

# Zeshui Song

(929) 410-2239 | [zeshui.song@cooper.edu](mailto:zeshui.song@cooper.edu) | [zeshui-song.github.io](https://zeshui-song.github.io) | [linkedin.com/in/zeshui-song](https://linkedin.com/in/zeshui-song)

## EDUCATION

### The Cooper Union for the Advancement of Science and Art

B.E. in Mechanical Engineering; GPA: 3.859

New York, NY

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

Advanced Regents Diploma; AP Scholar with Distinction

Brooklyn, NY

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

Mechanical 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 CO<sub>2</sub> 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

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

**Tools/Hardware:** Arduino Microcontrollers, Stepper Motors (NEMA 17/23), TB6600 Motor Drivers, Load Cells (HX711), Gas Sensors (CO<sub>2</sub>, Ethanol)