# Shihao Li

Shihao Li | shihaoli01301@utexas.edu | 814-215-1959

## Summary

Ph.D. student in Mechanical Engineering at The University of Texas at Austin, specializing in data-driven control and reinforcement learning for complex dynamical systems. Research focuses on developing robust data-driven predictive control, safe reinforcement learning algorithms, and Gaussian process models for system identification and forecasting. Applied these methods to fuel cell degradation modeling and roll-to-roll manufacturing optimization. Proficient in MATLAB/Simulink and Python, with a strong publication record and proven ability to translate advanced control theory into practical, high-performance applications. Seeking an internship in control engineering or intelligent systems to contribute innovative, data-driven solutions in industrial and energy domains.

## Education

**University of Texas at Austin**, Austin, Texas — August 2023 – Present
*Doctor of Philosophy | Mechanical Engineering | Dynamic Systems and Control* — **GPA: 3.95/4.0**

**Pennsylvania State University**, University Park, Pennsylvania — September 2019 – May 2023
*Bachelor of Science in Mechanical Engineering* — **GPA: 3.67/4.0**
*Major GPA: 3.86/4.0*

## Experience

**Graduate Research Assistant** — Jan 2024 – Present
*University of Texas at Austin – Advanced Power Systems and Controls Lab*

- **Learning-Based Control:** Developed reinforcement learning and data-driven control frameworks that guarantee safety and robustness under uncertainty, including safe RL with quadratic-program safety filters, distributionally robust data-driven predictive control combining physics and data-driven prediction, and trajectory valuation/influence-function methods for data attribution. Implemented in Python (NumPy, PyTorch) and MATLAB
- **PEM Fuel Cells:** Built multi-physics PEMFC model with catalyst-layer degradation; designed curriculum-based RL with physics-informed rewards and safety shielding; applied Gaussian processes for degradation forecasting and lifetime-aware operation
- **Roll-to-Roll Manufacturing:** Developed physics-based models of PET–EVA–PET lamination adhesion using Hertzian contact and transient heat transfer, and validated predictions through peeling-force experiments. Implemented dual-roller heating that reduced EVA heating time by **62.6%**, enabling higher throughput. Applied reinforcement learning for real-time PID auto-tuning of tension control, integrating LabVIEW to achieve stable operation at elevated web speeds.

**Teaching Assistant** — Jan – May 2025
*University of Texas at Austin – ME 384Q.1: Introduction to Modern Control*

- Conducted office hours and mentored projects on state-space modeling, controllability, observability, stability, and optimal control; supported MATLAB/Simulink implementations for over 80 students
- Graded homework, midterm, and final exams; reinforced feedback control and dynamic optimization concepts through student Q&A and lecture support

**Undergraduate Research Assistant** — Oct 2021 – Apr 2022
*University of California, Los Angeles – Fluid Mechanics of Renewable Energy*

- Examined thermodynamics, design, and operation of renewable energy systems including hydropower, solar, and biomass under supervision of Dr. Nasr Ghoniem
- Conducted comprehensive literature review and analysis of multi-junction solar cell efficiency factors, resulting in peer-reviewed publication in Energy Sources, Part A (2023)

## Course Projects

**Two-wheeled Self-balancing Inverted Pendulum Control** — Fall 2024
*ME 384R: Multivariable Control Systems*

- Developed comprehensive 2D and 3D mathematical models using Newton-Euler and Lagrange methods for robust state-space representation
- Designed Linear Quadratic Regulator (LQR) and $H_2$ controllers to stabilize inherently unstable system, balancing control effort and trajectory smoothness

- Conducted robustness analysis under structured uncertainties, confirming consistent performance through MATLAB simulations

**LEGO EV3 Self-balancing Robot Design** Fall 2023

*ME 384N: Automatic Control Systems Design*

- Modeled and engineered PID control system for self-balancing robot, integrating theoretical knowledge with MATLAB/Simulink for stability optimization
- Employed Newton-Euler dynamics and Routh Stability Criteria in state-space modeling, ensuring precise maneuverability and equilibrium control
- Validated control logic through rigorous simulations, achieving rapid stabilization with minimal overshoot in real-time adjustments

**Lithium-ion Battery Electrical-Thermal Modeling** Spring 2023

*ME 462: Modeling of Dynamic Systems – Pennsylvania State University*

- Utilized MATLAB and Simulink to model electrical-thermal behavior of lithium-ion battery systems
- Developed mathematical model with model identification process and analyzed system parameters for performance optimization

**Line-Following Robot Design** Spring 2022

*ME 450: Mechanical Engineering Design Methodology – Pennsylvania State University*

- Designed and refined prototypes using SolidWorks and Arduino IDE, addressing industry-related design concerns
- Integrated hardware and software modules into cohesive infrastructure for autonomous line-following functionality
- Implemented IR sensor-based emergency braking and parking algorithms using MATLAB and Arduino programming

## Awards | Technical Skills

- **Awards:** Warren A. and Alice L. Meyer Endowed Scholarship (UT Austin), Dean's List (Multiple Semesters, Penn State)
- **Programming & Tools:** Python (NumPy, PyTorch, SciPy, Matplotlib), MATLAB/Simulink, LabVIEW, LaTeX, Microsoft Office
- **Control & Optimization:** Reinforcement Learning, Model Predictive Control, Data-Enabled Predictive Control (DeePC), Robust & Optimal Control, System Identification
- **Modeling & Simulation:** Multi-physics modeling, Gaussian Process Regression, Dynamic System Simulation, Degradation Modeling
- **Engineering Software:** SolidWorks (CSWA Certified), AutoCAD

## Publications

- **Li, S.**, Martin, C., Morquecho, E.V., Chen, Z., Chen, D., & Li, W. (2025). Modeling of Adhesion Dynamics in Roll-to-Roll Lamination Processes. *Manufacturing Letters*, 44, pp.552-558.
- **Li, S.**, Li, J., Martin, C., Bakshi, S., & Chen, D. (2025). MDR-DeePC: Model-Inspired Distributionally Robust Data-Enabled Predictive Control. *Modeling, Estimation and Control Conference (MECC)*, October 2025.
- Li, J., Chu, J., Zhao, F., **Li, S.**, Li, W., & Chen, D. (2025). Constrained Optimal Planning to Minimize Battery Degradation of Autonomous Mobile Robots. *arXiv preprint arXiv:2506.13019*.
- Li, J., **Li, S.**, Xu, J., Bakshi, S., & Chen, D. (2025). Influence Functions for Data Attribution in Linear System Identification and LQR Control. *arXiv preprint arXiv:2506.11293*.
- Li, J., **Li, S.**, & Chen, D. (2025). Smart Predict-Then-Control: Integrating identification and control via decision regret. *arXiv preprint arXiv:2506.11279*.
- Li, J., Jian, C., Zhao, F., **Li, S.**, Li, W., & Chen, D. (2025). Robust Optimal Task Planning to Maximize Battery Life. *arXiv preprint arXiv:2506.11264*.
- **Li, S.**, Hao, C., Wu, P., Ji, J., Yang, Y., & Yao, J. (2023). Review of Multi-junction Solar Cell & Factors Impacting the Efficiency of Multi-junction Solar Cell. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 45(4), 12737–12758.

## Service

- **Peer Reviewer:** Modeling, Estimation and Control Conference (MECC)
- **Peer Reviewer:** ASME Journal of Dynamic Systems, Measurement and Control