Qi Shutong

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EDUCATION

University of Toronto (UofT)   **Toronto, Canada**
Ph.D. Student, Electrical and Computer Engineering   *Sep. 2020 - Present*
Research topic: Physics-Informed Machine Learning for Electromagnetic and Multiphysics Modeling

Beihang University (BUAA)   **Beijing, China**
B.Eng., Electronic and Information Engineering   *Sep. 2016 - Jun. 2020*
Excellent Graduate

RESEARCH EXPERIENCE

University of Toronto, Department of Electrical and Computer Engineering   **Toronto, Canada**
Research Assistant, Advised by Professor Costas D. Sarris   *Sep. 2020 - Now*

- Developed a deep neural network to compensate for numerical errors in the Finite-Difference Time-Domain (FDTD) method for planar microwave circuit modeling, enhancing accuracy and efficiency.
- Designed a physics-informed deep curl operator for efficient electromagnetic modeling, achieving a two-order-of-magnitude speedup over FDTD in uncertainty quantification tasks.
- Established a hybrid Physics-Informed Neural Network (PINN) with a finite difference method for time-domain electromagnetic modeling with unconditionally stable time-stepping.
- Pioneered a novel approach by combining FDTD method and PINN for multiphysics simulation.

Beihang University, School of Electronic and Information Engineering   **Beijing, China**
Research Assistant, Advised by Associate Professor Qiang Ren   *Sep. 2018 - Jun. 2020*

- 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   **Hanover, USA**
Research Assistant, Advised by Assistant Professor Xing-dong Yang   *Jun. 2019 - Sep. 2019*

- Conducted antenna radiation pattern simulations for optimizing communication performance.
- Formulated and executed experiments to evaluate the impact of various types of fabrics on the radiation performance of the antennas.
- Collected and classified user gestures and achieved classification accuracy over 90%.

WORK EXPERIENCE

Ansys Lumerical   **Remote**
Intern, Mentored by Dr. Jens Niegemann   *Aug. 2024 - Dec. 2024*

- Developed and optimized fast algorithms for metalens modeling.
- Utilized adaptive Kriging methods to interpolate meta-atom feature maps.
- Evaluated advanced adaptive sampling strategies for challenging feature maps.
- Implemented sparse grids interpolation as a benchmark for the adaptive Kriging approach.

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,* [TechRxive](#).

- **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   *Feb. 2024*
- Excellent Graduate, Beihang University   *Jun. 2020*