Alex Echols (she/her)

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Education

Carnegie Mellon University, Pittsburgh, PA
B.S. Materials Science and Engineering, GPA: 3.23/4.0, Expected Graduation May 2025

Relevant Coursework

Materials Science and Engineering

- Structure of Materials
- Thermodynamics of Materials
- Defects in Materials
- Transport in Materials
- Phase Relations and Diagrams
- Microstructure and Properties I
- Additive Manufacturing and Materials
- Quantum Phys. and the Structure of Matter
- Introduction to Materials Characterization
- Selection and Performance of Materials
- Introduction to Polymer Science
- Methods of Computational Materials Science
- Molecular Simulation of Materials
- MSE Capstone I & II

Computer Science

- Fundamentals of Programming and Computer Science
- Introduction to Data Structures

Mathematics

- Concepts of Mathematics
- Differential and Integral Calculus
- Integration and Approximation
- Linear Algebra and Vector Calculus for Engineers
- Differential Equations
- Engineering Statistics and Quality Control

Other

- Writing about Data
- Rhetoric, Science, and the Public Sphere
- Structural Design for Theatre I

Publications

Conference Papers

A.Pathak, H. Ramasubramanian, A.McGaughey, J. Malen, A.Echols, “Molecular Dynamics and First-Principles Approach for Phonon Scattering in Alxga1-Xn Alloys: Role of Mass- and Force Constant-Disorder”, IMECE2024, Portland, OR

Research Experience

Molecular Dynamics (MD) Simulations of AlGaN Alloys
Research Advisor: Alan McGaughey
Carnegie Mellon University, Summer 2024

Implementation of Virtual Crystal Approximation into LAMMPS

- Modified industry standard MD (LAMMPS) source code, including force calculations for certain potentials
- Implemented novel interpolation methods for interatomic force constants

Study of thermal properties of AlGaN with Molecular Dynamics

- Used MD simulations (LAMMPS) to quantify a number of material properties including lattice constants, elastic properties, and thermal conductivity in alloy systems

Professional Experience

Materials Simulation and Testing Intern
Managers: Jonathan Trenkle, Brady Adams
Markforged, Waltham, MA, Summer 2023

- Characterized the properties of additively manufactured carbon fiber-nylon-fiberglass composites, using standard laboratory techniques and equipment
- Modified existing FEA code to implement composite materials based on measured property values
- Cleaned and debugged FEA code for commercial software launch

iD Tech, Pittsburgh, PA
Instructor, Summer 2022
Manager: Briar Harrison

- Worked with children ages 6-17, teaching a variety of STEM concepts, including Python, Javascript, and basic electronics skills

Leadership Experience

Shop Manager
Scotch 'n' Soda Theatre, Fall 2023 through Spring 2024

- Oversaw a 7 person shop staff, including organizing regular meetings and ensuring that all tasks were completed in a timely manner
- Coordinated equipment rentals to other organizations within Carnegie Mellon University
- Worked with other organization leaders to create a more comprehensive and accessible documentation system

Carpentry Shop Manager
Scotch 'n' Soda Theatre, Fall 2022 through Spring 2023

- Oversaw maintenance and upkeep of various power and hand tools
- Ensured proper training of all members on relevant equipment, including standardization of training procedures
- Worked to procure additional parts, equipment, and supplies as necessary

Master Carpenter
Scotch 'n' Soda Theatre, 10 Productions

- Managed the construction of theatrical sets for 10 separate productions
- Created CAD breakdowns of theatrical sets based on provided scenic designs
- Evaluated necessary supplies and created budgets using cost estimation and material selection skills
- Oversaw theatrical "load-in" and "strike", supervising up to 50 construction crew members to construct and tear-down theatrical sets

Steel Dragons Robotics, Team Captain, Fall 2020 through Spring 2021

- Oversaw FIRST Robotics (FRC) team #117 through the 2020-21 academic year
- Planned and scheduled meetings, resolved interpersonal conflicts, oversaw technical aspects of competition robot in a team with roughly 20 members
- Managed a leadership team of 8 other students, covering a variety of technical and non-technical areas
- Fundraised $20k needed for competition expenses, robot parts, and meeting costs
- Created more thorough documentation of all roles and responsibilities to minimize knowledge loss from COVID-19 pandemic

Steel Dragons Robotics, Build Captain, Fall 2019 through Spring 2020

- Trained and advised team members on technical aspects of FRC robot construction
- Devised feasible and functional robotic system designs for competition challenges with team members
- Repaired and improved robotics systems in time and resource constrained situations with team

Relevant Projects

MSM_MD, 2024

A custom molecular dynamics code written from the ground up in C++

- Features loading of arbitrary atomic input data, support for multiple atom types, potentials, and unit systems
- Developed individually throughout Molecular Simulation of Materials course as a part of coursework

Characterization of Cold-Sprayed 6061 Al, 2024

Comparison of wrought and cold-sprayed 6061 Al for work with Sandia National Lab

- Experimental design for measurement of various physical properties including hardness, electrical properties, and corrosion resistance
- Executed planned experiments using standard laboratory equipment and practices including ASTM testing standards
- Communicated with Sandia National Lab regarding results, experimental design, and project management as a part of MSE Capstone course project

Constant Current Laser Power Supply, 2024

Design and fabrication of a 10W, constant current laser power supply for SLM 3D printer

- Reviewed literature on power electronics including textbooks and academic papers
- Modified and combined pre-designed modules to create a circuit fitting the given constraints
- Designed PCB, selected components, and constructed power supply using hardware and software skills
- All stages, from project conception to final implementation were self-led and executed

Hollow Knight TAS Assistant, 2023
A standalone program for interfacing with information in the video game Hollow Knight

- Designed and developed main program (Python) and supplementary scripts and modifications to interface with existing game code (Lua, C#)
- Analyzed in-game data to create accurate models for in-game behavior of player character and dynamic objects
- Learned the details of various communication methods including sockets and direct memory management

Skills

Software

Python (9+ Years)
C# (4+ Years)
C++ (3+ Years)
MATLAB (3+ Years)

OnShape (5+ Years)
KiCAD (3+ Years)

Google/MS Office Suite (10+ Years)

ImageJ (1+ Year)
LAMMPS (1 Year)
Linux (1 Year)

Hardware

Basic Wood/Metalworking tools (10+ Years)
3D Printing (9+ Years)
Soldering (9+ Years)

Lathe (3+ Years)
Manual Mill (3+ Years)
MIG Welder (1 Year)

Laboratory

Tensile/Compression Testing (3+ Years)
XRD (2+ Years)
Impact Testing (1+ Year)
Microindentation (1+ Year)

SEM (2+ Years)
Optical Microscopy (2+ Years)

Experiment Design (3+ Years)