# Fatemeh Safari

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## EDUCATION

Michigan Technological University(MTU) | Houghton, MI — May 2020
**MSc Electrical Engineering**

University of Mazandaran | Mazandaran, Iran — February 2015
**BS Physics**

## PUBLICATION

1. E. Hedayati, **F. Safari**, G. Verghese, V. R. Ciancia, D. K. Sodickson, S. Dehkharghani, and L. Alon, "An experimental system for detection and localization of hemorrhage using ultra-wideband microwaves with deep learning," *arXiv:2310.02215*, 2023. [Online]. Available: `https://arxiv.org/abs/2310.02215`.
2. O. Yaghmazadeh, S. Schoenhardt, A. Sarabandi, A. Sabet, K. Sabet, **F. Safari**, L. Alon, and G. Buzsáki, "In-vivo measurement of radio frequency electric fields in mice brain," *Biosensors and Bioelectronics: X*, vol. 14, pp. 100328, 2023. [Online]. Available: `https://www.sciencedirect.com/science/article/pii/S2590137023000250`.
3. S. Jamilan, N. P. Gandji, G. Semouchkin, **F. Safari**, and E. Semouchkina, "Scattering from Dielectric Metasurfaces in Optical and Microwave Ranges," *IEEE Photonics Journal*, 2019.
4. S. Jamilan, G. Semouchkin, **F. Safari**, and E. Semouchkina, "Interference Phenomena at Resonances in Dense Silicon Metasurfaces," in *Proceedings of PhotonIcs & Electromagnetics Research Symposium*, Rome, 2019.

## PROFESSIONAL/RESEARCH EXPERIENCE

**Research Associate in Radiology, NYU Grossman School of Medicine** — **Sep 2020 - Aug 2023**

- **Microwave Medical Imaging Prototype for Stroke Classification and Localization**
  - Designed electronic printed circuit boards and a switch matrix on PCB up to 4 GHz using KiCad.
  - Developed UWB unidirectional Vivaldi antennas for medical imaging purposes using HFSS.
  - Designed and manipulated CAD models for 3D printing, which included an anthropomorphic human head phantom for pre-human testing, antenna holders, different mounts, and more.
  - Created dielectric tissue-mimicking solutions at 64MHz-6GHz with similar dielectric parameters to the human brain, muscle, and blood
  - Studied the electromagnetic response, behavior, and penetration of the designed UWB unidirectional Vivaldi antennas in a heterogeneous head model using CST Microwave Studio.
  - Contributed to the design of a 2x8 port PCB switch matrix functional up to 10 GHz, including simulating various transmission lines, vias, and coaxial launches.
  - Assisted with data collection from the stroke detection test bed prototype to validate system performance.
  - Contributed to the construction of a 2x16 switch-matrix functional up to 12 GHz, encompassing shift-register design, mechanical assembly, soldering, organization, and 16-port calibration.
  - Facilitated component-level testing and troubleshooting setups for PCBs.
  - Collaborated in a multidisciplinary team of engineers, physicists, and medical professionals.
  - Facilitated the procurement of a 2-port Vector Network Analyzer (VNA), including vendor selection, negotiation, and finalizing the purchase.

Several manuscripts are currently under review or in preparation for publication.

**Master Student, MTU** — **Sep 2018 - May 2020**

- **Electromagnetic Response from Dielectric Metasurfaces**
  - Investigated scattering parameters of dense and sparse arrays of dielectric resonators (metasurfaces) using CST Microwave Studio.
  - Conducted simulations to explore the parameter correspondence with Magnetic Dipole Resonance (MDR) and Electric Dipole Resonance (EDR), referenced in published work [jamilan2019scattering].
- **Electromagnetically Induced Transparency in Metasurfaces**
  - Simulated metasurfaces with arrays of cylindrical resonators using electromagnetic field simulation software (CST Microwave Studio and COMSOL Multi-physics) to find structures which provides EIT-like response
  - Discovered that EIT-like response has no correlation to MDR
  - It was shown that the EIT-like response happens at the EDR frequency and the slow-light effect can be observed
  - Found the group index velocity using MATLAB from transmission phase
  - Verified the simulations by performing experiments using dielectric cylinders in microwave range (10-12GHz) by X-Band horn antennas

## TEACHING EXPERIENCE

- **Michigan Technological University**
  - Developed an online version instruction (using NI Multisim) of "AC magnitude and Phase" for circuits and instrumentation course's lab for non-major students during the COVID-19 pandemic, Spring 2020
  - Circuits and Instrumentation (EE3010) Lab Instructor for EE, CE, BME, and ME major students, Fall & spring 2019/20, Fall 2018/19
  - Electric Circuits II (EE2112) Lab, Lab Instructor for EE and CE students, Spring 2018/19
  - Co-Developed a course design for fundamental physics laboratory III, 2012

## SOFTWARE AND TECHNICAL SKILLS

- COMSOL Multi-Physics
- AutoCad
- Autodesk Fusion 360
- Autodesk Inventor
- NI Multisim
- ANSYS Electronic Desktop (HFSS)
- MATLAB and Python
- Autodesk Eagle
- KiCad
- CST Microwave Studio
- NI LabVIEW
- PCB Routing (LPKF Protomat D104, H100)
- 3D Printing (Fortus, Phrozen, Anycubic)

## SELECTED PROJECTS OF COURSES

- **New Design of Patch Based Uda-Yagi; Special topics in Antennas** Spring 2020
  An Uda-Yagi Antenna can be improved by placing Patch antennas in place of some or all of its elements (including the reflector, driven element and directors). My goal was to increase the Uda-Yagi's bandwidth in 3GHz+ frequency. The model has been simulated in ANSYS Electronic Desktop(HFSS).
  In order to learn how an Anechoic chamber works, a dipole antenna was simulated in COMSOL Multi-physics, then built and tested in the Anechoic chamber to verify the performance of the antenna antenna.
- **Optimizing a Patch Antenna with a Metasurface; Advanced Micro Electro Mechanical Systems** Spring 2020
  Employing a metasurface with cylindrical resonators as its unit cells on top of a patch antenna to reduce

the return loss and improve the gain which can be useful in medical devices. The antenna and the model have been simulated by ANSYS Electronic Desktop(HFSS).

- **Design of a matched 50 ohm Feeding-Line Insert Fed microstrip Patch Wi-Fi Antenna for 2.45GHz; Microwave & Antenna Engineering** Spring 2019
  First based on the target center frequency the dimensions of our patch antenna was calculated. Then, using CST Microwave Studio software the antenna was modeled. In the simulation phase, different substrate permitivities have been tested to optimize the maximum radiation efficiency at the anntena's resonant frequency.

## PRESENTATIONS

- **Michigan Technological University**
  1. How to simulate a dipole antenna in COMSOL, Special topics in Antennas (02/2020)
  2. Carbon Nanotube Field Effect Transistors, Solid state Devices (03/2019)
  3. Dielectric meta-surfaces, Electronic Materials (12/2018)
- **Iran University of Science and Technology**
  1. Vacuum pump evacuation rate and its calculations, Vacuum Techniques (04/2014)
  2. Kramers-Wannier Duality of Statistical Mechanics Applied to the Boolean Satisfiability Problem of Computer Science, Statistical Mechanics (12/2013)