Michael A. Boateng

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EDUCATION AND QUALIFICATIONS

School of Engineering, Georgia Institute of Technology, Atlanta, GA *Aug 2023 – Jun 2028*
Doctor of Philosophy (Ph.D.), Electrical and Computer Engineering. CGPA: 3.83/4.0
- Graduate Research Assistant – AI Institute for Advances in Optimization (AI4OPT) | Energy Division
- **Georgia Tech Supervisors:** Prof. Pascal Van Hentenryck and Prof. Daniel Molzahn
- **External Supervisors:** Dr. Russell Bent (LANL), Prof. Parikshit Pareek (IIT Roorkee), Dr. Weihui Fu (ERCOT)

School of Engineering, Georgia Institute of Technology, Atlanta, GA *Aug 2023 – May 2025*
Master of Science (MS.), Electrical and Computer Engineering. CGPA: 3.80/4.0
- Minor: Industrial and Systems Engineering (ISyE) – *Regression Analysis,* ***Convex Optimization & Machine Learning***
- Coursework: ***Power Systems*** *(Protection, Cybersecurity, Operation & Control),* ***Statistical Methods****, Linear Systems & Control*

Engineering Department, Ashesi University, Accra, Ghana *Sep 2018 – Jun 2022*
Bachelor of Science (B.Sc.), Electrical and Electronics Engineering. Cum Laude
- B.Sc. Project: Overall Best Thesis – Engineering Department [Published in IEEE Xplore| Citations: 20+]

RESEARCH & PROFESSIONAL EXPERIENCE

Graduate Student Participant, Chicago, IL *Jul 2026 – Aug 2026*
Argonne National Laboratory (ANL), *Extreme-scale Computing Training for Scientific Applications*
- Selected as 1 of 75 nationwide for ATPESC 2026, training on leadership-class supercomputers (Aurora, Polaris, Frontier) in parallel programming and scalable nonlinear solvers (PETSc) relevant to Newton-based power-flow
- Completed the hands-on ML track on Aurora AI Testbeds, covering distributed deep-learning training, performance profiling, LLM pre-training on a supercomputer (tracked with Weights & Biases), fine-tuning, and inference
- Explored coupled simulation-and-AI workflows, explainable AI for science, and agentic tools for automating scientific workflows, informing scalable training of optimization proxies for large constrained grid problems

Graduate Research Consultant*,* Austin, TX *Oct 2025 – Present*
Electric Reliability Council of Texas (ERCOT), *Risk Assessment of Texas Grid Using a Neural Net AC SCOPF*
- Collaborating with ERCOT engineers on security-constrained optimal power flow (SCOPF), the nonconvex problem that sets least-cost generation that must be feasible under equipment outages, including greater-than-N-2 contingencies
- Developing self-supervised primal-dual learning proxies that learn structured approximations of preventive SCOPF on 1,000+ bus systems while embedding AC nonlinear constraints, rather than predicting dispatch as a black box
- Designing structure-aware repair layers (adaptive participation factors, exact contingency repair) that reduced the optimality gap from 1.88% to 0.32% and training time per epoch by 28% on a 1,354-bus benchmark

Graduate Research Intern, Los Alamos, NM *May 2025 – Present*
Los Alamos National Laboratory (LANL), *End-to-End Learning for AC Feasibility Restoration in DCOPF*
- Formulated a differentiable repair layer replacing discrete generator-control logic with smooth surrogates, cutting cost gaps to AC optimal power flow (ACOPF, the nonconvex problem) by ~85% and solves ~75% faster on 9,241 buses
- Derived implicit-function-theorem gradients (KKT adjoints for the linear DC model and a single transpose-Jacobian solve for the nonlinear AC equations), enabling end-to-end training with NumPy/SciPy, PyTorch, CVXPY, and Gurobi
- Designing a price-preserving pipeline that jointly learns DC model parameters and generator participation factors under a self-supervised cost-and-violation loss, computing locational marginal prices (LMPs) from Jacobian sensitivities

Graduate Research Assistant, Atlanta, GA *Apr 2025 – Oct 2025*
AI Institute for Advances in Optimization (AI4OPT), *Volt-VAR Optimization for Large-Scale Power Systems*
- Designed a transmission-scale Volt/VAR Optimization framework that co-optimizes OLTC tap ratios and capacitor-bank modules under AC power-flow physics, implementing a relax–round–resolve pipeline, that encodes device limits
- Formulated operations-aligned objectives that hold voltage and VAR setpoints while penalizing active-power redispatch and preserving economic dispatch, integrating ACOPF/market references for AC-feasible setpoints
- Performed an extensive review of transmission-scale Volt/VAR and discrete ACOPF (MINLP, relax–round–resolve, cutting-plane/OA, homotopy, metaheuristics, interior-point); pinpointing gaps in *(i)* scalable AC-feasible tap/shunt schedules, *(ii)* realistic device step modeling, and *(iii)* coordination with market dispatch and loss/price sensitivities

Graduate Research Intern, Los Alamos, NM *Sept 2024 – Aug 2025*
Los Alamos National Laboratory (LANL), *Exploring DCOPF and ACPF Formulations for AC Feasibility*
• Formulated a pipeline mapping DC optimal power flow (DCOPF, the fast linear approximation used in electricity markets) dispatches to AC power flow (ACPF, nonlinear grid physics) solutions via loss-aware convex models and a structured Newton solver; published in the Electric Power Systems Research journal
• Benchmarked 10,000+ stochastic scenarios on systems of up to 13,659 buses (PEGASE, RTE, and IEEE cases), achieving near AC feasibility on the largest case and 3–5× fewer constraint violations under extreme loading
• Reduced dispatch error by 75% and cost difference by 93% versus conventional single-slack recovery, and cut Newton iterations by ~50% on stressed test cases; presented at the Power Systems Computational Conference in Cyprus

Company Founder, Atlanta, GA *Mar 2025 – Present*
Georgia Tech Start-up Launchpad (Create-X), *MPower Boards: Empowering Power Grid Education and Research*
• Founded MPowerBoards (MPBs) through Create-X with $5,000 seed funding, turning power-grid simulations into interactive physical boards: custom PCBs with embedded microcontrollers and LEDs that display real-time power flow
• Designed 3 boards: USA1 (PJM-5/IEEE-14 with DC/AC optimal power flow, LMPs, and SCOPF), Gh1 (synthetic Ghana grid with N-1 analysis on OLED substation panels), and ISO1 (North American interconnections and ISOs)
• Leading a four-member team from working prototypes to classroom use with 15+ students, 10+ K-12 participants, and 8+ faculty and researchers, partnering with Georgia Tech's AI4OPT and GOAL lab; scoping a provisional patent

SKILLS

• **Languages:** English (Native), Sign Language, C++, MATLAB, PHP, MySQL, HTML, CSS, R, Python, and Julia
• **Tools:** PowerModels, High-Performance Computing, Scikit-learn, Gurobi, SciPy, CVXPY, IPOPT, PyTorch, Git

HONORS AND AWARDS

Los Alamos National Lab's 'Distinguished Student Performance Award' 2026 (1 of 8 across lab) NM, USA *Aug 2026*
Argonne National Lab's Training Program on Extreme-Scale Computing (1 of 75 Nationwide), IL, USA *Jul 2026*
Create-X Entrepreneurship Program with $5000 Seed Funding for Power Systems Education, GA USA *Feb 2026*
GT's Up with the White and Gold 'Rising Star Award': Center for Student Engagement, GA USA *Apr 2026*
Center for Nonlinear Studies Grid Science Winter School & Conference: Travel Grant Winner, NM, USA *Jan 2025*
Argonne Department of Energy's CyberForce® Competition: Travel Grant Winner, IL, USA *Nov 2024*
International Solid-State Circuits Conference: Travel Grant Winner (1 of 4, 1st Year ECE PhDs), CA USA *Jan 2024*
Silver Medalist: Poster Presentation, International Genetically Engineered Machine *(Competition),* France *Oct 2022*

RECENT JOURNAL/ CONFERENCE PUBLICATIONS

- **M.A. Boateng,** R. Bent, S. Misra, P. Pareek, P. Van Hentenryck, and D. Molzahn, "PACR: Parameter-Optimized AC Power Flow Restoration for AC Feasible DCOPF Dispatch," ArXiV available. June 30, 2026.
- **M.A. Boateng,** R. Bent, S. Misra, P. Pareek, P. Van Hentenryck, and D. Molzahn, "Towards AC Feasibility of DCOPF Dispatch," Electric Power Systems Research, 2027. Presented at the 24th Power Systems Computation Conference (PSCC), June 8–12, 2026 | [Acceptance rate: **34.6%** in 2026].
- S. Tong, **M.A. Boateng,** M. Tanneau, and P. Van Hentenryck, "Volt/VAR Optimization in Transmission Networks with Discrete-Control Devices," Electric Power Systems Research, 2027. Presented at the 24th Power Systems Computation Conference (PSCC), June 8–12, 2026 | [Acceptance rate: **34.6%** in 2026].
- **M.A. Boateng,** G. Gauderman, and N. Uwamahoro, "Physics-Informed Dynamic State Estimation for Current Transformers Using Graph Neural Networks," in Proceedings of the Fault and Disturbance Analysis Conference (FDAC), Apr. 13–14, 2026.
- R. Asiamah, S. Talkington, **M. Boateng**, M. Vanin, F. Geth, and D. Molzahn, "Classifying Reactive Power Control Laws of Behind-the-Meter Solar Photovoltaic Inverters," Proc. IEEE Kansas Power and Energy Conf. (KPEC), 2025.

REVIEWED CONFERENCE/ JOURNAL PAPERS

• 2026 *Electric Power Systems Research* ***Journal*** (Elsevier, Impact Factor: 4.2; CiteScore: 8.2). Track: Neural Networks (x5)
• 2025 IEEE *Kansas Power and Energy* ***Conference*** *(KPEC),* Track: Solar Power, Transmission Systems (x2)

LEADERSHIP AND COMMUNITY INVOLVEMENT

Chief of Staff: Georgia Tech Graduate Student Government Association, GA, USA *May 2026 – Present*
Secretary: Institute of Electrical and Electronics Engineers, GT Chapter, GA, USA *May 2026 – Present*
STEM Volunteer: Building Laser Harps with Electronics, Santa Fe Community College, NM, USA *Jul 2026*
STEM Volunteer: Designing Guitars with Electronics, Northern NM College, Española, NM, USA *Jul 2026*
Volunteer Presenter: AI for Energy Outreach for Denmark High School Students, GA, USA *Mar 2026*