

Henry Tsai

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Education

Horace Mann School (Class 2028)

Bronx, NY

- GPA: 3.98 Unweighted. Honor courses in Math and French
- Electives in Intermediate Computer Science (A+) and Mechanical Engineering and Automation (A+)

Columbia Science Honors Program (September 2025 – Present)

New York, NY

- Highly selective high school program; selected upon entrance exam results.
- Completed Relativistic Astrophysics course, focusing on derivations of relativistic objects and stellar bodies, with emphasis on General Relativity and other modern theoretical frameworks.

Independent Research

Research and Development of a Low-Cost, Water-Cooled Actuator

August 2025 – Present

- Designed, manufactured, and tested a water-cooled, 3D-printed quasi-direct drive (QDD) actuator with a custom outrunner BLDC motor, cycloidal planetary gearbox, and water cooling system.
- Doubled continuous torque compared to similar 3D-printed actuators; almost reached metal actuator performance.
- Authored 20-page research paper documenting methodology, results, and analysis; submitted for Terra NYC STEM Fair 2026.

Activities

Competitor, USA Computing Olympiad (USACO)

July 2024 – Present

- Advanced to USACO Gold division in January 2026 (Second Highest Division, Top ~15% Nationwide)
- Advanced to USACO Silver division in December 2024

Co-Founder & Co-President, Engineering Research Club, Horace Mann School

September 2025 – Present

- Co-founded club exploring theoretical, mathematical, and design-focused engineering.
- Led discussions and workshops on physics principles, FEA simulations, and design integration.
- Grew membership to 40+ students; facilitated collaborative engineering projects and discussions.

Member, FIRST Robotics Competition Team 5806, Horace Mann School

September 2024 – Present

- One of two robot designers for the 2026 FRC competition.
- Created a comprehensive CAD parts library in Fusion 360 for team standardization.
- Designing critical subsystems including the turret, indexer, and chassis.
- Developing game strategies through mathematical modeling and analysis.

Engineering/CS Enthusiast

August 2018 – Present

- Designed and built a 6-axis 3D-printed robotic arm with custom cycloidal drives; designed a 4030 CNC router.
- Used machine learning and pathfinding algorithms to develop a health diagnostic web application and an in-store retail navigation web prototype for Horace Mann Startups and Service Club.
- Built and tested a 2-axis soft robotic arm using soft pneumatic actuators.
- Researching non-motor electric actuators and electric artificial muscles for biomimetic robots and prosthetics.
- Learning PCB design and circuitry to design custom electronics.

Technical Skills

- **Robotics:** Mechatronics, actuator design, soft robotics, control systems
- **Programming:** Python, Java, algorithms and data structures
- **Engineering Software:** Fusion 360 (CAD, FEA, Generative Design), Simscale FEA
- **Fabrication:** 3D printing, Shop tools