

Marco Ching

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Education

University of Waterloo | Waterloo, ON, Canada

09/2022 – 06/2027 (Expected)

Bachelor of Applied Science (BASc) – **Honours Mechanical Engineering Co-op**

Relevant Coursework: Building Energy Analysis; Fluid Power Control Systems; HVAC Systems, Equipment & Energy Efficiency (Winter 2027); HVAC Load Analysis and Design (Winter 2027); Fire Safety Engineering (Winter 2027)

Research Interests

Building energy modeling and simulation | Building performance verification | HVAC systems and controls | Adaptive facades and natural ventilation | Low-carbon building systems

Technical Skills

Building Energy & Simulation: Whole-building energy modeling, COMFEN, HVAC load calculations and design, U-value and envelope analysis, lighting design, fire protection design, ASHRAE 90.1

Fluid Process Systems: Head-loss calculations, pipe sizing, pump systems, P&ID interpretation, hydraulic & pneumatic circuits

Design & Digital Engineering: Revit, BIM coordination, Navisworks, SolidWorks, AutoCAD, Dynamo, Autodesk Construction Cloud, Bluebeam, ArcGIS, Power BI, GD&T, DFM/A, tolerance stack-up

Computation & Controls: C++, MATLAB, Simulink, PLC, Raspberry Pi, Arduino, sensor integration, motor control

Fabrication & Prototyping: 3D printing, laser cutting, machining

Research & Technical Projects

Energy Simulation & Parametric Analysis – ME572 Building Energy Analysis | 2026

Report

- Built a 5,000 ft² office energy model and benchmarked annual site energy use against ENERGY STAR; evaluated roof, wall, glazing, and ventilation measures through 17 parametric simulations.
- Found that lowering glazing SHGC from 0.70 to 0.30 reduced annual energy cost by 7.5% and peak cooling load by 31.5% but increased GHG emissions by 10.6%, as reduced solar gains shifted demand from electric cooling toward natural-gas heating under the project's emissions assumptions.
- Identified that one-at-a-time parametric analysis could isolate individual design effects but could not capture interactions among envelope variables, limiting conclusions about combined design changes.

Interior Lighting Design & COMFEN Analysis – ME572 Building Energy Analysis | 2026

Report

- Designed a 1,632 ft² lighting layout to 52 fc at 0.52 W/ft², below the 0.6 W/ft² target; used COMFEN to evaluate how reduced lighting power affected heating and cooling loads.
- Modeled a 25% reduction in lighting power using Toronto weather data during winter, reducing annual EUI by 6.3% while increasing heating demand by 13.6% because lower lighting loads also reduced internal heat gains during the heating season.

Volcanic-Tectonic Earthquake Monitoring & Low-Cost Detector Development | 2024

Poster

- Deployed Raspberry Shake geophones at two locations in Hong Kong to collect low-magnitude tremor data and investigate seismic activity near Cheung Chau.
- Analyzed seismic waveforms from multiple locations and used triangulation to estimate the source region of detected tremors.
- Identified intermittent data loss and measurement limitations in the original Raspberry Shake setup, including dependence on continuous power/connectivity and sensor placement on an elevated structural column.
- Improved monitoring reliability by adding backup power and offline data acquisition, using higher-sensitivity tremor sensors and geophones, and ground-mounting sensors closer to the area of interest to improve coupling and signal quality.

Baseball Aerodynamics & Pitch Modeling – ME 362 Fluid Mechanics II | 2025

Report

- Developed a MATLAB model of fastball, curveball, slider, and knuckleball trajectories using drag, spin-dependent lift, gravity, release velocity, and spin axis; compared predicted vertical and horizontal break with MLB Statcast data.

- Analyzed Reynolds number, boundary-layer transition and separation, pressure gradients, and seam effects; identified where the smooth-sphere model failed to capture the knuckleball's asymmetric, unsteady wake behavior.

Five-Degree-of-Freedom Remote-Operated Robotic Manipulator | 2025

Report

- Designed and built a 5-DOF robotic manipulator with a 51 cm reach and ± 5 mm positional accuracy using SolidWorks and 3D-printed components.
- Built the motor-driver and control circuitry and programmed coordinated joint movement in C++ using an Arduino Mega ADK.
- Troubleshoot servo over-current, wire-crimp failures, and USB host-shield signal issues through several build and testing iterations.

All-Terrain Electronically-Assisted Collapsible Wagon – ME481 | Ongoing

Report

- Designed a fail-safe mechanical steering system that uses lateral handle movement to keep the front wheels steerable if the electrical steering system or motor fails.
- Developed a trailing-arm suspension layout and created CAD assemblies to check fit, clearance, manufacturability, and integration with the rest of the wagon.
- Currently moving into physical prototyping, including supplier selection and procurement of the drive, power, and structural components.

Engineering Experience

Chevalier Group – Envirotech Trainee | Hong Kong

09/2026 – Present

- Performed process and hydraulic design calculations for water-treatment chemical systems, including sodium bisulfite storage sizing for a 640 MLD facility, dosing-flow calculations across a 4:1 turndown range, pipe sizing, and suction & discharge head-loss analysis incorporating pipe lengths, fittings, valves, manifolds, and pump arrangements.
- Designed and coordinated chemical-storage, dosing-system, and piping layouts from P&IDs using Navisworks, integrating tanks, pumps, valves, and maintenance access while reviewing installed works for constructability, durability, and compliance with design intent.
- Prepared and reviewed engineering documentation including compliance submissions, pump technical submittals, flange-standard comparisons, and construction schedules. Evaluated centrifugal and progressive-cavity pumps against ARUP & WSD requirements for hydraulic performance, materials, PLC controls, and manufacturer data.

WSP Global Inc. – BIM Co-op Student | Toronto, Canada

01/2026 – 04/2026

- Developed and coordinated Revit BIM models for HVAC and plumbing systems on the Eglinton Crosstown West Extension, incorporating ductwork, piping, air terminals, valves, fittings, equipment clearances, and multidisciplinary design requirements.
- Designed fire-protection sprinkler layouts and water-distribution systems for Union Station Expansion Project Blue Route Phases 2–6, accounting for code requirements, constructability, spatial coordination, and evolving architectural and engineering constraints.
- Managed BIM coordination and submission workflows across 10 project scopes, supporting internal, interdisciplinary, alliance, and IFC reviews while tracking design changes and resolving model & interface issues ahead of submission deadlines.

Airport Authority Hong Kong – BIM Engineering Trainee | Hong Kong

06/2025 – 08/2025

- Developed a Dynamo–Power BI workflow to extract and structure BIM data for project analytics, supporting the transition of airport engineering information and model-management processes to Autodesk Construction Cloud.
- Reviewed and maintained 20+ completed Revit BIM models for Hong Kong International Airport, checking model quality, consistency, and alignment with architectural and engineering requirements across airport facilities.
- Contributed to an AI-assisted waste-sorting patrol robot project using SLAM and LiDAR, focusing on real-time environmental mapping, localization, and autonomous navigation within an airport operating environment.

Awards & Certifications

3rd Place, IEEE Young Engineers Conference | 2022

University of Waterloo President's Scholarship | 2023

Mandatory Basic Safety Training Certificate (Construction Work) – Hong Kong Human Resources Ltd. | 2026