Ahmed Khamis, M.Sc, PhD

Power Electronics Modeling Engineer

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Research-focused modeling Engineer with 10+ years of experience applying advanced machine learning and numerical methods to analog, mixed-signal, and power electronics systems. Expertise in developing graph neural network (GNN) architectures and physics-informed models to accelerate circuit simulation, modeling, and design automation workflows. Skilled in Python and C++ software development, algorithm design and applied mathematics. Experienced in integrating knowledge graphs and heterogeneous GNNs—into EDA-related applications, including circuit topology generation, parameter optimization, and multi-physics modeling for IC design. Authored 5 journal and 13 conference publications on AI-based electric circuit representation and secured competitive research funding for AI-driven circuit generation and datacenter power converter modeling through EDITA and **IBM-AIU** programs.

EDUCATION

Spring 2025

PhD at University at Albany SUNY

Thesis Title: "Graph-Based Machine Learning Framework for Power Electronic Converter Circuit Analysis and Design"

Development of a graph-based machine learning (ML) framework for representation learning of electronic circuits. Creation of a software environment with integration between Matlab, python, LTspice environments data modalities including time series and scientific simulation data. Developing heterogeneous physics informed ML models for circuit analysis and validation through experimental testing. The framework integrates AI/ML principles with power electronics modeling and simulation tools, addressing design, thermal domain, and validation testing.

Spring 2017

MSC degree in Electrical and Control Engineering, AASTMT
Excellent with honor

Thesis Title: "Electric Spring Dual Functionality: RES Grid Integration and Power Quality Enhancement"

The proposed Electric Spring utilizes the concept of power electronics to perform dual functionality; the first is to mitigate the feeder voltage within the power quality standards limits within microgrids, while the second is to inject extracted power from a local RES to grid through a single phase interface inverter and energy storage systems.

Spring 2013

B.Sc. Degree in Electrical and Control Engineering, AASTMT
3rd rank on class, Excellent with honor, **3.86 GPA (ABET accredited)**

Thesis Title: "Module integrated converter for PV connected systems" Implementing two stage converter system, utilizing a forward converter for MPPT implemented on TMS28335 digital signal controller and a single phase inverter with SPWM to interface the PV power to the grid at unity power factor.

WORK EXPERIENCE

Research Assistant & PhD student
Electrical and Computer Engineering Dept., UAlbany SUNY

Sept 2019-
April 2025

Research projects:

- Design, build and debug of 20KW dual active bridge using SiC devices with minimal stray inductance/capacitance.
- PCB Schematic Entry and Layout of 125KW DC-DC converter circuit and controls.
- Developed the mathematical model of an interleaved Boost-buck converter, and performance was evaluated using LTspice.
- Electrical characterization and qualification of MEMS under resonant and soft switching operation.
- Design and simulation of optimized MEMS device function and parametric problems using LTspice.
- Evaluation of MEMS turn on and off timings, and measurement plans for MEMS product design evaluation.
- Designed automated testing setups for Machine learning models using python.
- Design of multi-phase boost-buck coupled inductors for magnetic components, while validating the magnetic properties using Ansys Maxwell.
- Development of switching patterns of coupled multi-phase boost-buck converters, while utilizing GaN switches with optimized switching pattern to enhance the performance and to reduce losses.
- Developed computationally light LTspice simulation models for various power electronic converters (Buck, boost, buck-boost, Interleaved boost-buck) .

Teaching:

- Electric circuits, Advanced Electronics, Advanced power electronics, Robotics, Fundamentals of electric vehicles (EVs)

Assistant Lecturer
Electrical and Control Engineering Dept., AASTMT

Mar 2015 –
Aug 2019

Research projects:

- Design and development of solar battery chargers for optimized energy harvesting using Power converters (Boost, Buck, LDO, PMIC).
- Implementation of grid connected single-stage DC-AC voltage source inverter for PV units using Boost and buck converters.
- Wheeled mobile robot with forward and inverse kinematics based positioning and feedback.
- Research and Development (R&D) of 3 DOF robot arm control.
- Connecting the organization to the latest technology developments and trends in EV industry by designing and implementing an advanced control algorithms of an induction motor V/F driver for electric vehicle (EV) applications.
- Design of sensorless MPPT controller for grid connected inverter using applied control theory and embedded programming while adhering to electrical safety requirements and grid EMC standards.

Teaching:

- Microprocessor-based control, Electrical measurements, Electrical drives, Linear control systems, Power systems Electric circuits, Power electronics and Robotics.

Dec2013 – Feb 2015

Military service: Ariel defense systems

Hands on experience in maintaining complex aerial defense systems, including missile guidance, and tracking technologies.

Leadership skills

- Examination board head assistant at AASTMT.
- Founder member of "El-Midan" political student guild.
- Founder member of charity organization "Goodwill academy" at AASTMT.
- "PCB design" guest speaker held by IEEE AASTMT branch.

Soft skills

- Technical Proposal Writing.
- Technical Report Writing.
- Technical documentation.
- Problem solving skills.
- Presentation skills (certified).
- Product design.
- Great communication skills and able to work as a part of a multidisciplinary team.
- Self-starter and can work independently

TECHNICAL SKILLS

Python/ Pytorch	Dual active bridge (DAB)	Converter Modeling and Simulation	Control theory
Power Electronics	DC-DC, DC-AC converter	Mathematica	foundation models
Machine learning	PLECS LTspice simulation models	PCB Schematic Entry and Layout (Cadence Tools)	MultiSIM
FEM using Maxwell/CST	TMS28335 MatLab/Simulink	Design and fine-tune of AI models using python and pytorch	Converter Submodules
Bench Test Hardware and Software Development	Embedded systems	PCB design Python C/C++	Analog and Digital Circuit Analysis techniques
grant proposals writing	Analytical skills	Automating Lab Bench (Python, PyVisa, SCPI, LabVIEW)	artificial intelligence
DC/DC converter topologies	switch mode power supplies	Energy Storage Systems	multi-modal foundation models
scientific simulation data	Magnetic Components	scientific simulation data	EMI Filter Design Microgrids
MathWorks MATLAB	Communication Protocols (SPI, I2C, PMBus)	High-level Programming Languages (Python, LabView, C/C++)	Research and Development (R&D)
Patent review	EMI Filter Design	Eagle	Grid Integration of Renewables
NGSpice	LTspice		

RESEARCH PROJECTS:

- Developed a graph-based machine learning framework for electronic circuit representation learning by integrating MATLAB, Python, and LTspice pipelines for time-series and simulation data; implemented heterogeneous physics-informed models to support circuit design, thermal analysis, and experimental validation.
- Design and implementation of 500V/120A (60KW) inverter Circuit.
- Circuit design and controller design of resonant test board for MEMS soft switching.
- Simulation software environments integration between Matlab, python, LTspice environments for the purpose of solving converter performance prediction problems.
- Performed failure analysis on Micro Electro-mechanical Switch (MEMS) and lifetime expectancy.
- Development and testing of Renewable energy sources grid integration with Electric Spring.

- Coupled inductor design, analysis, development and testing using Maxwell FEM for interleaved buck-boost converter.

CERTIFIED COURSES:

- **"Introduction to Power Electronics"** by University of Colorado Boulder on Coursera**.**
- **"Converter Circuits"** by University of Colorado Boulder on Coursera**.**
- **"Converter Control"** by University of Colorado Boulder on Coursera**.**
- **"Advanced Converter Control Techniques"** by University of Colorado Boulder on Coursera**.**
- **"Magnetics for Power Electronic Converters"** by University of Colorado Boulder on Coursera.
- **Power Electronics for Smart Grid Technologies Topologies, Converters, Modelling and Applications** by University of Strathclyde, UK
- **Machine Learning** by Stanford University.
- **Machine Learning Foundations: A Case Study Approach** by University of Washington.
- **Total Productive Management [TPM]** by AASTMT.

JOURNAL PUBLICATIONS:

- **A. K. Khamis** and M. Agamy, "Homogeneous Versus Heterogeneous Graph Representation for Graph Neural Network Tasks on Electric Circuits," in *IEEE Transactions on Circuits and Systems 2025.*
- **Ahmed K. Khamis** and M. Agamy, "Circuit topology aware GNN-based multi-variable model for DC-DC converters dynamics prediction in CCM and DCM", *Neural Computing & Applications 2024.*
- **Ahmed K. Khamis** and M. Agamy, "Circuit Dynamics Prediction via Graph Neural Network & Graph Framework Integration: Three Phase Inverter Case Study", in *IEEE Open Journal of power electronics 2024.*
- **Ahmed K. Khamis** and M. Agamy, "Comprehensive Mapping of Continuous/Switching Circuits in CCM and DCM to Machine Learning Domain using Homogeneous Graph Neural Networks," in *IEEE Open Journal of Circuits and Systems* 2023.
- **A. K. Khamis**, M. Agamy and R. Ramabhadran, "Split Duty Cycle Coupled Multiphase Boost–Buck Converter," in *IEEE Transactions on Industry Applications*, vol. 57, no. 6, pp. 6195-6208, Nov.-Dec. 2021, doi: 10.1109/TIA.2021.3114133.
- **Ahmed K. Khamis,** N.E. Zakzouk and A.K. Abdelsalam "Generalized Cost-effective Converter for Solar Street Lighting Featuring Averaged State Space Model-based Sensorless MPPT" - Computers & Electrical Engineering Journal, 2022.
- **Ahmed K. Khamis**, N.E. Zakzouk, A.K. Abdelsalam and B. W. Williams, "Performance Assessment of Continuous Input and Output Power Buck-Boost DC/DC converters for Photovoltaic Applications" – Energies 2019
- **Ahmed K. Khamis**, N.E. Zakzouk, A.K. Abdelsalam and A.A. Lotfy, "Electric Spring Dual Functionality: Bus Voltage Regulation and RES integration" – IEEE Access

CONFERENCE PUBLICATIONS:

- **A. K. Khamis** and M. Agamy, "Converter Dynamics Prediction Beyond Training Data Using Heterogeneous-Physics-Informed GNN" – [ECCE 2025]
- **A. K. Khamis** and M. Agamy, "Spectral Analysis of Heterogeneous Graph Representation for GNN Tasks on Electric Circuits" – [ISIE 2025]
- **A. K. Khamis** and M. Agamy, "A Heterogeneous Graph Framework for ML Applications in Electric Circuits" – [IECON 2024]
- M. Agamy, M. H. Todorovic and **A. Khamis**, "Soft Switched MEMS Power Relay Using a Resonant Auxiliary Circuit" – [ECCE 2024]

- **Ahmed K. Khamis** and Mohammed Agamy," Three-Phase Inverter Dynamics Predictions Using GNN-based Regression Model" - [ECCE2023]
- **Ahmed K. Khamis** and Mohammed Agamy," Circuit Structure Dependent Multi-Variable Regression Model Based Predictions for DC-DC Converters" - APEC2022
- **Ahmed K. Khamis** and Mohammed Agamy," Switching Converter Circuits Representation in CCM & DCM Using Graph Neural Network" – APEC2022
- **Ahmed K. Khamis** and Mohammed Agamy," Converter Circuits to Machine Learning: Optimal Feature Selection" – ECCE2022
- **Ahmed K. Khamis** and Mohammed Agamy," Mapping Continuous Circuit Structures to Machine Learning Space" – ISIE2022
- **Ahmed K. Khamis** and Mohammed Agamy "Switching Pattern Analysis of Coupled Multi-phase Boost-Buck Converters" – APEC2021
- **Ahmed K. Khamis** and Mohammed Agamy "Magnetic Component Design for Split Duty Cycle Coupled Multi-phase Boost-Buck Converter" – APEC2021
- **Ahmed K. Khamis**, Mohammed Agamy and Ramanujam Ramabhadran, "Split Duty Cycle Coupled Multi-phase Boost-Buck Converter", ECCE 2020.
- **A.K. Hassan**, N.E. Zakzouk, A.K. Abdelsalam and A.A. Lotfy, "Electric Spring Enhanced Decoupled Dual Function Operation: Bus Voltage Controller and Renewable Energy Grid Integration", 8th IET International Conference on Power Electronics, Machines and Drives (PEMD 2016).

INTERNSHIPS

- Abou - Quir Fertiliz ers Co. - - - Summer Internship
- Alex. Carbon Black Co. - - - Summer Internship
- Petrojet Co. - - - Summer Internship
- SUMED Arab Petroleum Pipelines Co. - - - Summer Internship

REFERENCES:

Name	Email	Organization
Mohammed Agamy	magamy@albany.edu	University At Albany, SUNY
Ahmed Lotfy	alotfy@aast.edu	AASTMT
Pallab Midya	pallab.midya@menlomicro.com	MenloMicro