

Justin An

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SKILLS

Mechanical & CAD: SolidWorks, Fusion 360, CATIA, ASME Y14.5 GD&T, ISO Tolerance Fits, FEA/Stress Analysis, Kinematic Linkages, DFM/DFA, Rapid Prototyping, CNC Machining, Polymer Casting.

Software & Controls: Python (PyTorch, NumPy), C++, Reinforcement Learning (PPO, Isaac Gym), Linux (Bash), Git, SolidWorks VBA API, CAN Bus Protocol.

EXPERIENCE

Red Rabbit Robotics | *Robotics Mechanical Designer*

Sep 2025 – Apr 2026

- Architected **7 modular humanoid and manipulator arms** in 2 days, replacing costly off-the-shelf harmonic drives with custom architectures to slash per-joint unit costs by **\$4,800 CAD**.
- Developed **6 distinct robotic joint architectures**, optimizing gear reduction topologies to increase torque density by **~50%** and establish a standardized, high-torque hardware platform for on-site deployment.
- Engineered an automated **field-deployable conveyor testing rig**, providing a continuous **hardware-in-the-loop (HIL)** validation environment for dynamic pick-and-place algorithms without manual resets.
- Leveraged **Generative Design** and non-linear **FEA** to reduce total structural mass by **20%**, optimizing stiffness-to-weight ratios and preventing motor thermal overload during continuous payload sorting.

Trexo Robotics | *Mechanical Engineering Intern*

Jan 2025 – Apr 2025

- Designed a bio-mimetic test fixture to simulate **human-gait center of mass** dynamics, executing accelerated **1M+ step physical durability trials** to secure critical validation data for **FDA 510(k)** clearance.
- Engineered an **IP44-rated sealed motor housing** utilizing custom elastomeric **gasket profiles** and compression calculations to satisfy strict medical device ingress standards.
- Authored **SolidWorks VBA API scripts** to automate manufacturing drawing generation and BOM compilation, reducing manual documentation overhead by **95%** and accelerating procurement timelines.

UWAT VEXU Robotics | *Mechanical Lead – Head Designer*

Sep 2023 – Mar 2025

- Directed mechanical design for the **1st Seed team globally** at the 2024 VEXU World Championships, establishing **top-down master-modeling CAD standards** and agile CNC routing workflows across the team.
- Formulated **custom polyurethane intake wheels** via vacuum degassing and multi-part casting, increasing compliant contact friction and boosting object acquisition reliability by **200%**.
- Designed a high-torque **dual-speed transmission** with custom gear reductions, enabling seamless, on-the-fly shifting between rapid field traversal and high-torque defensive pushing maneuvers.
- Instituted a **PLM design review pipeline**, reducing prototype iteration cycles by **3 weeks** by identifying kinematic collisions and **DFM tooling constraints** prior to aluminum stock machining.

PROJECTS

Project Hephaistos: High-Torque Actuator | *Independent Project*

Dec 2025 – Present

- Designing a **QDD cycloidal actuator** to withstand **100 Nm peak torque spikes**, simulating **Hertzian contact stresses** and $12\times$ body-weight dynamic impact loads in **FEA** to ensure joint survivability during aggressive sprint and jump gaits.
- Decoupled the internal cycloidal stage from the structural housing, establishing modular sub-assemblies for **scalable DFM** and optimized conductive heat dissipation.
- Implemented **ASME Y14.5 GD&T** and precision **ISO tolerance fits** across bearing journals and pin shafts to eliminate backlash and guarantee rigid load transfer under dynamic reversals.
- Evaluated surface contact hardness and performed **CTE differential analysis** to prevent thermal binding across the **aluminum-steel interface** during continuous high-current stall conditions.
- Integrated **frameless BLDC motors** and off-axis magnetic encoders with **Delrin anti-backlash gearing**, isolating magnetic flux leakage to maximize angular tracking accuracy.
- Modified open-source **Field-Oriented Control (FOC)** hardware to support CAN bus daisy-chaining, clean wire routing, and higher continuous phase currents.

EDUCATION

University of Waterloo | *Bachelor of Applied Science in Mechatronics Engineering, Co-op*

Sep 2023 – Apr 2028