Mohammadmahdi Maharebi

M.Sc. Student | Electrical Communication Engineering

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Profile

M.Sc. student specializing in **computational photonics and computational physics** with strong foundations in **numerical methods** (FDTD, FEM, eigenmode solvers) and **reproducible scientific software**. Experienced in verification/validation of EM solvers and research-grade workflows. Silver medalist in Iran's National Physics Olympiad. Interested in reproducible computational photonics workflows and physics-based modeling of optical and material systems.

Selected reproducible repos (code + report): FDTD PEC cavity | Fiber perturbation analysis

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Education

2024–Present — **M.Sc. Electrical Communication Engineering**, *University of Kassel*, Kassel, Germany, *GPA: 1.53/1.0 (sehr gut)*

Key topics: microwaves, optoelectronics, engineering mathematics, digital communications and lab. Focus on computational EM, photonics, and optimization methods.

2017–2023 — **B.Sc. Electrical Engineering**, *Sharif University of Technology*, Tehran, Iran

Emphasis on electromagnetics, microwave engineering, and signal processing.
Teaching Assistant (2021–2023): Circuit Analysis I (*Head TA*), Circuit Analysis II, Object-Oriented Programming in Java; responsible for labs, grading, and mentoring.

Selected Research Projects

2025 — **2D FDTD PEC Cavity Solver**, *Python / NumPy*, Computational Electromagnetics
- Implemented TMz FDTD solver on Yee lattice; validated five cavity modes with mean error **0.43%**.
- Demonstrated convergence: error scales as Δx^2 with mesh refinement (tested up to $200{\times}200$ grid).
- Used FFT-based peak detection with windowing and multi-probe averaging for robust eigenfrequency extraction.
- *Reproducible: one-command rerun, figures regenerated from raw data, tests included.*
- *Code:* github.com/mmaharebi/fdtd-pec-cavity

2025 — **Fiber Mode Perturbation Analysis**, *Python / SciPy*, Operator Theory & Tolerance Study
- Derived first-order sensitivities of β and n_{eff} for refractive-index and radius variations.
- Implemented eigenmode solvers with Brent root-finding and normalized integrals; numerical error $< 0.1\%$.
- Verified perturbation theory validity: first-order predictions agree with full solutions within 2%.
- Generated sensitivity maps and tolerance curves for realistic fabrication ranges.
- *Reproducible: one-command rerun, figures regenerated from raw data, tests included.*
- *Code:* github.com/mmaharebi/fiber-perturbation

2021–2023 — **RF / Microwave Design Portfolio**, *HFSS / ADS / MATLAB*, Antenna & Circuit Design
- Designed 16 dBi horn antenna (10–12 GHz) with optimized matching and far-field validation.
- Modelled phased dipole array (15 dBi) including mutual coupling and beam steering.
- Designed 3 dB branch-line coupler (10 GHz) with > 20 dB isolation and low insertion loss.

Technical Skills

Numerical Methods	FDTD and FEM post-processing, eigenmode solvers, perturbation / operator methods, PDE discretization
Verification & Validation	Convergence analysis, error estimation, numerical stability testing, benchmark validation

Programming	Python (NumPy, SciPy, Matplotlib, Jupyter), MATLAB, C++, Java, TypeScript/React, Git/GitHub
Scientific Workflows	Linux/Bash scripting, CI testing, reproducible pipelines, scientific Python packaging
Tools	LaTeX, VS Code, Jupyter notebooks, profiling tools
EM / RF	HFSS, ADS; S-parameters, Smith chart, array factor analysis
Domains	Computational photonics, EM simulation, antennas, microwave circuits, signal processing

Professional Experience

2024–Present   **R&D Engineer — Communication Systems & Software**, Kassel, Germany
Develop simulation tools and web applications; integrate EM-related numerical models with modern software engineering practices. Built simulation tooling in Python with CI tests, automated documentation, and reproducible pipelines. Maintain public repositories with validation code and full technical reports.

2019   **Intern — 5G Demo Platform**, *Hamrah-e Avval (MCI Iran)*, Tehran, Iran
Built gesture-controlled 5G demonstration using Arduino and Leap Motion sensor. Presented low-latency communication concepts in a robotics setup for visitors and internal stakeholders.

Awards

2017   Silver Medal — Iran's National Physics Olympiad

2017   National Elites Foundation Recognition (Iran)

Languages

English	Professional proficiency	*Comfortable with technical communication and documentation*
German	A2.1 (actively improving)	*Learning; familiar with technical coursework*
Persian	Native	*Mother tongue*

Links

GitHub	github.com/mmaharebi
Portfolio	mahdymahareb.de
Key Repos	FDTD cavity solver, fiber perturbation, RF designs, FEM visualization tool