

Zeshui Song

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EDUCATION

The Cooper Union for the Advancement of Science and Art

New York, NY

B.E. in Mechanical Engineering

Aug. 2024 – Present

- **Relevant Coursework:** Statics, Dynamics, Mechanics of Materials, Materials Science, Design and Prototyping, Systems Engineering, Thermodynamics, Physics I-III, Calculus I-III

Brooklyn Technical High School

Brooklyn, NY

Advanced Regents Diploma; AP Scholar with Distinction

2020 – 2024

EXPERIENCE & RESEARCH

Tow Tank Research

July 2025 – Present

Mechanical Designer

New York, NY

- Engineered a linear gantry using a NEMA 23 stepper, timing belt, and dual MGN12 rails for precise wing force measurement.
- Designed high-stiffness modular 80/20 framing to optimize load paths and minimize structural vibration.
- Integrated Arduino motion control with a TB6600 driver and limit switches for repeatable homing.

Vertically Actuated Immersion Tank

July 2025 – Present

Lead Designer

New York, NY

- Designed a NEMA 17/lead screw vertical actuator to study beetle behavior during air-to-water transitions.
- Developed motion control using GRBL and G-code to vary immersion rates and depth systematically.
- Optimized stability via an optical breadboard base and precision linear motion guide shafts.

PROJECTS

FSAE Suspension Dynamics Model | *Python (SciPy), ODE, Kinematics*

Nov. 2025 – Dec. 2025

- Characterized the front suspension of a Cooper Union FSAE car by developing a four-bar linkage kinematic model and solving for rigid-body static equilibrium.
- Derived a nonlinear effective spring constant and integrated it into a second-order ODE to simulate free oscillation, validating results against experimental video tracking data.
- Implemented geometric solvers using circle-circle intersections to ensure numerical robustness across the full range of motion.

Wales: Water-Based Motion Rectifier | *Onshape CAD, 3D Printing, Fluid Systems*

Jan. 2025 – May. 2025

- Designed an Archimedes screw energy-buffer system in Onshape to decouple variable input for constant output.
- Developed a bevel gear transmission and crowned pulley system in Onshape to ensure reliable power transfer and self-centering of drive belts.
- Achieved a nearly constant output speed ($R^2 = 1.00$) by maintaining constant pressure in the upper reservoir via an overflow outlet.

GigaSniffer: Spoilage Detector | *Arduino, Sensor Calibration, Prototyping*

Sept. 2024 – Dec. 2024

- Built a portable CO2 and ethanol sensor array using Arduino with rolling-average filtering for spoilage detection.
- Fabricated a laser-cut sensing chamber and integrated real-time graphical feedback for alerts.

HX711 Digital Scale | *Mechanical Design, Arduino, Signal Conditioning*

April 2025 – May 2025

- Designed a 2000g scale with high linearity ($R^2 = 1.0$) using a pulley-based mechanism to isolate non-normal forces.

TECHNICAL SKILLS

CAD/Mechanical: Onshape, Solidworks, AutoCAD, Fusion 360, Inventor, 80/20 Aluminum Framing

Prototyping/Fab: 3D Printing (FDM), Laser Cutting, Sand Casting, Soldering, Precision Linear Motion

Programming: Python (SciPy, NumPy), MATLAB, Arduino IDE, Embedded C, GRBL

Tools/Hardware: Arduino Microcontrollers, Stepper Motors (NEMA 17/23), TB6600 Motor Drivers, Load Cells (HX711), Gas Sensors (CO2, Ethanol), Oscilloscopes