Alvaro Miguel

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Education

Purdue University – West Lafayette, IN	Aug 2020 – May 2024
Bachelor of Science in Mechanical Engineering	GPA: 3.87/4.00

- Relevant Coursework: Thermodynamics II, Linear-Circuit Analysis, C-Programming, Numerical Methods, Computational Fluid Dynamics, Advanced Thermodynamics, Electrochemical Energy Systems

Skills

- C/C++; Python; MATLAB; NX; SOLIDWORKS; MS Office; Arduino; High-performance Linux computing (cluster)
- Fluent in Spanish and English

Work Experience

Summer Undergraduate Research Fellowship (SURF)   West Lafayette | May 2023 – August 2023

- Worked as a research fellow under Dr. Partha P. Mukherjee on various projects pertaining to solid-state batteries and Li-ion batteries.
- Converted physics-based model of solid-state battery from MATLAB to C++ and carried out a validation analysis by simulating electrochemical performance over wide range of current rates and comparing with experimental data.
- Carried out simulations of Silicon-Graphite composite anode coupled with NCMA-cathode using 3D thermo-electrochemical model to test higher theoretical capacity chemistry under different conditions.

Research and Personal Projects

Electrode heterogeneity effects on eVTOL aircraft   West Lafayette | January 2023 – Present

- Extracted cathode microstructure binary reconstructions of an NMC-based Li-ion battery from X-ray tomographic microscopy to analyze electrode heterogeneity effects on electric vertical take-off and landing aircraft.
- Used 3D thermo-electrochemical model coupled with eVTOL dynamics to visualize local heat generation spots, Li-deposition regions along different states of charge and Li-concentration evolution to understand the effect of heterogeneities on eVTOL performance and safety.
- Made use of Linux high-performance computing environment for data analysis and post-processing.

Li-ion thermo-electrochemical model GUI   West Lafayette | August 2022 – May 2023

- Designed and implemented GUI using C++ and OpenGL to allow external users to carry out thermo-electrochemical performance calculations for Lithium-ion batteries. Made extensive use of CMAKE and dynamic libraries.
- Optimized algorithm for cross-platform compatibility as well as creating an individual package to allow external users to access the application.
- Created voltage and temperature signature plots from thermos-electrochemical model by externally linking GUI to MATLAB and Python.

Arduino Quadcopter - Personal Project   San Salvador | May – August 2022

- Designed, 3D-printed, and assembled quadcopter using Arduino with team of 2.
- Developed a flight computer using C++ based on output values from multiple Arduino sensors.
- Designed voltage divider circuit to calculate remaining battery percentage.

Awards and Recognitions

- 2021-2022 Waterman Scholarship in Mechanical Engineering
- 2022-2023 Gordon Hall Memorial Scholarship in Mechanical Engineering
- 2022-2023 Bottomley Research Scholarship
- Member of The Electrochemical Society (ECS)

Hobbies and Interests

- Reading non-fiction books, sustainable energy, Li-ion batteries, aerospace industry