Ryan Kai Sum Wong

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Education

University of Waterloo - BASc, Mechanical Engineering, GPA: 3.9 — Aug 2025 – May 2030

Professional Experience

Research Assistant – <u>MIT Jameel Clinic</u> – Cambridge, Massachusetts. — Jul 2024 – Aug 2024
- Developed Python program using Medicare APC/DRG/CPT codes to calculate SYBIL AI net cost savings (~$700 per patient) from 125k+ patient records, using Pandas, NumPy, and SciPy for data cleaning and analysis.
- Applied K-means clustering to identify distinct patient cost patterns across 4 treatment groups, enabling clearer assessment of AI deployment impact on healthcare cost efficiency.

Relevant Experience

Mechanical Lead – <u>UWaterloo BioMechatronics Design Team</u> – Waterloo, Ontario. — Sep 2025 – Present
- Directed a 20+ member team to design and manufacture a soft lower-body exoskeleton with a 2-DOF powered hip joint, offsetting 20% of walking power to enhance assisted mobility.
- Developed parametric anthropometric models from human biomechanics datasets, achieving ergonomic fit across 80% of standard body measurements.
- Led a 10-person FEA subgroup to optimize a 6061-aluminum dorsal chassis under a 5 kg cantilevered and 20 kg compressional load, reducing weight by ~23%.
- Produced GD&T manufacturing drawings and executed multi-process fabrication (CNC, waterjet, lathe, 3D printing, sheet metal), delivering components validated against design specifications.

Founder, Captain & Design Lead – <u>VEX Robotics Team 3708E</u> – Hong Kong. — Feb 2023 – Aug 2025
- Founded and expanded the robotics program to 4 teams of 40 students, establishing team structure, budgets, and timelines, twice qualifying to represent Hong Kong at the VEX Worlds International Championship.
- Directed Mechanical and Hardware teams using CAD, FEA, and laser machining, reducing robot weight by 4 lb, coming 4th in qualifiers and winning the Excellence Award at the Hong Kong Tech Open.
- Managed a 300-page engineering notebook documenting mechanical design and build processes, directly supporting the team's Design Award recognition.

Projects

FPV UAV Test Platform - Version 3 — Dec 2025 – Present
- Performed aerodynamic stability and drag analysis using XFLR5 and ANSYS to optimize an airframe for 20 m/s cruising.
- Designed a lightweight structure using the anisotropic properties and density of LW-PLA to reduce overall mass by 48% while maintaining strength, and thermal properties of PETG to reduce ESC heat-sink enclosure warping by 78%.

Swerve Vacuum Robot — Nov 2025 – Present
- Designed and validated a high-speed custom swerve-drive module (5.07 m/s) using ANSYS static and transient structural simulations to guide mechanical design.
- Co-owned a ROS2-based holonomic control stack with LiDAR SLAM (Gazebo) and A* path planning, improving navigation via motion profiling and PID tuning.

Skills

- **Design & Simulation:** SolidWorks, Fusion360, AutoCAD, Engineering Drawings, GD&T, ANSYS, XFLR5, KICAD, Altium.
- **Technologies:** Python (NumPy, Pandas, SciPy, Matplotlib, Seaborn), C++, MATLAB, Arduino, I2C, SPI, IMUs, PID.
- **Manufacturing & Machining:** Lathe, Mill, Waterjet, Laser Machining, CNC routing, Sheet Metal Work, 3D Printing(FDM).

Portfolio

Details at www.ryankaisum.ca
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FPV UAV Test Platform - Version 3 (Dec 2025 - Present)

- Designed and fabricated a fully 3D-printed 1 kg flying-wing UAV optimized for efficient cruise flight above 30 km/h.
- Conducted batch airfoil and stability analysis in XFLR5 across Re = 5,000 to 3,000,000 to inform airfoil, planform, and geometry selection across all flight regimes.
- Used the Spalart-Allmaras model in ANSYS Fluent to simulate aerodynamic drag to acquire pressure, drag and lift coefficients in the transitional flow regime (Re = 10^5 to 10^6), to validate design choices.
- Tuned sweep, dihedral, and V-tail geometry via modal stability analysis, achieving longitudinal damping coefficients of 0.372 (short-period) and 0.231 (phugoid), 48% airframe mass reduction using LW-PLA, and 78% reduction in ESC enclosure warping using PETG.
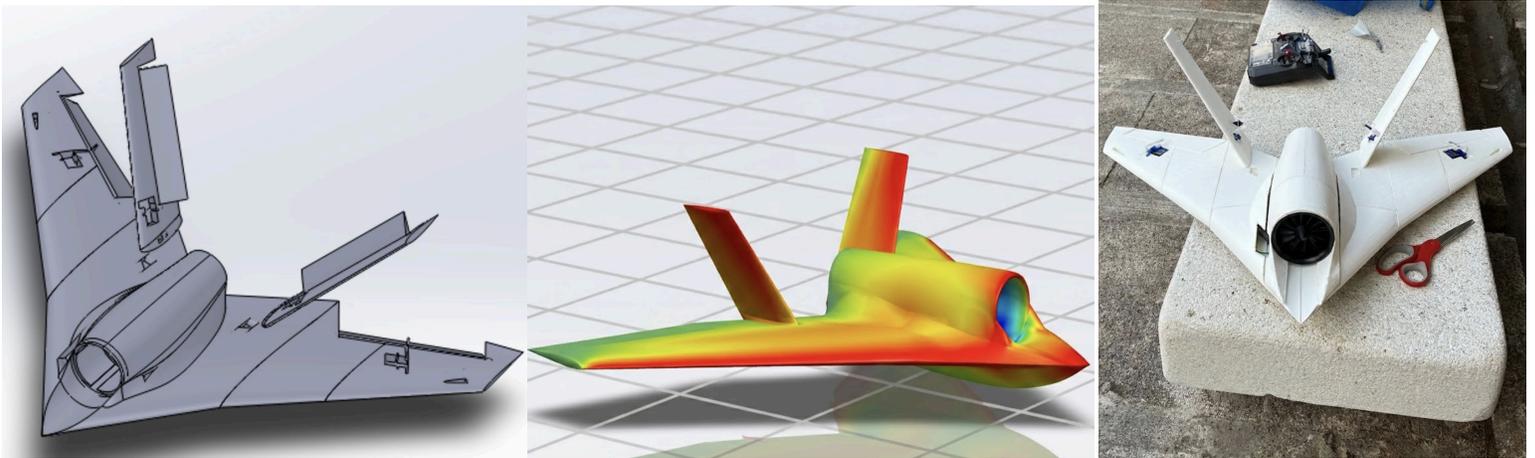

Swerve Vacuum Robot (Nov 2025 - Present)

- Designed a fully holonomic autonomous vacuum robot using a custom swerve-drive system for omnidirectional motion.
- Designed 3D-printable swerve-drive gearboxes with bevel/spur gears, and belt drives, achieving 5.07 m/s no-load speed.
- Co-developed a distributed ROS2 control architecture in Gazebo, partitioning LiDAR SLAM and A* path planning on a Raspberry Pi and low-level steering control on an ESP32.
- Validated component strength using ANSYS steady-state and transient structural simulations under operational, static, and crash-impact loading.
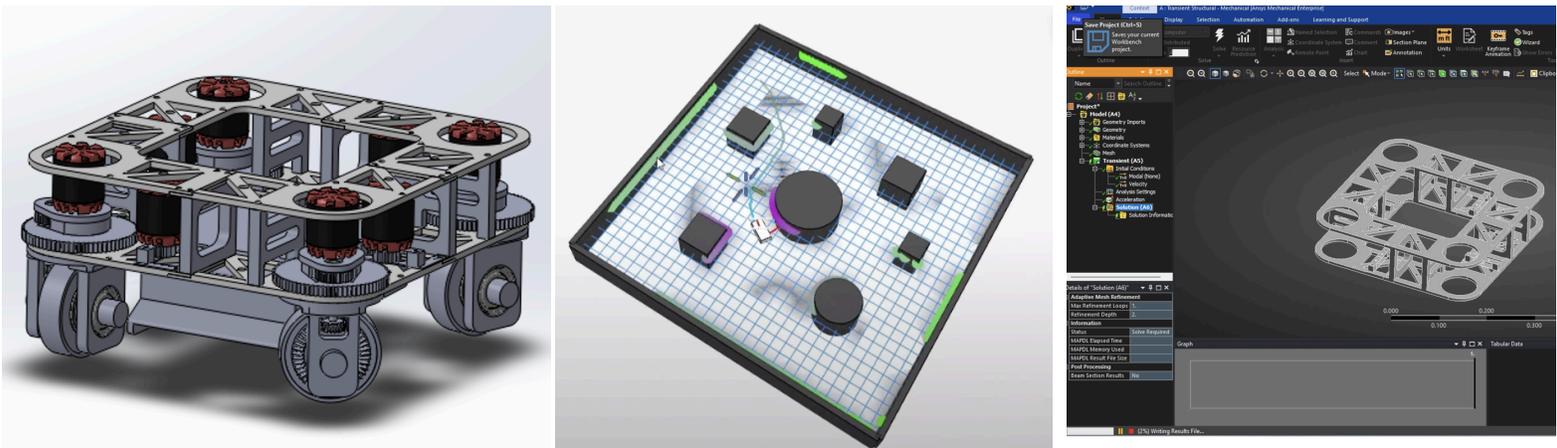
Soft Exoskeleton (Oct 2025 - Present)

- Designed a parametric lower-body soft exoskeleton to assist walking by offsetting 20% of walking power.
- Used anthropometric datasets to build parametric models ensuring ergonomic fit across 80% of standard human measurements, with a passive self-adjusting linear slide mechanism for automatic alignment on strap tightening.
- Modeled a 2-DOF hip joint for natural gait support and designed a CNC-machinable cycloidal gearbox housing, alongside waterjet-cut side chassis plates, reducing manufacturing cost by ~40%.
- Applied GD&T principles to produce technical drawings adopted as team-wide fabrication standards.
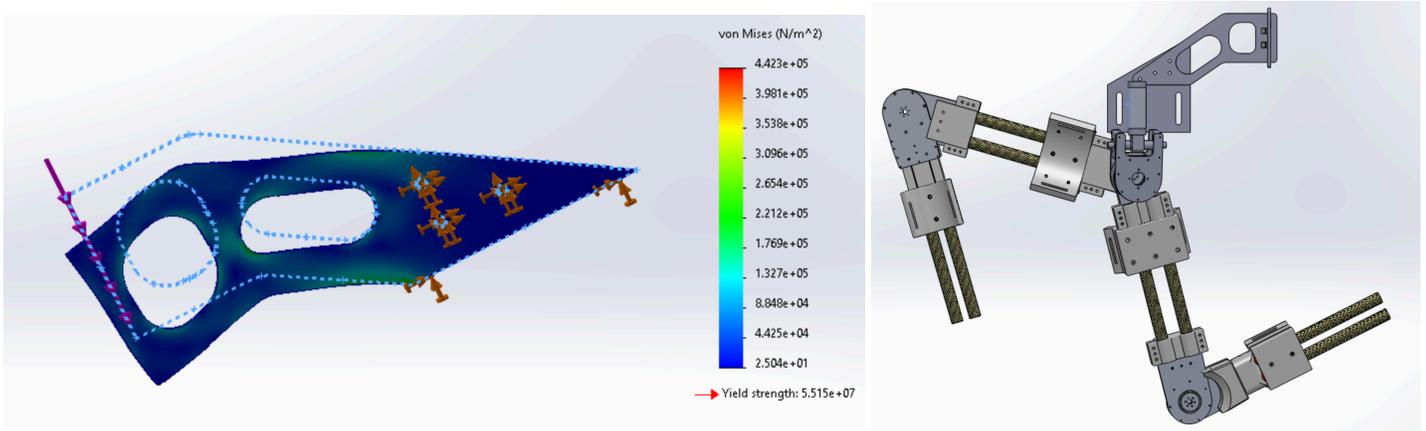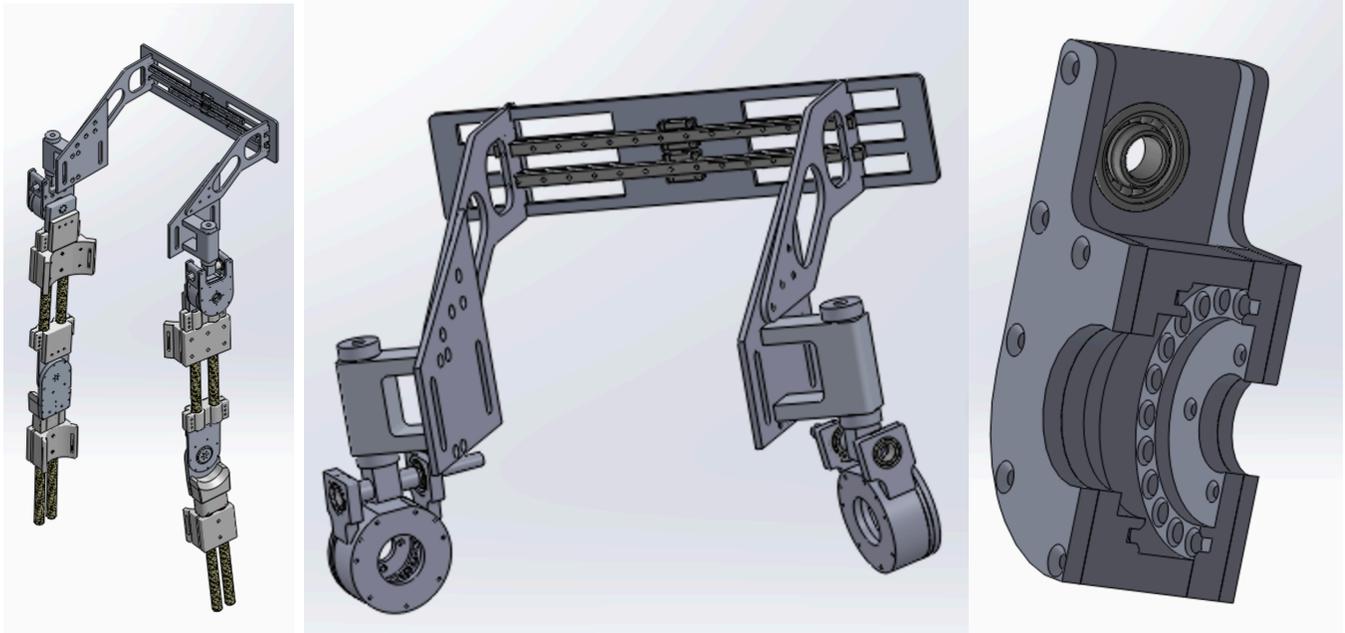
PlaneBrain (Oct 2024 - Present)

- Designed a modular embedded flight control system for fixed-wing UAVs, targeting attitude control and yaw damping.
- Implemented Mahony sensor fusion on ESP32 with MPU6050 IMU and FlySky i6X RC input, writing and tuning an acro-style PID rate controller with exponential stick mapping.
- Deployed onboard the FPV UAV test platform, achieving effective yaw damping to counteract underdamped dutch roll.
- Designing a custom all-in-one Altium PCB integrating ESP32-WROOM-32, IMU, and GNSS, with higher-level autonomy in development in MATLAB on a dual-processor architecture (Raspberry Pi + ESP32).

Pneumatic Launchers (Jul 2024 - Oct 2025)

- Investigated the relationship between chamber pressure and launch velocity using a LIDAR sensor testing rig for velocity measurements, deriving an adiabatic expansion model validated against empirical data.
- Extended the framework into a CAD and structural concept study for a PVC pneumatic launcher (not physically built due to legal/safety constraints), using steady-state simulations to validate pressure vessel safety at 70 psi.
- Used transient CFD with Spalart-Allmaras in ANSYS Fluent to model pressure behavior around U-bends and bottlenecks, finding U-bend geometries in standard PVC cannot form safe designs under pressure concentration.