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Alex Zheng

Education

B.S. Mechatronics Engineering (First In Class), University of Waterloo Sep *2023–Present*

Technical Skills

- **Programming:** C, C++, Python (NumPy), MATLAB/Simulink, Git, Linux, Docker, Bash, GDB, CMake, VHDL
- **Protocols:** SPI, I^2C, CAN, USB (2.0), LVDS, UART, Ethernet
- **Tools:** STM32, Altium, ROS, Siemens EDA, SolidWorks, LTSpice/LTPowerCAD, Oscilloscope, 3D-Printing, Soldering

Work Experience

UG Math Researcher, *Waterloo Algebraic Intelligence and Computation Lab* | Waterloo, CA *Jan 2026–Present*

- Researching neuro-symbolic AI with algebraic, hierarchical coordinatization to build provably safe autonomous decision-making machines, with zero-shot generalization, in finite discrete-event systems
- Solved dynamic programming and graph optimization computations in C/C++ to disprove Hadwiger's Conjecture

Hardware Design Intern, *Teledyne DALSA* | Waterloo, CA *Jan 2025–Aug 2025*

- Developed 16-layer mixed-signal PCB with STM32, PLL, DAC, 10-rail PDN to test die resilience in harsh conditions
- Architected system-optimized power-trees with π filters, input protection, and 47° phase margin, reducing ripple
- Designed PCB stack-ups and component placement, reducing layer count while optimizing power planes and return paths to mitigate thermal/noise coupling, accelerating layout by two weeks
- Implemented board-level USB 2.0, LVDS, SPI interfaces with impedance-controlled routing for 120 MHz sensors
- Led board bring-up for multimillion-dollar program, debugging signal/power integrity issues, and integration of FPGA firmware on custom PCBs, using JTAG, TCL, EtherCAT, SFP test suites and oscilloscopes

Junior Technical Analyst, *Ontario Ministry of Transportation* | Toronto, CA *May 2024–Aug 2024*

- Wrote Python and SQL scripts to verify, format, and transfer patron data across 4 apps using the pyodbc module
- Created local .NET, WebLogic servers and UAT / API tests using NUnit and SoapUI for new DEV network

Technical/Research Projects

Low-resolution reflectometry for inline thin-film inspection *(co-author)* | Conference

- Developed Python G-code translator converting user-defined motion into deterministic, 3-DOF raster scan trajectories, with parameter validation, on a modified 3D printer
- Designed a time-motion synchronization algorithm to compute timestamps for spectrometer data acquisition using piecewise kinematics (position, velocity, acceleration, jerk), enabling precise thin-film metrology
- Multi-threaded Python backend, PyQt GUI, and USB-serial I/O, supporting start/stop signalling, live timer feedback, and time-synchronized motion and data acquisition
- Led the camera rig model design, unifying the spectrometer, camera, and 3D-printer gantry into one module

Temperature controlled IC test fixture

- Developed PID-controlled PWM code for a test-fixture heater ensuring temperature control to ± 2.0 °C using a Raspberry Pi, Python, power electronics, and thermistor
- Calibrated NTC thermistor with Steinhart-Hart model, accounting for self-heating and dissipation coefficient
- Designed power electronics with power conversion, motors, PFET, encoders, ADCs, and connectors by researching components, verifying calculations, and soldering
- Led the test fixture model design, integrating DUT, circuitry, and heating/cooling system into one fixture module

Integrating sensor fusion to build a world view (3D aircraft simulation)

- Implemented Kalman filter based sensor fusion (IMU, gyroscope, accelerometer) for accurate state estimation
- Visualized and statistically quantified estimation error and uncertainty from sensor noise, latency, and dropout