

Chikai Cao

Rochester, NY | 585-230-8906 | chikaicao1031@gmail.com | Website Link: <https://chikaicao.com>

Education

University of Rochester | Rochester, NY

Bachelor of Science in Mechanical Engineering

Aug 2023 – Dec 2026

- Major GPA: 3.95/4.0 | GPA: 3.69/4.0 | Schwartz Discovery Grant (\$6000) | Dean's List (4/6 semesters)
- **Research & Project Relevant Courses:** Solid Mechanics, Fluid Dynamics, Heat Transfer, Advanced Mechanical Design, Thermodynamics, Materials Science, Instrumentation & Measurement, Circuit Analysis

Technical Skills

- **Programming & Data Analysis:** MATLAB, Python, Machine Learning, Principal Component Analysis (PCA), Linux
- **Simulation & FEA/CFD:** ANSYS, NX Nastran (Linear Buckling & Static Analysis), Finite Element, Thermal Simulation
- **CAD & Manufacturing:** Siemens NX, SolidWorks, Creo, Tolerance Analysis & GD&T, 3D Printing, Drill Press, CNC Machining & G-Code Execution

Internship Experience

Baidu, Inc – Applied Products Department | Beijing, China

Algorithm / Data Analysis Engineer

July 2026 – Sep 2026

- **Cloud Computing Infrastructure & Data Engineering:** Configured secure local-to-cloud GPU sync via rclone; automated end-to-end preprocessing pipelines in Python to convert ANSYS .rst files into .vtu formats for AI training.
- **AI Surrogate Validation:** Mapped stress tensors, displacements, and meshes in ParaView to benchmark AI predictions against CAE ground truth, generating full-field error metrics for model iteration.
- **Containerization & Deployment:** Built modular Docker images via multi-stage builds and layer caching, resolving intranet dependency conflicts to ensure consistent cloud deployment and faster testing cycles.

University of Rochester – Prof. Wenjie Zang's Research Group | Rochester, NY

Undergraduate Researcher

Sep 2025 – Present

- **Nanoparticle Localization Model:** Deployed machine learning model, YOLOv8, to automate nanoparticle detection in microscopy images, replacing manual inspection to enable high-throughput sizing and distribution analysis.
- **Spectral Data Dimensionality Reduction:** Independently conducted Principal Component Analysis (PCA) on UV-Vis spectroscopy datasets, extracting dominant principal components based on cumulative explained variance to reduce high-dimensional spectral profiles into low-dimensional feature matrices for optical property classification.

Project Experience

Department of Mechanical Engineering, University of Rochester | Rochester, NY

Senior Design Projects

Aug 2025 – Present

ALD (Atomic Layer Deposition) Glovebox System Design and Fabrication

- **Plan Evaluation & Structural Design:** Evaluated concepts via Pugh Matrix; engineered a modular polycarbonate glovebox with draw-latch seals and a 304 – Stainless Steel chamber to optimize vacuum integrity and assembly.
- **Mechanical & Thermal FEA:** Performed tolerance stack-up, seal, and torque calculations; developed an FEA thermal model validated via low-power testing to predict full-power operating feasibility.
- **Testing:** Validated vacuum integrity via helium leak detection, achieving a leak rate of 4.7×10^{-10} torr·L/s (surpassing the design requirement of 1.0×10^{-9} torr·L/s).

Formula Inspired Electric Racecar Virtual Design Simulation & Test

- **Automobile Design:** Executed mechanical engineering design across the suspension, chassis frame, driver ergonomics, and powertrain layout, optimizing mass distribution and lightweighting.
- **Simulation & Performance Verification:** Performed multi-body dynamics (MBD), structural FEA, and CFD to iteratively validate chassis kinematics, structural stiffness, and aerodynamic loading.
- **Immersive VR Design Review:** Conducted digital packaging and clearance checks within an immersive VR environment.

Finite Element Beam Structure Optimization & Buckling Analysis

- **Concept Evaluation & Trade Study:** Formulated structural concepts within a complex geometric clearance envelope; conducted trade studies using a Pugh Matrix across stiffness-to-weight, load-path feasibility, and ease of assembly to develop a hybrid spatial truss configuration.
- **Iterative FEA & Buckling Optimization:** Modeled beam elements in Siemens NX / NASTRAN (SOL 105); integrated custom MATLAB scripts parsing .dat files to iteratively adjust cross-sections, member orientations, and intermediate cross-bracing, predicting a critical eigenvalue buckling failure load of 258.3 lbf (exceeding the 250 lbf target).
- **Precision Fabrication & Boundary Validation:** Fabricated a physical truss prototype matching FEM dimensions using stacked balsa plies cut at 53° compound miter angles; verified normal reaction forces and nodal constraints against test fixture brackets, achieving an ultimate strength-to-weight ratio of 3,168.9.

Junior Design Project

Jan 2026 – April 2026

Aerodynamic Drag Reduction & CFD Analysis of Kei Truck Bed Geometries

- **Experimental Wind Tunnel Testing:** Designed and executed a comparative wind tunnel study using a 1/10 scale Kei truck model at 31 m/s ($Re \approx 0.68 \times 10^6$); instrumented a custom test rig using strain measurements and force calibrations to isolate net vehicle drag across open, flat, and sloped bed configurations.
- **CAD Modeling & Additive Prototyping:** 3D-scanned vehicle chassis geometry using a FARO arm to reverse-engineer surface CAD models; designed modular tonneau bed covers and wind tunnel mounting fixture in Siemens NX, fabricating components via Prusa 3D printer.
- **Computational Fluid Dynamics (CFD):** Conducted external flow simulations in Siemens NX applying a Spalart-Allmaras (SA) turbulence model; characterized wake separation and recirculating vortex structures, predicting a 7.5% drag reduction for the flat cover that was validated by wind tunnel trials (9.8% reduction at 95% CI).

Teaching & Leadership Experience

Department of Mechanical Engineering, University of Rochester | Rochester, NY

Undergraduate Teaching Assistant – ME 204: Mechanical Design

Fall 2026

- **Machine Shop Supervisor:** Supervised undergraduate project teams in the machine shop, providing hands-on training in drill press operation, safe machining practices, and hardware prototyping.
- **Engineering Design Mentorship:** Held weekly office hours covering matrix structural analysis, NASTRAN finite element modeling, and mechanical component design calculations.
- **Grading:** Evaluated student engineering design reports, homework assignments, and physical prototype test outcomes.

Undergraduate Teaching Assistant – ME 160: Engineering Computation I

Fall 2025

- **Course Project Architecture:** Designed and structured applied MATLAB computational project assignments: modeling 3D ballistic trajectory dynamics and automated 10-ring target scoring for 12-arrow competition datasets, guiding students in vectorization and multi-axis kinematics.
- **Instruction & Code Debugging:** Led weekly computational workshops on algorithm design and data structures; guided students through numerical modeling workflows and resolved script errors in MATLAB.
- **Grading:** Evaluated student code submissions, numerical problem sets, and computational exams, providing technical feedback on computational efficiency and code structure.