Daniel Zhan

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EDUCATION

B.S. Engineering Physics & Computer Science – *May 2023*
Cornell University
Relevant Coursework:

- Physics: Analytical Mechanics, Electromagnetism + Electrodynamics, Quantum Mechanics I + II, Statistical Thermodynamics, Electronic Circuits, Controlled Fusion, Mathematical Physics I + II, Astronomy and Cosmology
- Computer Science: Machine Learning, Algorithms, Operating Systems, Computer Systems Organization, Functional Programming, Honors Discrete Structures, Market Networks, Computer Game Architecture*, Robot Learning*
- Teaching Assistant for the following courses: Mechanics, Electromagnetism, Waves, Data Analytics for Info Science

* To be completed Spring 2023

EXPERIENCE

Undergraduate Research Assistant – ***Sept. 2022 - Present***
Cornell Laboratory of Plasma Studies - Ithaca, NY

- Currently working on modifying a two-dimensional magnetohydrodynamic (MHD) simulation under the direction of Prof. Seyler in Fortran 90 to specify initial configurations and conditions to produce plasma jets that satisfy certain requirements. I will then modify a three-dimensional version of the simulation accordingly and compare results.

Undergraduate Research Assistant – ***Sept. 2021 - Present***
Fuchs Group, Cornell University - Ithaca, NY

- Currently developing a computational quantum dynamics model of the Boron-Vacancy center in hexagonal Boron Nitride. This model aims to quantify the system's rate of photoluminescent state transitions. I developed a simulation to study photoluminescent state transitions in the Nitrogen-Vacancy charge center in the diamond lattice, and am modifying this program to simulate the Boron-Vacancy center and determine its effectiveness as a quantum sensor.
- The model is being developed in Python using the QuTiP package, which provides time-dependent solvers for the Lindblad master equation and provides functionalities to facilitate computation on state matrices and vectors.

Software Engineer – ***Sept. 2020 - Present***
Cornell Mars Rover - Ithaca, NY

- Worked with a team of 70 engineers to build a rover from scratch to analyze soil for extant life, navigate autonomously, and perform various dexterous tasks with its arm as a competitor in the University Rover Challenge.
- Designed and implemented a direct joystick-to-joint-motor control scheme using the principles of Forward Kinematics for the arm that allows a rover operator to control individual arm joint motors.
- Implemented an Inverse Kinematics-based control scheme for the arm that gives a rover operator direct control over the position and orientation of the end effector to enable execution of more complicated arm tasks efficiently.
- The control schemes offer two different logical and communication intermediaries between inputs from an abstracted rover controller (i.e. a joystick) and electrical signals (motor velocities and efforts) sent to arm joint motors. They are implemented in C++ using ROS 2 and with Inverse Kinematics and Motion Planning algorithms provided by MoveIt 2.

Physics Lab Technician Intern – ***Jun. 2021 - Aug. 2021***
Honeywell - Broomfield, CO

- Developed an automated tester for Honeywell's ion trap qubit chip (these chips serve as the core computation units for a trapped ion quantum computer) to verify that the electrical functionalities of the chip are working as intended to streamline chip testing and ensure proper electromagnetic manipulation of the trapped ion.
- Designed and implemented live hardware calibration, capacitance and resistance tests over electrode pairs, various test statistics, support for custom test settings, and a GUI to measure the electrical characteristics of the ion trap chip using Python and digital multimeters. It reduces testing time by over 95% and eliminates sources of human error.

Automation Developer Intern – ***Jun. 2020 - Aug. 2020***
Merck - Kenilworth, NJ

- Developed various web scraping and other automation tools (using Python and Selenium) to analyze competitor medication documentation and accelerate time-consuming business processes by up to 2000%.

PROJECTS

General Fusion Research Project

- Compiled a 25-page report on General Fusion's nuclear reactor design with a focus on providing technical analysis of reactor physics and engineering design decisions. A short presentation was prepared as a summary of the paper.
- Some topics covered in depth included acoustically driven plasma compression, liquid metal wall shielding and energy recovery, and a Lawson Criterion analysis to demonstrate design effectiveness.

Mechanical Resonator Research Project

- Analyzed the oscillation properties of a piezoelectric quartz resonator using circuit-based methods, and fit resulting data to the Butterworth-Van Dyke equivalent circuit. Produced a paper and presentation of my findings.

SKILLS & TECHNOLOGIES

Skills:
Research, Computational Modelling, Numerical Methods, Circuit Design and Analysis, Arduino Microcontrollers, Systems Programming, Robotics, Website Development
Technologies:
Python, Flask, Java, C++, OCaml, HTML/CSS, Git, Unix, Fortran 90, Docker, ROS, MoveIt
Activities:
Team Captain @ Cornell Badminton Club Team, Instructor for PE 1441 (Intermediate Badminton), Vice President & Mentor @ Cornell Applied and Engineering Physics Society, Mentor @ Association for Computer Science Undergraduates