

NINAD KIRAN GAIKWAD

PhD Candidate | Optimization, Optimal Control, Power & Energy Systems

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📍 Spokane, WA, USA



RESEARCH PROFILE

Optimization and control researcher and engineer developing mathematical-programming, optimal-control, and learning-enabled methods for power and energy systems. Work spans AC optimal power flow, convex relaxation, distributed ADMM-based optimization, model predictive control, nonlinear and mixed-integer formulations, Bayesian and state estimation, and reinforcement learning. Applications include residential and community energy management, intelligent buildings, distribution-grid planning, and grid-edge control.

Research Areas: Optimization; Optimal Control; Model Predictive Control; Distributed Optimization; AC Optimal Power Flow; Convex Relaxation; Estimation Theory; Reinforcement Learning; Power and Energy Systems; Intelligent Buildings; Distributed Energy Resources; Energy Resiliency.

EDUCATION

Jan 2022 – Present	PhD in Electrical Engineering and Computer Science Research focus: development of a framework for modeling and control of networked buildings, spanning building thermal modeling and estimation, scientific machine learning, building-grid co-simulation, and intelligent control. Major areas of study include Power Systems Analysis, Power Systems Dynamics and Control, and Estimation Theory.	Washington State University (WSU)
Jan 2024 – Dec 2025	MS in Computer Science Thesis: <i>On Intelligent Control of Residential Energy Systems</i> . Major areas of study include Machine Learning, Data Science, and Algorithmics, with research centered on intelligent control and simulation of residential energy systems.	Washington State University (WSU)
Aug 2018 – Dec 2021	MS in Mechanical Engineering Major areas of study: Control Theory, Probability, Optimization, Machine Learning, and Reinforcement Learning. GPA: 3.18/4.	University of Florida (UFL)
Aug 2014 – Jun 2016	MTech in Electrical Engineering Major areas of study: Electrical Machine Analysis, Power Electronic Drives, and Power System Dynamics and Control. CGPA: 9.88/10.	Sardar Patel College of Engineering (SPCE)
Feb 2014 – Jun 2014	MProfEng in Electrical Engineering (One Semester) Major areas of study: Power Systems and Renewable Energy Technologies. High Distinction: 86.33%.	University of Wollongong (UOW)
Aug 2008 – Jun 2012	BTech in Electrical Engineering Major areas of study: Power Engineering and Control Systems. CPI: 5.8/10.	Veermata Jijabai Technological Institute (VJTI)

PROFESSIONAL EXPERIENCE

Research Experience		
Jan 2022 – Aug 2025	Graduate Research Assistant	Washington State University — School of Electrical Engineering and Computer Science
	- Developed modeling, estimation, simulation, and intelligent-control methods for networked buildings and grid-edge applications. - Developed computationally efficient grey-box, black-box, and scientific-machine-learning thermal models and building-grid simulation/co-simulation workflows for residential and commercial buildings.	
Aug 2018 – Dec 2021	Graduate Assistant	University of Florida — Mechanical & Aerospace Engineering
	- Developed model-predictive-control and reinforcement-learning algorithms for home energy resiliency and mentored one graduate and two undergraduate researchers on related work. - Supported undergraduate Controls and Numerical Methods instruction for six semesters as a teaching assistant.	
May 2021 – Aug 2021	Research Intern	National Renewable Energy Laboratory (NREL) — Energy Systems Control and Optimization Group
	- Analyzed transient-voltage stability of a two-bus inverter-based microgrid using Lyapunov-based methods. - Developed a GUI-based application for microgrid stability analysis and visualization.	

Jun 2018 – Jul 2018	Research Consultant	VJTI — Centre of Excellence in Complex and Nonlinear Dynamical Systems
	- Established the SWEEFA-V1.0 renewable-energy forecasting system for research use. - Trained two graduate students on the platform and developed a research-and-development roadmap for its continued advancement.	
Aug 2016 – Jan 2017	Jr. Project Fellow	Gujarat Energy Research and Management Institute (GERMI)
	- Supported renewable-energy training programs and continued development of the SWEEFA renewable-energy forecasting system. - Mentored graduate students developing RNN- and ARIMA-based renewable-energy forecasting models.	
Aug 2015 – Jun 2016	Research Intern	Gujarat Energy Research and Management Institute (GERMI)
	- Completed MTech thesis research in solar and wind forecasting and conceptualized and developed the MATLAB GUI-based Solar & Wind Energy Estimation and Forecasting Application (SWEEFA). - Mentored two graduate students contributing to development of the forecasting platform.	

Academic Experience, Teaching & Mentoring

Jun 2024 – Aug 2024	Instructor — Computational Skills for MIRA Summer Bridge Program	Washington State University
	- Designed and taught a six-week Python programming course for students transitioning from high school to college. - Developed the course syllabus, instructional materials, laboratory exercises, and course-management resources.	
Jul 2022	Tutor — Bridge Program, College Access & Transition Programs	Washington State University
	- Taught a two-week introduction-to-engineering program for recent high-school graduates. - Introduced foundational Python programming concepts while helping students understand similarities and differences across engineering disciplines.	
Jan 2017 – Jun 2017	Assistant Professor — Electrical Engineering	Sardar Patel College of Engineering
	- Taught a graduate course on applications of power electronics in renewable-energy systems and supported MATLAB/Simulink learning. - Guided and mentored three graduate students through seminar mini-projects.	

Industrial Experience

Sep 2025 – Present	Lead Power Systems Developer	iGridSim — Research & Development
	- Develop scalable distribution-grid simulation pipelines integrating CIM-based network models, distribution power flow, and graph-based topology validation for large feeder datasets. - Develop machine-learning methods using AMI data for secondary-distribution modeling and optimization-based tools for intelligent distribution-grid analytics and planning.	
Jun 2025 – Aug 2025	Power Systems Intern	GE Vernova — Digital Technology
	- Developed a full AC Optimal Power Flow formulation and a convex relaxation to improve computational tractability for grid-planning applications. - Implemented a distributed ADMM-based solver for scalable optimal power flow.	
Jan 2025 – Apr 2025	Engineering Intern	North American Electric Reliability Corporation (NERC) — Advanced System Analytics and Modeling
	- Automated and analyzed FNET, GADS/TADS, and Velocity Suite datasets to support extreme-weather resiliency studies. - Developed a Plotly-Dash interface and streamlined the Case Quality Metrics workflow for reliability-data processing, analysis, and visualization.	
May 2023 – Aug 2023	Machine Learning Intern	Edo Energy — Research & Development Group
	- Developed an open-source state-estimation toolbox based on Bayesian filtering and smoothing for building thermal models. - Developed Bayesian-inference-based parameter-estimation methods for identifying building thermal-model parameters from data.	

Dec 2017 – May 2018	Consultant	Mytrah Energy — Technology & Digital Innovation Group
	- Contributed to implementation of a real-time renewable-energy forecasting system and developed solar- and wind-plant performance-analysis tools. - Trained and led a three-person data-analytics team supporting renewable-energy analytics and forecasting activities.	
Aug 2013 – Oct 2013	Engineering Intern	Crompton & Greaves — Transformer Design Department
	- Developed a spreadsheet-based tool for transformer terminal-connector selection. - Prepared a technical report comparing transformer-winding interleaving and counter-shielding methods for surge protection.	
Sep 2012 – Oct 2012	Engineering Intern	Reliance Infrastructure — Dahanu Thermal Power Plant
	- Studied electrostatic-precipitator operation and fault-detection practices and prepared a technical training report. - Digitized aging technical manuals and power/control schematics to improve internal accessibility of plant documentation.	
Jun 2012 – Jul 2012	Coal Power Plant Trainee	Abhijeet MADC Nagpur Energy Pvt. Ltd. — MIHAN Power Plant
	- Completed plant-wide technical training covering the operation and function of major coal-fired power-plant systems. - Collaborated with fellow trainee engineers to prepare a comprehensive plant-training report.	

PROJECTS

Washington State University

Jan 2022 – Present	Framework for Modeling and Control of Networked Buildings	Project Repository
	PhD research integrating control-oriented building thermal models; optimization- and Bayesian-inference-based estimation; black-box and scientific-machine-learning methods; scalable building simulation and data workflows; building-grid co-simulation; and intelligent control for grid-edge applications.	
Jan 2024 – Present	Intelligent Control of Residential Energy Systems / SmartCommunitySim	Project Repository
	MS Computer Science research developing a scalable residential-community simulation and benchmarking framework for baseline, rule-based, model-predictive-control, and reinforcement-learning controllers under on-grid and off-grid operation with heterogeneous distributed energy resources. This work extends the home-energy-resiliency research initiated at the University of Florida.	
Aug 2022 – Present	Power Systems Analysis Toolbox (PowerEdu.jl)	Project Repository
	Julia-based power-systems analysis package developed from WSU coursework, with capabilities spanning Newton-Raphson power flow, continuation power flow, static state estimation, optimization, and ongoing power-system stability and transient simulation.	
Jan 2022 – Apr 2022	Power-System Control Algorithm Vulnerability Analysis using Network Science	Project Repository
	Developed a modular Python power-system transient simulator with closed-loop control and communication capabilities, and evaluated degree centrality, PageRank, and eigenvalue-based analysis for identifying nodes critical to distributed frequency-control performance.	

University of Florida

Jan 2019 – Dec 2021	Home Energy Resiliency	Project Repository
	Developed model-predictive-control and reinforcement-learning methods for residential energy resiliency using rooftop PV, battery storage, controllable loads, and related home-energy resources. This research became the foundation for the later WSU MS Computer Science work on intelligent residential energy systems and community-scale simulation and control.	
Aug 2020 – Dec 2020	GAN and VAE for MNIST	Project Repository
	Implemented dense- and CNN-based Generative Adversarial Networks and Variational Autoencoders in TensorFlow for handwritten-digit generation.	
Aug 2019 – Dec 2019	Optimal Control: Indirect and Direct Numerical Methods	Project Repository
	Implemented indirect Hamiltonian-boundary-value and direct collocation formulations for optimal-control problems in MATLAB, including nonlinear programming solved using IPOPT.	
Jan 2019 – Apr 2019	State-Feedback Set-Point Tracking Control	Project Repository
	Performed simulation-based system identification and designed a Linear Quadratic Regulator for set-point tracking using an estimated state-space model.	

Aug 2018 – Dec 2018	ARMA Time-Series Modeling for Solar PV Forecasting Developed ARMA forecasting models using least-squares and maximum-likelihood estimation and studied model order, training-data volume, and prediction timescale using real solar-generation data.	Project Repository
Indian Institute of Technology Bombay (IIT-B)		
Aug 2017 – Oct 2017	Data Fault Detection Developed data-fault-detection algorithms for real building data collected using Raspberry-Pi-based sensors in collaboration with Dr. Anupama Kowli. Implemented SVM, ANN, wavelet, PCA, and hybrid PCA-wavelet methods in MATLAB using a modular software structure.	Project Repository
Sardar Patel College of Engineering		
Aug 2015 – Jun 2016	Forecasting of Solar & Wind Energy MTech thesis project developing the Solar & Wind Energy Estimation and Forecasting Application (SWEFFA), a MATLAB GUI-based platform for plant-level solar and wind energy estimation, weather and generation-data preprocessing, ANN- and ARIMA-based forecasting, and automated WRF forecasting using Bash scripts on a four-node Raspberry Pi 2 cluster.	Project Repository
Jan 2015 – Apr 2015	DTC Control of DFIG Studied an ANN-based direct-torque-control strategy for a doubly fed induction generator, reproduced the method in SimPowerSystems/MATLAB, prepared an IEEE-style technical report, and presented the work as a departmental seminar.	Project Repository
Aug 2014 – Dec 2014	Vector Control of DFIG Studied a vector-control strategy for a doubly fed induction generator, reproduced the method in SimPowerSystems/MATLAB, prepared an IEEE-style technical report, and presented the work as a departmental seminar.	Project Repository
University of Wollongong		
Feb 2014 – Jun 2014	Reactive Power Capability of Distributed Energy Systems Team project evaluating reactive-power support from DFIGs, solar inverters, and diesel generators. Led the DFIG component, interpreted IEEE research literature, and contributed to the technical report and presentation. Grade: A.	Project Repository
Veermata Jijabai Technological Institute		
Aug 2011 – Jun 2012	Application of Vacuum Tubes in Sound Engineering and High-Frequency Amplification Final-year team project examining contemporary vacuum-tube devices and their potential applications in sound engineering and high-frequency amplification, with emphasis on technical-literature analysis, engineering reporting, and collaborative project work. Grade: A.	Project Repository
PUBLICATIONS		
Peer-Reviewed Conference Papers and Accepted Papers		
Oct 2026	"Building Thermal Models using Real-World Data: Seasonal Transferability and Setpoint Sensitivity" Accepted paper, IEEE IAS 2026, Vancouver, BC, Canada.	Paper Link
Jul 2026	"Learning to Optimize: Gaussian Process Surrogates for Battery Energy Storage Coordination" Oral presentation, IEEE Power and Energy Society General Meeting 2026, San Francisco, CA, USA.	Paper Link
Oct 2025	"House Thermal Model Estimation: Robustness Across Seasons and Setpoints" Oral presentation, 57th North American Power Symposium (NAPS 2025), Hartford, CT, USA.	Paper Link
Sep 2025	"Smart Residential Community Simulator for Developing and Benchmarking Energy Management Systems" Oral presentation, IEEE SmartGridComm 2025, Toronto, ON, Canada.	Paper Link
Jul 2025	"Comparing Building Thermal Dynamics Models and Estimation Methods for Grid-Edge Applications" Oral presentation, IEEE PES General Meeting 2025, Austin, TX, USA.	Paper Link
Jul 2025	"An Open-Source Simulation and Data Management Tool for EnergyPlus Building Models" Oral presentation, IEEE PES General Meeting 2025, Austin, TX, USA.	Paper Link
Apr 2025	"Duck Curve Mitigation Through Optimal Orientation of Utility-Scale Solar Photovoltaics" Oral presentation, IEEE KPEC 2025, Manhattan, KS, USA.	Paper Link

Nov 2024	"Model Predictive Control based Energy Management System for Home Energy Resiliency" Oral presentation, 56th North American Power Symposium (NAPS 2024), El Paso, USA.	Paper Link
May 2021	"Reinforcement Learning-Based Home Energy Management System for Resiliency" Oral presentation, American Control Conference (ACC 2021), New Orleans, USA.	Paper Link
Aug 2020	"Smart Home Energy Management System for Power System Resiliency" Oral presentation, IEEE Conference on Control Technology and Applications (CCTA 2020), Vancouver, Canada.	Paper Link
Mar 2017	"On The Development of Solar & Wind Energy Forecasting Application Using ARIMA, ANN And WRF in MATLAB" Oral presentation, INDIACom 2017 IEEE Conference, Delhi, India.	Paper Link
Oct 2016	"Photovoltaic Grid Connected Plant Energy Estimation Application in MATLAB" Oral presentation, PVSEC-26, Singapore.	Paper Link

Preprint

Feb 2021	"Increasing Energy Resiliency to Hurricanes with Battery and Rooftop Solar Through Intelligent Control" arXiv preprint arXiv:2102.04406.	Paper Link
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Conference Posters

Aug 2024	"From Basic ANN to Scientific ML-Based Building Thermal Models For Grid-Edge Applications" Advanced Grid Institute Day 2024, Tri-Cities, USA.	Poster Link
Aug 2024	"Enhancing Building Thermal Models: From Basic Greybox to SciML-Driven Digital Twins" Advanced Grid Institute Day 2024, Tri-Cities, USA.	Poster Link
Aug 2024	"Building Energy Models using Generative Learning for Grid-Edge Applications" Advanced Grid Institute Day 2024, Tri-Cities, USA.	Poster Link
Jul 2024	"ANN Based Thermal Modeling of Buildings" IEEE PES General Meeting 2024, Seattle, USA.	Poster Link
Jul 2024	"Comparison of Bayesian Filters-Smootherers for Joint State-Parameter Estimation of Building Thermal Model" IEEE PES General Meeting 2024, Seattle, USA.	Poster Link
Jul 2024	"An Opensource GUI-Based Application for EnergyPlus Data Analysis" IEEE PES General Meeting 2024, Seattle, USA.	Poster Link
Apr 2024	"Smart Residential Community Simulator" Power and Energy Conference at Illinois 2024, Urbana-Champaign, USA.	Poster Link
Feb 2017	"Development of Solar & Wind Energy Forecasting Application" XXXI Gujarat Science Congress 2017, Gandhinagar, Gujarat, India.	Poster Link
Oct 2016	"Photovoltaic Module PV-IV Curve Generator with Shading Analysis in MATLAB" PVSEC-26, Singapore.	Poster Link

TECHNICAL EXPERTISE

- **Optimization** : Gurobi, CVX, CasADi, Pyomo, PyScipOpt, JuMP
- **Programming** : MATLAB/Simulink, Python, Julia, C/C++
- **Power & Energy Systems** : OpenDSS, MATPOWER, SimPowerSystems, EnergyPlus, PVSyst
- **Machine Learning** : TensorFlow, PyTorch, Neuromancer
- **Reinforcement Learning** : TensorForce, Stable-Baselines, tf_agent, TorchRL
- **Scientific Computing** : HPC, Slurm, Docker, Kubernetes
- **Data & Databases** : PostgreSQL, MongoDB, Hadoop, Apache Spark
- **Methods** : Optimization, Optimal Control, Model Predictive Control, Estimation Theory, Control Theory, Reinforcement Learning, Machine Learning, Probability, Linear Algebra, Algorithmics

CERTIFICATIONS

Sept 2015 - Dec 2015	Post Graduate Diploma in Embedded Systems • Microcontroller programming (8051, ARM, PIC) • Embedded Linux development	Prolific Systems & Technologies
Mar 2013 - June 2013	Post Graduate Diploma in Industrial Automation • Programmable Logic Controllers (PLCs) • SCADA systems • Variable-speed drives	Prolific Systems & Technologies

TECHNICAL WORKSHOPS

Conducted:

Apr 2017	Introduction to L^AT_EX • Organized and delivered a one-day workshop for graduate students covering the fundamentals of L^AT_EX. • Demonstrated structured thesis preparation and document development in L^AT_EX.	SPCE
Apr 2017	Introduction to MATLAB • Designed and delivered a 12-hour workshop for undergraduate students covering MATLAB programming fundamentals. • Demonstrated the design and implementation of GUI applications in MATLAB.	SPCE

Attended:

Jan 2025	Grid Science Winter School and Conference • Participated in a competitive five-day winter school and conference focused on AI, optimization, and control for interdependent and low-inertia energy systems. • Engaged with researchers and presented a poster as part of a curated graduate cohort focused on theoretical advances in resilient power-grid operation.	LANL
May 2024	DataDriven Operation of Autonomous Power Systems • Studied decentralized control of converter-based resources in low-inertia systems, with emphasis on integration of distributed renewable energy. • Studied data-driven and online feedback-optimization methods for real-time operation of autonomous power systems.	EECI IGSC
Sept 2016	Solar PV Plant Design, Operation & Maintenance Workshop • Participated in hands-on installation of a 15 kW rooftop solar PV plant and developed PV-system simulation skills using PVSyst. • Presented a technical talk on PV tracking mechanisms and supported workshop delivery.	GERMI
Feb 2015	Real-Time Simulation in Power Electronics • Performed real-time simulation of buck and boost converters and a squirrel-cage induction motor. • Received hands-on training in configuring real-time simulations on a floating-point DSP platform.	IIT-B
Dec 2014	Short-term Training Program (AICTE Sponsored) on Renewable Energy Sources for Sustainable Developments • Attended lectures delivered by faculty from IITs, NGO representatives, and government officials. • Studied contemporary solar-energy-harvesting technologies, sustainable development, and energy auditing.	VJTI
Dec 2014	LabView Software Workshop • Received hands-on training in LabVIEW. • Developed virtual instruments in LabVIEW and interfaced them with external equipment.	SPCE
Dec 2014	Power Electronics Simulation Workshop • Received hands-on training in SimPowerSystems, PSCAD, PSIM, and SABER for power-electronics simulation.	IIT-B
Oct 2014	ETAP Training Workshop • Received hands-on training in ETAP. • Performed single-line-diagram development, load-flow analysis, short-circuit analysis, and motor-starting transient studies in ETAP.	AKER Power & Gas

TEST SCORES

June 2017	Test of English as a Foreign Language Total Score: 117/120, Reading: 29/30, Listening: 29/30, Speaking: 30/30, Writing: 29/30	TOEFL
July 2017	Graduate Record Examination Total Score: 315/340, Verbal: 156/170, Quantitative: 159/170, AWA: 4/6	GRE

AWARDS

Aug 2016	Academic Achievement Award Ranked first in the MTech program.	SPCE
Aug 2008	Academic Achievement Award Achieved an average score of 91.33% in the HSC examinations.	VAZE