

Siddhant Singh

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RESEARCH INTERESTS

Lithium ion, redox flow batteries, SEI modeling, degradation modeling, python, MATLAB, Simulink, Simscape, cyclic voltammetry, cell cycling, parallel computing, data-driven learning, electric vehicles

EDUCATION

Ph.D. in Mechanical Engineering

University of Michigan, Ann Arbor, MI

In Progress

GPA: 4.0/4.0

Bachelor of Arts in Physics and Applied Mathematics Statistics

Macalester College, Saint Paul, MN

May 2021

GPA: 3.96/4.0

PH.D. PROJECTS

Graduate Student Research Assistant | *Mechanical Engineering, University of Michigan*

August 2021 – Present

- **Computational Modeling of Lithium Ion Battery Degradation and Bayesian Optimal Experimental Design:**

- Employed a Single Particle Model-based simulation using Mathworks Simulink, Simscape, and the Python package pybamm.
- Investigated the electrochemical and thermal performance of batteries, studying degradation factors like SEI growth and lithium plating and compared results to experimental data.
- Current work involves estimating parameters related to the battery and using Bayesian techniques to optimize experimental design inputs for more informed cell cycling.

- **Cell Cycling and Analysis of Aqueous Organic Redox Flow Batteries:**

- Conducted assembly and testing of flow batteries, evaluating candidate organic compounds for large-scale energy storage applications.
- Focused on azobenzenes, a promising class of redox-active molecules.
- Presented findings at the 242nd Meeting of the Electrochemical Society in Boston and scheduled to speak at the Spring 2024 Meeting of the American Chemical Society (ACS).

- **Electrochemical Desalination using the ceramic membrane Sodium Super Ionic Conductor (NaSICON):**

- Used a hybrid redox flow cell for electrochemical desalination of seawater and brackish water using a NaSICON membrane and compared its performance against polymer membranes.
- Presented a poster on this work at the 240th Meeting of the Electrochemical Society (ECS).

- **Work with Optimization and Parallelization:**

- Utilized an in-house-built ODE model to simulate carbon capture processes and optimized simulation parameters by fitting them to experimental data.
- Parallelized the code to minimize runtime for hundreds of ODE solves on Michigan's Great Lakes HPC Cluster.
- Co-author of a paper currently under review.

HONORS & ACCOLADES

Macalester College: Kofi Annan Scholarship, Charles J. Turck Presidential Scholarship, John Howe Scott Sophomore Chemistry Prize, Dean's List, Sung Kyu Kim Award for best capstone paper in physics, Phi Beta Kappa Society

University of Michigan: First-year Fellowship from the Department of Mechanical Engineering

TECHNICAL SKILLS

Microsoft Excel, Microsoft Powerpoint, Java, C++, MATLAB and Simulink, python, R, SQL, Apache Spark, JAX (Automatic Differentiation)

RELEVANT COURSES

Advanced Batteries, Machine Learning, Battery Modeling and Controls, Foundations of Artificial Intelligence, Electrochemical Engineering, Computational and Data-driven methods, Data Science in Python, Automatic Control, Linear Systems Theory