Islam I. Abdulaal

Postgraduate Student and Researcher in Integrated Photonics

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Professional Summary

Research-oriented ECE postgraduate student specializing in integrated photonics, nonlinear optics, and physics-informed design workflows. Experience includes simulation-intensive photonic device development, machine-learning-assisted inverse design, and research communication through publications, technical programs, and mentoring.

Research Interests

Integrated photonics; nonlinear and quantum photonics; photonic-electronic co-design; physics-informed machine learning for inverse design; optical communications; biomedical photonic sensing.

Education

B.Sc. in Electronics and Communications Engineering Aug 2021 – Aug 2026
Alexandria University, Faculty of Engineering *Alexandria, Egypt*

- **CGPA:** 3.39/4.00 (Distinct with Honors).
- **Thesis:** Intra-DC IEEE 802.3 Ethernet MDM-based 400 Gb/s integrated silicon transceiver.
- **Advisor:** Dr. Eslam Elfiky.
- **Focus:** Ge/Si PIN photodetector modeling, mode-division multiplexing, EO modulation, and optical DSP.

Research Experience

Research Intern Sep 2025 – Present
*NanoPhoto Lab, IMRE, A*STAR* *Remote*

- Continued collaboration with Dr. Omar Abdelraouf after Egypt Scholars Advanced Labs track.
- Contributing to a review on metamaterial bound states in the continuum (BIC).
- Investigating quantum photonics concepts involving 2D materials and liquid crystals.
- Running device-level simulations in Lumerical FDTD with MATLAB-based post-processing.

Research Intern Jul 2025 – Sep 2025
Advanced Labs Program, Egypt Scholars Inc. *Remote*

- Completed an intensive 10-week program on independent research execution.
- Collaborated on MPM SPDC inverse design using physics-informed neural networks (PINNs).
- Generated and validated approximately 12 million simulation samples for $NbOCl_{2x}$ design studies.
- Contributed to manuscript preparation for multiphysics PINN workflows.

Undergraduate Researcher Jul 2023 – Aug 2025
OPST Group, CSMNP, SmartCI, Alexandria University *Hybrid*

- Completed structured training in photonics fundamentals, simulation, and mathematical modeling.
- Developed fiber Bragg grating (FBG)-based concepts for multi-parameter respiratory monitoring.
- Co-authored a funded proposal (USD 15k) supported by Alexandria University Technology Park.
- Built and validated MATLAB-Lumerical models for fiber mode coupling and edge-filter interrogation.

Selected Research Projects

Multi-Parameter Respiratory Monitoring via FBG 2025 – Ongoing
Funded Project (AUTP) *12-month cycle*

- Designed a compact sensing workflow for early asthma/COPD exacerbation detection.
- Developed analytical models for mode coupling and FBG spectral response.
- Validated performance with Lumerical FDTD/MODE and developed an INTERCONNECT interrogation setup.

PINN Inverse Design for Photonic Quantum Systems 2025 – Ongoing
Collaborative Research *6-month cycle*

- Designed and evaluated PINN architectures for inverse design of integrated nonlinear sources.

- Modeled SPDC structures in $NbOCl_{2x}$ waveguides and benchmarked against simulation-driven baselines.
- Integrated large-scale data generation and model validation into a reproducible workflow.

Publications

Preprints

[1] **Abdulaal, I. I.**, Elsayed, A. W. A., Abdelraouf, O. A. M., "Terahertz quasi-bic metasurfaces for ultra-sensitive biosensing and high-speed wireless communications," Preprint submitted to *Journal of Optics* (IOP), 2025. arXiv: 2510.00357 [physics.optics]. [Online]. Available: https://arxiv.org/abs/2510.00357

Manuscripts in Preparation

[2] **Abdulaal, I. I.**, Abdelraouf, O. A. M., "$Nbocl_{2x}$-based spdc inverse design using a physics-informed neural network model," Manuscript in preparation, 2026.

[3] **Abdulaal, I. I.**, Elsayed, A. W. A., Abdelraouf, O. A. M., Sallam, B., Mahmoud, A., Hazem, A., "Physics-informed machine learning multiphysics for forward modelling, inverse design, and equation discovery," Manuscript in preparation, 2026.

Professional Training

Analog and Mixed-Signal Simulation & Modeling Trainee — Jul 2025 – Sep 2025
Siemens EDA – EMEA — *Hybrid*

- Completed 90+ training hours in AMS behavioral modeling and verification.
- Designed an 8× PLL behavioral model (Verilog-A) with 960 MHz output.
- Achieved 92% overall performance across labs and technical evaluations.

Analog-to-Digital Converter Design & Verification Trainee — Feb 2025
Siemens EDA – EMEA — *Remote*

- Designed and verified an 8-bit SAR ADC in single-ended and fully differential variants.
- Achieved 7.8 ENOB, 49.3 dB SNR, and 60.5 dB SFDR using FFT-based analysis.

CMOS Analog Integrated Circuit Design Trainee — Jun 2024 – Sep 2024
Information Technology Institute (ITI) — *Remote*

- Completed 180+ training hours in analog CMOS design and verification.
- Built folded-cascode and two-stage OTA designs with full AC/transient/stability validation.

Leadership and Service

Chairman — Feb 2025 – Oct 2025
IEEE SSCS Alexandria University Student Branch Chapter — *Hybrid*

- Led chapter restructuring and program governance.
- Built 50+ collaborations with student branches, institutions, and industry stakeholders.
- Coordinated 80+ technical events and volunteer teams serving 500+ students.

General Coordinator — Aug 2021 – Sep 2023
Education Clinic (USA-Registered NGO) — *Remote*

- Coordinated 80+ volunteers serving students across the MENA region.
- Directed program execution, outreach sessions, and academic support activities.

Technical Skills

Photonics: Lumerical (FDTD, MODE, INTERCONNECT), COMSOL, Silvaco TCAD
Scientific Computing: MATLAB, Python, Octave, PyTorch, TensorFlow
Analog and Mixed-Signal: Cadence, LTspice, NGspice, Xschem, Verilog-A/AMS
Digital and Hardware: Verilog, VHDL, Vivado, Quartus, QuestaSim, FPGA/CPLD
Engineering Tools: Git, Linux, LaTeX, Jupyter, LabVIEW

Awards and Funding

- **Alexandria University Technology Park (AUTP) Research Grant** (2025): USD 15k for photonics-based respiratory monitoring research.
- **ICMTC AI Contest (AIC-2), 4th Place** (2024): Ranked 4th among 500 teams.
- **Huawei ICT Skills Competition, National Finalist (AI Track)** (2023).

- **NASA Space Apps Challenge, Global Nominee** (2021).

Teaching and Mentoring

Peer Tutor and Mentor 2025 – Present
IEEE SSCS Student Activities *Hybrid*

- Delivering structured photonics training with emphasis on simulation and computational workflows.
- Supporting student technical development through guided project execution and mentoring.

Professional Memberships and Languages

Memberships: IEEE Student Member (ID: 101099759); IEEE SSCS; IEEE Photonics Society
Languages: Arabic (native), English (professional working proficiency)

References

Available upon request.