B.Eng., Electronic and Information Engineering **Excellent Graduate**

RESEARCH EXPERIENCE

University of Toronto, Department of Electrical and Computer Engineering Research Assistant, Advised by Professor Costas D. Sarris

- Developed a hybrid CNN-LSTM model to predict S-parameters from planar circuit layouts, enabling rapid signal integrity analysis from geometry and material inputs.
- Designed a physics-informed deep curl operator for fast, generalizable electromagnetic solvers, achieving over 100× speedup over FDTD in uncertainty-aware design and modeling tasks.
- Established a hybrid Physics-Informed Neural Network (PINN) with finite-difference time-stepping, enabling unconditionally stable time-domain simulations of wave propagation.
- Pioneered an unsupervised PINN-U-Net framework for coupled electrothermal simulations, supporting layout-aware multiphysics analysis in reliability-critical systems.

Beihang University, School of Electronic and Information Engineering

Research Assistant, Advised by Associate Professor Qiang Ren

- Utilized the Finite-Difference Frequency-Domain (FD-FD) method for generating an electromagnetic scattering database.
- Developed a deep neural network (U-net) to accelerate the simulation of 2-D and 3-D electromagnetic scattering problems using the FD-FD approach.

Dartmouth College, Department of Computer Science

Research Assistant, Advised by Assistant Professor Xing-dong Yang

• Conducted antenna radiation pattern simulations for optimizing communication performance.

WORK EXPERIENCE

Ansys Lumerical

Intern, Mentored by Dr. Jens Niegemann

- Developed and optimized fast algorithms to accelerate meta-optic design workflows, contributing to automated layout-to-performance modeling of metalenses.
- Applied adaptive Kriging methods for accurate and efficient interpolation of meta-atom feature maps.
- Evaluated advanced adaptive sampling strategies to improve model fidelity across complex design spaces with high parameter sensitivity.
- Benchmarked sparse grid interpolation as a reference for surrogate-assisted CAD workflows.

Hanover, USA Jun. 2019 - Sep. 2019

Beijing, China Sep. 2016 - Jun. 2020

Remote

Aug. 2024 - Dec. 2024



Toronto, Canada

Sep. 2020 - Now

Sep. 2018 - Jun. 2020

Beijing, China

Toronto, Canada Sep. 2020 - Present

shutong.space

SKILLS

- Programming languages: Proficient in **Python** and **MATLAB**. Familiar with **C** and **C++**.
- Technologies & Frameworks: Extensive experience with Python libraries and frameworks, including **PyTorch**, **GPyTorch**, **NumPy**, **pandas**, **Scikit-learn**, and **Keras**. Proficient in using version control with **Git** and job scheduling with **Slurm** on HPC clusters, and working in **Linux-based environments**.
- Strong background in electromagnetic theory and numerical methods, particularly FDTD and FEM. Hands-on experience with industry-standard simulation tools, including ANSYS HFSS, Lumerical, COMSOL Multiphysics, CST Studio, and FlexCompute Tidy3D.
- TOEFL: 105

SELECTED PUBLICATIONS

- **Shutong Qi** and Costas Sarris, "Fast Modeling of Defect Periodic Structures with a Physics-Informed Deep Operator Network," in submission to *IEEE Antennas and Wireless Propagation Letters*, <u>TechRxive</u>.
- Shutong Qi and Costas Sarris, "Physics-Informed Deep Operator Network for 3-D Time-Domain Electromagnetic Modeling," in *IEEE Transactions on Microwave Theory and Techniques*, doi: 10.1109/TMTT.2024.3521389.
- **Shutong Qi** and Costas Sarris, "Hybrid Physics-Informed Neural Network for the Wave Equation with Unconditionally Stable Time-Stepping," in *IEEE Antennas and Wireless Propagation Letters*, doi: 10.1109/LAWP.2024.3355896.
- Shutong Qi and Costas Sarris, "Electromagnetic-Thermal Analysis With FDTD and Physics-Informed Neural Networks," in *IEEE Journal on Multiscale and Multiphysics Computational Techniques*, vol. 8, pp. 49-59, 2023, doi: 10.1109/JMMCT.2023.3236946.
- Shutong Qi and Costas Sarris, "Deep Neural Networks for Rapid Simulation of Planar Microwave Circuits Based on their Layouts," in *IEEE Transactions on Microwave Theory and Techniques*, 2022, doi: 10.1109/TMTT.2022.3210229.
- Shutong Qi, Yinpeng Wang, Yongzhong Li, Xuan Wu, Qiang Ren and Yi Ren, "2D Electromagnetic Solver Based on Deep Learning Technique," in *IEEE Journal of Multiscale and Multiphysics Computational Techniques*, 2020, 5: 83-88.
- Shutong Qi and Costas Sarris, "Coupled Electromagnetic-Thermal Analysis for Temperature-Dependent Materials with Physics-Informed Neural Networks," in 2024 IEEE/MTT-S International Microwave Symposium, Washington D.C., USA, 2024.
- Shutong Qi and Costas Sarris, "Physics-Informed Neural Networks for Multiphysics Simulations: Application to Coupled Electromagnetic-Thermal Modeling," in 2023 IEEE/MTT-S International Microwave Symposium, San Diego, CA, USA, 2023, pp. 166-169, doi: 10.1109/IMS37964.2023.10188015.
- More co-authored papers can be found on my Google Scholar profile.

AWARDS & ACHIEVEMENTS

- IEEE Microwave Theory and Technology Society Graduate Fellowship
- Excellent Graduate, Beihang University

Feb. 2024 Jun. 2020