VINEET JAGADEESAN NAIR

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EDUCATION

Massachusetts Institute of Technology | PhD in Computational Science & Engineering | **GPA**: 5.0/5.0 *2/21 - 5/25*
Thesis: Coordination of distributed energy resources for a reliable, resilient, and affordable decarbonized grid

Massachusetts Institute of Technology | SM in Computational Science & Engineering | **GPA**: 5.0/5.0 *9/19 - 9/21*
Thesis: Cumulative prospect theory passenger behavioral models for dynamic pricing & transactive control of shared mobility

University of Cambridge | MPhil in Energy Technologies | Gates Cambridge Scholarship | 1st Class Honor *9/18 - 9/19*
Thesis: Optimal design & energy management of islanded, hybrid microgrids for off-grid communities in sub-Saharan Africa

University of California, Berkeley | **GPA**: 3.85/4.0 | Dean's Honors List | Phi Beta Kappa *8/14 - 5/18*
B.S. Mechanical Engineering (Honor), B.A. Economics | Distinction | Tau Beta Pi, Pi Tau Sigma, Omicron Delta Epsilon
Minors in Electrical Engineering & Computer Sciences, Human-Centered Design, Entrepreneurship & Technology

Programming: Python, Julia, MATLAB/Simulink, Java, JAX, R, PyTorch, TensorFlow, SQL, Fortran, Git, STATA, LaTeX

RESEARCH EXPERIENCE

Research Intern, | Tata Motors, Pune, India *9/25 - present*
- Artificial intelligence (AI)-based advanced motor control algorithms for electric vehicle power converters

Postdoctoral Research Associate | MIT Mechanical Engineering & Schwarzman College of Computing *6/25 - present*

Human Frontier Collective Specialist | Scale AI *6/25 - present*
- Evaluating capabilities of large language foundation AI models for control, optimization, and energy system applications

Computational Research Intern | Shell, London, United Kingdom *9/25 - 12/25*
Applying machine learning, optimization, and geospatial data analysis to decarbonize the shipping and maritime sector

Research Intern | Catalyst Investment Management, Amman, Jordan *6/25 - 8/25*
Techno-economic analysis & optimization of sustainable AI data centers in the Middle East and North Africa (MENA) region

Graduate Research Assistant | Active Adaptive Control Lab, MIT Mechanical Engineering *9/19 - 6/25*
- Applying optimization, game theory, machine learning & control tools to model power grids & electricity markets
- Advised by Dr. Anuradha Annaswamy, thesis committee: Prof. Andy Sun & Prof. Kamal Youcef-Toumi
- Designed new local market structures & algorithms to coordinate & compensate distributed energy resources (DERs)
- Modeled dynamic pricing for shared, mobility-on-demand services using cumulative prospect theory
- Worked with external partners including Ford, Siemens, Shell, GE, PNNL, NREL, Dept. of Energy & Princeton University
- Managed global collaborations with faculty in Portugal, Spain, Switzerland, & Brazil
- Helped with proposal writing & coordination to secure $4 million+ in grant funding from US DOE & MIT Energy Initiative

Visiting Researcher | Universidad Politécnica de Madrid, Madrid, Spain *10/23 - 12/24*
- Applied blockchain infrastructure & smart contracts for novel electricity markets & distributed optimization algorithms

Computational Scientist PhD Resident | [Google] X, the moonshot factory, Mountain View, CA *5/23 - 9/23*
- Built improved inverter models & power system simulators for the grid with Project Tapestry
- Scientific, physics-informed machine learning to enhance speed & accuracy of transient dynamic numerical simulations
- Improved stochastic optimization for power system planning with hydro & renewables to study value of battery storage

Graduate Research Intern | National Renewable Energy Laboratory (NREL), Golden, CO *6/22 - 8/22*
- Power grid modeling & digital real-time simulation for hardware-in-the-loop validation of optimization/control algorithms

Research Consultant for Innovation Challenge | Avangrid, Orange, CT *5/21 - 8/21*
- Worked with Smart Grid Innovation team to implement distributed energy resources management system (DERMS) pilot
- Developed hybrid, federated software architecture & decision-making method to enhance cybersecurity & interoperability

Research Intern, Artificial Intelligence/Deep Learning for Smart Grids | Siemens, Princeton, NJ *5/20 - 9/20*
- Developed bilevel optimization framework & market mechanism for grid integration of distributed energy resources

Graduate Student Researcher | Control Group, Cambridge University Engineering Department *11/18 - 9/19*
- Researched optimal design, management, & control of hybrid, islanded microgrids, supervised by Dr. Ioannis Lestas

Honors Undergraduate Researcher | UC Berkeley *1/17 - 5/18*
- Advised by Prof. Duncan Callaway, Prof. Kameshwar Poolla, & Prof. Claire Tomlin
- Designed & prototyped low-cost electricity monitors, scaled up to produce 80+ units for field trials in Nicaragua
- Researched user incentives & programmed sensor networks to optimize usage & improve behavioral energy efficiency
- Studied optimal electric vehicle charge scheduling from a hybrid systems perspective

Cal Energy Corps Research Intern | Academia Sinica, Taipei, Taiwan *6/16 - 8/16*
- Increased efficiency of organic, low-cost dye-sensitized solar PV cells 8 to 9%, improved stability through co-sensitization

Undergraduate Research Apprentice | Indoor Air Lab, Civil & Environmental Engineering, UC Berkeley *1/16 - 6/16*
- Investigated temperature effects on airflow patterns & mixing times of gaseous pollutants, under Prof. William Nazaroff
- Independently designed & completed pilot experiment studying ultrafine particle emissions from dust & hot surfaces

PROFESSIONAL EXPERIENCE

AI Fellow | MIT-Pillar AI Collective *1/24 - 6/24*
- Customer discovery to explore commercial applications of my research i(timeseries forecasting & physics-informed AI
- Participated in the National Science Foundation (NSF) Innovation Corps (I-Corps) Spark and Fusion programs at MIT

MIT Delegate & UNFCCC Observer | COP28, Dubai, United Arab Emirates *8/23 - 12/23*
- Represented MIT to observe international negotiations at the 2023 United Nations Climate Change Conference

Thriving Earth Exchange Community Science Fellow | American Geophysical Union (AGU) *1/21 - 11/23*
- Worked with scientists, community leaders, legislators, utility representatives, environmental advocates, & local citizens
- Developed greenhouse gas inventory and energy plan for Otsego County, New York

Energy Management Intern at DEW21 (Energy & Water Authority) | Dortmund, Germany *7/18 - 8/18*
- Modeled & optimized hourly/daily price forward curves to predict natural gas prices in European markets,

Mechanical & Process Engineering Intern | Applied Materials, Santa Clara, CA *5/17 - 8/17*
- Developed more accurate & cost-effective real-time method for monitoring solid chemical levels inside process chambers
- Drafted 3D models & drawings, collaborated with suppliers to implement alternative sensors & measurement techniques

External Consultant | Electric Power Research Institute & Amazon Web Services *1/16 - 6/17*
- Identified key drivers for H_2 production, storage, transport, & usage for iron & steel decarbonization
- Analyzed technical, financial, & policy issues for battery storage (with renewables) in Amazon data centers

TEACHING & MENTORSHIP

Research Mentorship and Supervision (9/23 – present)
- Danielle Knutsen (MIT undergraduate): Data curation & machine learning analysis for large-scale energy datasets
- Peer Brigger (master's student, ETH Zurich): Assessing true marginal value of batteries in the future decarbonized grid
- Luca Hartmann (master's student, ETH Zurich): Distributed model predictive voltage control with circuit dynamics
- Jose Vargas (MIT undergraduate): Probabilistic forecasting of electricity supply, demand & flexibility with uncertainty

AI Lead Instructor | MIT International Science & Technology Initiatives, Lima, Peru *10/24 - 1/25*
- Develop and teach 3-week intensive course on machine learning and data science for early & mid-career professionals in Lima, Peru

Technical Curriculum Developer & Lead Instructor | MIT International Science & Technology Initiatives *11/23 - 1/24*
- Developed & taught high school course on climate change, clean energy & decarbonization in South Africa & Botswana

Data Science Instructor | MIT International Science & Technology Initiatives, Montevideo, Uruguay *11/22 - 1/23*
- Organized 3-week machine learning & entrepreneurship course at Universidad Tecnológica del Uruguay
- Developed & taught interactive lessons on various machine learning topics
- Mentored teams of students & professionals working on diverse startups & research projects

PUBLICATIONS

Vineet Nair. “Optimal transmission switching and grid reconfiguration for transmission systems via convex relaxations.” Electricity (2025)
Vineet Nair et al. “Resilience of the electric grid through trustable IoT-coordinated assets.” Proceedings of the National Academy of Sciences (2025).
Vineet Nair, “Enhanced physics-informed neural networks for high-order power grid dynamics.” NeurIPS Workshop on Tackling Climate Change with Machine Learning (2024).
Vineet Nair et al. “Federated learning forecasting for Strengthening Grid Reliability & Enabling Markets for Resilience.” International Conference on Electricity Distribution (CIRED) USA Workshop (2024).
Luca Hartmann, **Vineet Nair**, Florian Dörfler, & Anuradha M. Annaswamy. “Circuit-aware distributed optimal voltage control for distribution grids.” MIT “A+B” Applied Energy Symposium (MITAB 2024).
Vineet Nair, & Anuradha M. Annaswamy. “A game-theoretic, market-based approach to extract flexibility from distributed energy resources.” 5th IFAC Workshop on Cyber-Physical Human Systems (CPHS 2024).
Lucas Pereira, **Vineet Nair**, et al. “Accurate federated learning with uncertainty quantification for distributed energy resource forecasting applied to smart grids planning & operation: The ALAMO vision.” International Conference on Electricity Distribution (CIRED) Europe Workshop (2024).
Vineet Nair, et al**.** “Enhancing power grid resilience to cyber-physical attacks using distributed retail electricity markets.” 15th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2024).
Vineet Nair, & Anuradha M. Annaswamy**.** “Local retail electricity markets for voltage control & distribution grid services.” 7th IEEE Conference on Control Technology & Applications (CCTA 2023).
Priyank Srivastava, Rabab Haider, **Vineet Nair** et al. "Voltage regulation in distribution grids: A survey." Annual Reviews in Control (2023).
Anuradha M. Annaswamy* & **Vineet Nair**. “Human Behavioral Models Using Utility Theory & Prospect Theory.” In Cyber-Physical-Human Systems: Fundamentals & Applications, UK: Wiley, in Press (2023).
Vineet Nair et al**.** “A Hierarchical Local Electricity Market for a DER-rich Grid Edge.” IEEE Transactions on Smart Grid (2022)**.**
Thomas Lee*, **Vineet Nair*** et al. “Impacts of Dynamic Line Ratings on the ERCOT Transmission System.” 54th IEEE North American Power Symposium (NAPS 2022).
Vineet Nair & Lucas Pereira. “Improving accuracy & convergence of federated learning edge computing methods for generalized DER forecasting applications in power grids.” NeurIPS Tackling Climate Change with Machine Learning workshop (2022).
Vineet Nair. “Estimation of Cumulative Prospect Theory-based Passenger Behavioral Models for Dynamic Pricing & Transactive Control of Shared Mobility on Demand.” Master of Science Thesis in Computational Science & Mechanical Engineering. Massachusetts Institute of Technology (2021).
Vineet Nair et al, “Sensitivity Analysis of Passenger Behavioral Model for Dynamic Pricing of Shared Mobility on Demand.” Preprint (2020).
Vineet Nair. “Optimal design & energy management of islanded, hybrid microgrids for remote, isolated off-grid communities with no external power exchange.” Master of Philosophy Thesis in Energy Technologies. University of Cambridge (2019).
Sean Anderson, **Vineet Nair**. “Electric vehicle charge scheduling on highway networks from an aggregate cost perspective.” Preprint (2018).

PRESENTATIONS & TALKS

Vineet Nair & Anuradha Annaswamy. “Maximizing Security and Resilience to Cyber-attacks in a Power Grid.” MIT Energy Initiative Future Energy Systems Center Fall Workshop (2024).
Vineet Nair. “Towards a grittier grid: Data-driven decision-making for distributed energy resources.” Stanford University seminar (2024).
Lucas Pereira, **Vineet Nair**, et al. “Machine learning-based time series forecasting for distributed energy resources in power grids to enhance resilience.” 18th Annual Graduate Climate Conference (2024)
Vineet Nair. “Data-driven distributed optimization, markets, and control for an IBR-rich grid edge.” NSF Workshop on Enabling Cyber-Resilient Distribution Systems with Edge Inverter-Based Resources (IBR), MIT (2024).
Vineet Nair. “Better Decision Making & Coordination for Future Power Grids.” Invited seminar at Universidad Politécnica de Madrid (2024).
Vineet Nair et al. “Hierarchical Local Retail Electricity Markets for Distributed Energy Resources.” IEEE Power & Energy Society General Meeting (PESGM 2023)**.**
Vineet Nair & Anuradha M. Annaswamy. “Local retail electricity markets for grid services in DER-rich distribution systems.” Transactive Energy Theory Workshop, Pacific Northwest National Laboratory (PNNL) (2022).
Thomas Lee*, **Vineet Nair***, & Andy Sun**.** “Impacts of Dynamic Line Ratings on Security-Constrained Economic Dispatch for Transmission Grids & Wholesale Electricity Markets.” Technical Presentation to Federal Energy Regulatory Commission (FERC) (2022).
Vineet Nair, & Anuradha M. Annaswamy. “Local Hierarchical Electricity Markets for Distribution Grid Services like Voltage Control.” Poster presentation at the NREL Fifth Workshop on Autonomous Energy Systems (2022).
Vineet Nair et al**.** “Secure & Private Market-based Coordination of Grid Edge IoT Devices.” Invited presentation at INFORM 2021 Annual Meeting: Session on Data Analytics in Cyber-Physical Systems.

WORKING PAPERS

Vineet Nair. "Enhanced physics-informed neural networks and neural operators for transient simulations of high-order power grid dynamics", Submitted, under review (2025).
Vineet Nair. "Multiobjective optimization-based design & dispatch of islanded, hybrid microgrids for remote, off-grid communities in sub-Saharan Africa." Submitted, under review (2025).
Vineet Nair, Morteza Vahid Ghavidel, & Anuradha Annaswamy. "Dynamic resource coordination can significantly increase power grid hosting capacity to accommodate more renewables, storage, and electrified load growth." In preparation for Joule (2025).
Vineet Nair, Jesús Rodríguez-Molina, Juan Garbajosa, & Anuradha Annaswamy, "Blockchain-enabled energy price formation in local electricity market via energy traceability with Smart Contracts." In preparation for IEEE Internet of Things (2025).
Luca Hartmann, **Vineet Nair**, & Anuradha Annaswamy, "Circuit-aware distributed model predictive voltage control for distribution grids." In preparation for Control Engineering Practice (2025).
Danielle Knutson**, Vineet Nair**, & Anuradha Annaswamy. "Understanding technical & socioeconomic drivers behind the spatial distribution & heterogeneity of distributed energy resources in California." In preparation for Nature Energy (2025).
Peer Brigger, **Vineet Nair**, & Anuradha Annaswamy. "Assessing the true value of battery storage under uncertainty in distribution grids." In preparation for Energy Policy (2025).
Vineet Nair. "Techno-economic analysis of low-carbon data centers in the Middle East & North Africa." In preparation (2025).
Vineet Nair, Michael Hetherington, & Stephen Brown. "Data-driven approaches to reduce the emissions impacts of global LNG shipping." In preparation (2025).
Layla Araiinejad*, **Vineet Nair***, "The potential for nuclear fusion to sustainably & reliably power AI data centers." In preparation (2025).

REVIEWER SERVICE

Journals: IEEE Transactions on Smart Grid, Annual Reviews in Control, IEEE Transactions on Automatic Control, International Journal of Electrical Power & Energy Systems, Energies, Scientific Reports, Reliability Engineering & System Safety, IEEE Transactions on Control of Networked Systems, IEEE Transactions on Control Systems Technology, Communications Engineering

Conferences: IEEE Conference on Decision & Control, Journal of Energy Storage, ACM e-Energy Conference, IEEE International Conference on Automation Science & Engineering, International Federation of Automatic Control World Congress, American Control Conference, NeurIPS Tackling Climate Change with Machine Learning Workshop

HONORS & AWARDS

European Forum Alpbach Scholarship *8/25*
Aarav Amar Bajpayee Memorial Prize for Graduate Student Societal Impact | MIT Mechanical Engineering *5/25*
For excelling in research with societal impact related to the Health of the Planet or Global Energy Sustainability
Sigma Xi Scientific Research Honor Society Full Member *2/25*
Stanford Energy Postdoctoral Fellowship Finalist | Stanford University Precourt Institute for Energy *12/24*
Cyber-physical Human Systems (CPHS'24) Fellowship | International Federation of Automatic Control (IFAC) *10/24*
Stanford University Postdoctoral Recruitment Initiative in Sciences and Medicine (PRISM) award *9/24*
ARPA-e Energy Innovation Summit Student Program Award | US Department of Energy *5/22, 5/24*
National Science Foundation Innovation Corps (I-Corps) Spark and Fusion Grants *5/24*
Conference Travel Grant Award | MIT Graduate Student Council *3/24*
MIT-Pillar AI Collective Fellowship | Pillar VC & MIT Deshpande Center for Technological Innovation *12/23*
Den Hartog Travel Award in Mechanics | MIT Mechanical Engineering Department *1/23*
Out in STEM (oSTEM) Scholarship | Berkshire Hathaway Energy Foundation *10/22*
Best Paper Award: 3rd Place | 54th North American Power Symposium *10/22*
MIT MADMEC Sustainability Challenge: 2nd Place | MIT Materials Science & Engineering Department *10/22*
NREL Workshop on Autonomous Energy Systems Travel Grant | National Renewable Energy Lab *7/22*
Martin Family Society Fellowship for Sustainability | MIT Environmental Solutions Initiative *3/22*
Runner up | MIT Entrepreneurship & Maker Skills Integrator (MEMSI) Hardware Startup Bootcamp *1/22*
International Clean Energy Challenge Winner | Upper Austria *7/19*
Ruhr Fellowship | University Alliance Ruhr & TU Dortmund, Germany *4/18*
43rd Annual Business Today International Conference Impact Challenge Finalist | Princeton University *11/17*
Smart Cities Innovation Collider Winner | Sutardja Center, Pear VC, Bosch, & City Innovate Foundation *4/17*
Dean's Startup Seed Fund Winner | Haas School of Business, UC Berkeley *5/17*

LEADERSHIP, TEAMWORK & ACTIVITIES

Board of Directors Member | MIT Alumnx Pride *4/25 - present*
Finance lead | MIT Global Startup Workshop (GSW), Warsaw, Poland *10/24 - 3/25*
Impact Officer & AI x Climate/Health Project Lead | Global Shapers Cambridge Hub, World Economic Forum *9/23 - 4/25*
Graduate Student Representative | MIT Corporation Joint Advisory Committee on Institute-Wide Affairs *8/22 - 8/23*
Co-President | MIT Energy & Climate Club *4/22 - 5/23*
Content & Operations Team Member | MIT Global Startup Workshop (GSW), Athens, Greece *10/21 - 3/23*
Technical Research Seminar Organizer | MIT International Science & Technology Initiatives (MISTI) *9/22 - 11/22*
Elite Summer School in Robotics, Automation & Entrepreneurship | Innovation Centre Denmark *8/22*
Co-Managing Director | 2022 MIT Energy Conference *5/21 - 4/22*
Co-Director of Applicant Experience | 2021 Climate & Energy Prize (CEP) @ MIT *9/20 - 4/21*
Young Professionals Affinity Group Team Lead | Clean Energy for America (CE4A) *6/20 - 11/20*
Graduate Student Leadership Incubator Fellow | MIT 2019-20 Cohort *9/19 - 9/20*
Engage for Change Fellow | Cambridge Hub & University of Cambridge Environment & Energy Team *1/19 - 4/19*
Undergraduate Student Representative At-Large | The Green Initiative Fund, UC Berkeley *8/17 - 5/18*
Project Manager & Consultant | Bay Area Environmentally Aware Consulting Network (BEACN) *9/15 - 5/18*