Joel Mathias, Ph.D.

joel.mathias@asu.edu +1(352)277-9561 Indianapolis
joel-mathias.github.io github.com/joel-mathias
joel-mathias-90367b63 Joel-Mathias
scholar.google.com/citations?user=gBZFKz0AAAAJ

Education

2022 **Ph.D., Electrical and Computer Engineering, University of Florida**
Dissertation: *Balancing the Power Grid with Distributed Control of Flexible Loads.*
Advisor: Dr. Sean Meyn

M.S., Electrical and Computer Engineering, University of Florida

Bachelor of Engineering, Electronics & Communications, University of Mumbai

Employment History

May 2024 · · · **Engineer III — Market Design,** Midcontinent Independent System Operator (MISO), Carmel, IN.

- Design of capacity markets with reliability-based demand curves (including mathematical formulation, software implementation, testing, and stakeholder interactions)
- Computation of demand curves for operating, ramping, and short-term reserves in energy markets based on stochastic analysis

2022 – 2024 **Postdoctoral Research Scholar,** Arizona State University, Tempe, AZ.

- Focus on design of robust model predictive control and reinforcement learning techniques for automatic dispatch of distributed energy resources in power grid

2019 & 2021 **Research Intern.** Electric Power Engineers, LLC, Austin, TX.

- Implemented a distribution-level short-term load forecasting tool in Python using a deep learning architecture based on LSTM

2015 – 2022 **Graduate Research Assistant,** Lab. for Cognition and Control in Complex Systems, University of Florida, Gainesville, FL.

- Formulation of distributed stochastic control architecture to extract virtual energy storage (VES) from residential electric loads for ancillary services: ensures minimal load-to-grid communication, consumer privacy, and load-level QoS
- Design of simulation testbed to evaluate performance of control architectures

2009 & 2012 **Project Associate,** Tata Institute of Fundamental Research, Mumbai, India.

2010 – 2011 **Assistant Systems Engineer,** Tata Consultancy Services, Mumbai, India.

2009 – 2010 **Technical Editor,** Cactus Communications Pvt. Ltd., Mumbai, India.

Research Interests

- Energy and capacity markets; demand response
- Reinforcement learning, model predicitive control, stochastic and deterministic optimal control

Skills

Languages	Python, MATLAB, General Algebraic Modeling System (GAMS)
Datascience and Visualization	Azure Synapse Analytics, Pandas, Plotly, Dash, Matplotlib, Keras, TensorFlow
Mathematics	Real Analysis, Stochastic & Optimal Control, Convex Optimization
Misc.	Git, Jupyter/pySpark Notebooks, virtualization, LaTeX

Research Publications

Journal Articles

1. H. Ballouz, **J. Mathias**, S. Meyn, R. Moye, and J. Warrington, "Control engineer roles in the next power market transition," *Annual Review of Control, Robotics, and Autonomous Systems*, vol. 8, Jan. 2025.
2. **J. Mathias**, R. Moye, S. Meyn, and J. Warrington, "State space collapse in resource allocation for demand dispatch and its implications for distributed control design," *IEEE Transactions on Automatic Control*, 2023. DOI: 10.1109/TAC.2023.3293037.
3. **J. Mathias**, A. Bušić, and S. Meyn, "Load-level control design for demand dispatch with heterogeneous flexible loads," *IEEE Transactions on Control Systems Technology*, vol. 31, no. 4, pp. 1830–1843, 2023, ISSN: 1558-0865. DOI: 10.1109/TCST.2023.3245287.

Conference Proceedings

1. **J. Mathias**, R. Anguluri, O. Kosut, and L. Sankar, "Model predictive control for joint ramping and regulation-type service from distributed energy resource aggregations," in *IEEE Power & Energy Society General Meeting*, 2024.
2. F. Lu, **J. Mathias**, S. Meyn, and K. Kalsi, "Convex Q-learning in continuous time with application to dispatch of distributed energy resources," in *IEEE Conf. on Decision and Control*, Dec. 2023.
3. S. Meyn, F. Lu, and **J. Mathias**, "Balancing the power grid with cheap assets," in *IEEE Conf. on Decision and Control*, Dec. 2023.
4. **J. Mathias**, S. Meyn, H. Ballouz, and M. Ansari, "A distributed control architecture for optimal allocation of grid-responsive load aggregations," in *IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT)*, 2022, pp. 1–5. DOI: 10.1109/ISGT50606.2022.9817527.
5. **J. Mathias**, R. Moye, S. Meyn, and J. Warrington, "State space collapse in resource allocation for demand dispatch," in *IEEE Conf. on Decision and Control*, Dec. 2019, pp. 6181–6188. DOI: 10.1109/CDC40024.2019.9029384.
6. N. Cammardella, **J. Mathias**, M. Kiener, A. Bušić, and S. Meyn, "Balancing California's grid without batteries," in *IEEE Conf. on Decision and Control*, Dec. 2018, pp. 7314–7321. DOI: 10.1109/CDC.2018.8618975.
7. **J. Mathias**, A. Bušić, and S. Meyn, "Demand dispatch with heterogeneous intelligent loads," in *50th Annual Hawaii International Conference on System Sciences (HICSS)*, Jan. 2017, pp. 3138–3147. DOI: 10.24251/HICSS.2017.380.

8 **J. Mathias**, R. Kaddah, A. Bušić, and S. Meyn, "Smart fridge / dumb grid? Demand dispatch for the power grid of 2020," in *49th Annual Hawaii International Conference on System Sciences (HICSS)*, Jan. 2016, pp. 2498–2507. DOI: 10.1109/HICSS.2016.312.

Books and Chapters

1 Y. Chen, M. U. Hashmi, **J. Mathias**, A. Bušić, and S. Meyn, "Distributed control design for balancing the grid using flexible loads," in *Energy Markets and Responsive Grids: Modeling, Control, and Optimization*, S. Meyn, T. Samad, I. Hiskens, and J. Stoustrup, Eds., New York, NY: Springer, 2018, pp. 383–411, ISBN: 978-1-4939-7822-9. DOI: 10.1007/978-1-4939-7822-9_16.

News Media

1 H. Ballouz, **J. Mathias**, S. Meyn, R. Moye, and J. Warrington, *Addressing misconceptions on the performance of the energy market in Texas*, Utility Dive: https://tinyurl.com/5n933vyp, Apr. 2021.

Miscellaneous Experience

Teaching Assistantships

Spring 2020 — EEL 6935 – Stochastic Control, University of Florida

Spring 2021 — EEL 6935 – Control Systems and Reinforcement Learning, University of Florida

Selected Talks

Dec 2018 — *Balancing California's Grid Without Batteries,* IEEE Conf. Decision & Control, Miami, FL

Dec 2019 — *State Space Collapse in Resource Allocation for Demand Dispatch,* IEEE Conf. Decision & Control, Nice, France

Oct 2021 — *Optimal Control for Demand Dispatch in Smart Grid,* SIAM UF chapter meeting, FL

Scholarships and Awards

- JN Tata Endowment for Higher Education of Indians abroad for graduate studies in USA
- Lady Navajbai Ratan Tata Trust Higher Education Scholarship for studies in USA
- JRD Tata Scholarship for academic performance during undergraduate studies

References

Dr. Sean Meyn
Professor, Electrical and Computer Engineering,
University of Florida, Gainesville, FL, USA.
International Chair, INRIA, Paris, France.
meyn@ece.ufl.edu

Dr. Joseph Warrington
Principal Optimisation Engineer,
AstraZeneca,
Cambridge, UK.
joe.warrington@gmail.com