Joshua E. Hammond

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EDUCATION

University of Texas at Austin, Austin, TX | *Ph.D. Chemical Engineering* **Aug. 2026**
Research Advisors: Michael Baldea, Brian A. Korgel

University of Texas at Austin, Austin, TX | *M.S. Chemical Engineering* **Dec. 2025**

Brigham Young University, Provo, UT | *B.S. Chemical Engineering* **Aug. 2021**

RESEARCH

Updating Data-Driven Models
Ph.D. Research Jan. 2024 – Present
Advisors: Michael Baldea, Brian A. Korgel

- Developed the Subset Extended Kalman Filter to enable online updates of neural network parameters to accommodate systemic drift or discrete changes in the modeled system. Reduces update time $2-3\times$ compared to retraining all parameters.
- Trained and maintained neural network models of parametrically drifting dynamical systems including a damped spring, CSTR, diabetic glucose-insulin, temperature control arduino, and fluidized catalytic cracking and fractionator system.
- Sim2Real transfer learning of neural network models from simulated to physical systems.
- Model hyperparameter optimization using Asynchronous Hyperband Search on Texas Advanced Computing Center's Lonestar 6 supercomputer. PyTorch implementation on github.

Solar Irradiance Forecasting with Deep Learning
Ph.D. Research October. 2021 – Present
Advisors: Michael Baldea, Brian A. Korgel

- Developed a spatio-temporal deep learning model that forecasts solar irradiance up to two hours ahead using images of the sky and local meteorological measurements.
- Reduced input data requirements by $12\times$ while improving forecast accuracy using Conv-LSTM architecture to forecast future sky images, polar transformations to correlate satellite and ground-based images, and multiple-camera inputs.
- Combined process systems engineering and machine learning by adding a novel-to-irradiance forecasting disturbance model to the forecasting model which decreased error when performing feature selection.

Computationally-aided Photovoltaic Design
Ph.D. Research September. 2025 – Present
Advisors: Michael Baldea, Brian A. Korgel

- Used computational simulations to optimize the shape and size of groves in novel perovskite photovoltaic cells.

Renewable Power Integration in Energy Systems
Ph.D. Research Oct. 2021 – Present
Advisors: Michael Baldea, Brian A. Korgel

- Developed a model-based net load forecasting framework that combines local building models in EnergyPlus, probabilistic weather forecasts from NOAA, and historical load data to forecast substation-level net load.

- Optimized residential battery charge/discharge schedules to minimize electricity costs and demand charges using Pyomo and IPOPT.
- Evaluated the effects of electric tariff policies on optimal battery sizing and operation.

UAV Path Planning for Structural Monitoring
Undergraduate Research Aug. 2018 – Aug. 2021
Advisor: John Hedengren
- Flew UAVs to collect aerial imagery to evaluate and validate path-planning algorithms for 3D reconstruction of terrain and structures.
- Helped develop novel autonomous flight-path planning algorithm that identifies where to photograph next based on current 3D model quality.

PUBLICATIONS

Journal Articles

J.1 **Hammond, J. E.**, Lara Orozco, R. A., Baldea, M., & Korgel, B. A. (2024). Short-term solar irradiance forecasting under data transmission constraints. *Renewable Energy*, 233(June), 121058. `https://doi.org/10.1016/j.renene.2024.121058` preprint: `https://arxiv.org/abs/2403.12873`

J.2 **Hammond, J. E.**, Vernon, C. A., Okeson, T. J., Barrett, B. J., Arce, S., Newell, V., Janson, J., Franke, K. W., & Hedengren, J. D. (2020). Survey of 8 UAV set-covering algorithms for terrain photogrammetry. *Remote Sensing*, 12(14). `https://doi.org/10.3390/rs12142285`

J.3 Arce, S., Vernon, C. A., **Hammond, J.**, Newell, V., Janson, J., Franke, K. W., & Hedengren, J. D. (2020). Automated 3D reconstruction using optimized view-planning algorithms for iterative development of structure-from-motion models. *Remote Sensing*, 12(13). `https://doi.org/10.3390/rs12132169`

J.4 Freeman, M., Vernon, C., Berrett, B., Hastings, N., Derricott, J., Pace, J., Horne, B., **Hammond, J.**, Janson, J., Chiabrando, F., Hedengren, J., & Franke, K. (2019). Sequential earthquake damage assessment incorporating optimized suav remote sensing at pescara del tronto. *Geosciences (Switzerland)*, 9(8). `https://doi.org/10.3390/geosciences9080332`

Under Review

U.1 **Hammond, J. E.**, Soderstrom, T., Korgel, B. A., & Baldea, M. (2025). Staying Alive: Online Neural Network Maintenance and Systemic Drift. (Submitted to *Scientific Reports* June 2025) Preprint: `http://arxiv.org/abs/2503.17681`

Technical Reports

R.1 Patel, H., Panda, A., Shirekar, O., **Hammond, J. E.**, Jamali-Rad, H. (2022). STELLAR: Spatio-Temporal Deep Learning for Solar Irradiance Forecasting *Shell Global Solutions International B.V.* Amsterdam,

TEACHING

Teaching Assistant **The University of Texas at Austin**
CHE 360: Process Control Fall 2023, Spring 2024
Instructor: Thomas Badgwell

- Wrote and taught hands-on exercises for recitation sections of 50-80 students in addition to regular office hours, wrote homeworks and solutions, and proctored exams
- Worked with Dr. Badgwell to re-evaluate and improve course design to increase student engagement and learning outcomes
- *University of Texas at Austin Teaching Assistant Certification*
- Student Ratings: 4.77/5

Teaching Assistant **Brigham Young University**
CHE 436: Process Control Fall 2020, Winter, Spring & Summer 2021
Instructor: John Hedengren

- Funded by Mathworks, developed interactive course materials using MATLAB and Simulink to increase conceptual understanding and student engagement.
- Recorded and edited 56 tutorial videos to supplement in-person instruction.
- Managed 2 other undergraduate TAs to monitor progress and course material quality.

TALKS

T.1 **Hammond, J. E.**, Korgel, B., Soderstrom, Tyler A., Baldea, M. "Staying Alive: Maintaining Neural Network Models in the Presence of Systemic Drift" *AIChE Annual Meeting*, November 5, 2025. Boston, MA

T.2 **Hammond, J. E.**, Korgel, B., Baldea, M. "Some Preliminary Transfer Learning Results for Dynamical Systems" *Texas-Wisconsin-California Control Consortium*, September 9, 2025. Madison, WI

T.3 **Hammond, J. E.**, Korgel, B., Baldea, M. "Retrain or Update: Initial Results in ANN Model Maintenance" *Texas-Wisconsin-California Control Consortium*, September 24, 2024. Madison, WI

T.4 **Hammond, J.**, Baldea, M., Korgel, B. "Model-Based Net Load Forecasting" *NSF IUCRC Center for a Solar Powered Future by 2050 Semi-Annual Meeting*, April 16, 2024 Austin, TX

T.5 **Hammond, J.**, Baldea, M., Korgel, B. "Forecasting Solar Irradiance Under Data Transmission Constraints" *Texas-Wisconsin-California Control Consortium*, February 13, 2024 Austin, TX

T.6 **Hammond, J.**, Baldea, M., Korgel, B. "Spatio-temporal Deep Learning for Solar Irradiance Forecasting" *NSF IUCRC Center for a Solar Powered Future by 2050 Semi-Annual Meeting*, April 4, 2023 Austin, TX

T.7 **Hammond, J.**, Baldea, M., Korgel, B. "Machine Learning for Predicting Solar Power Generation" *Texas-Wisconsin-California Control Consortium*, February 28, 2023 Austin, TX

T.8 **Hammond, J.**, Baldea, M., Korgel, B. "The Solar-Powered Smart Home as a Resilient Nanogrid" *NSF IUCRC Center for a Solar Powered Future by 2050 Semi-Annual Meeting*, April 5, 2022 Austin, TX

T.9 **Hammond, J.**, Baldea, M., Korgel, B. "Advancing Sensing, AI, and Storage to Improve Solar Technologies" *NSF IUCRC Center for a Solar Powered Future by 2050 Semi-Annual Meeting*, April 5, 2022 Austin, TX

T.10 Hedengren, J., **Hammond, J.**, "Teaching Chemical Engineering with MATLAB, Simulink and TCLab" *MathWorks Seminar*, August 17, 2021

T.11 Hedengren, J., **Hammond, J.**, "Teaching Dynamics and Control with Arduino-based TCLab" *Mathworks Special Session at the 59th Conference on Decision and Control*, December 14, 2020

T.12 **Hammond, J.** "Field Demonstration of Volaire Automated Flight Optimization" *Joint Interagency Field Exercise*, Camp Roberts CA, November 4-6, 2019

T.13 Freeman, M., Hastings, N., Berrett, B., **Hammond, J.**, Hedengren, J., Franke, K., "Automated Flight Optimization for Infrastructure Monitoring" *Center for Unmanned Aerial Systems Winter 2019 Industrial Advisory Board Meeting*, February 6, 2019,

INDUSTRIAL EXPERIENCE

Renewable Power Integration Engineer **June 2022 – January 2023**
Shell International Exploration & Production | Power Integration & Storage

- Solar Irradiance Forecasting methodology using Deep Learning that is still used within real-time energy trading strategies
- Coordinated with data scientists, energy traders, and software engineers to deploy models into production
- Calculated future value of additional energy storage within US and European power markets
- Coordinated with maintenance crews to design and implement a network of sky-cameras for improved solar forecasting at a Shell solar farm

ACADEMIC SERVICE

Peer Reviewer **Industrial & Engineering Chemistry Research**
3 articles reviewed Mar. 2025 – Present
Peer Reviewer **Journal of Open Source Software**
4 articles reviewed Mar. 2024 – Present

MENTORING

Undergraduate Researchers
Liam Benner *Aug. 2022 – Aug. 2023*
NOAA data assimilation for net-load forecasting
Mary Zhao *Aug. 2025 – May 2026*
ERCOT market congestion forecasting using Graph Neural Networks
Vignesh Manjrekar *Aug. 2025 – May 2026*
PV System orientation optimization using Reinforcement Learning
Khoa Nguyen Le *Aug. 2025 – May 2026*
Minute-resolution solar forecasting dataset creation, market implications of solar forecasting.