

Ricky Kurosawa

(702)498-4234—ricky.kurosawa.th@dartmouth.edu — rickykurosawa.com— LinkedIn

EDUCATION

Dartmouth College (Thayer School of Engineering)

Expected June 2027

Master of Engineering in Mechanical Engineering

Bachelor of Engineering in Mechanical Engineering (dual-degree program with Vassar College)

Vassar College

May 2026

Bachelor of Arts in Applied Mathematics

GPA: 3.90/4.00

- Departmental Honors

SELECTED COURSEWORK

Dartmouth College

Intermediate Fluid Mechanics, Geophysical Fluid Dynamics, Post-Modern and Non-Linear Control, Modern Control Theory, Mechanical Behavior of Materials, Fourier Transforms.

Vassar College

Control of Dynamical Systems, Numerical Analysis, Nonlinear Differential Equations, Geophysics, Complex Analysis, Real Analysis.

RESEARCH EXPERIENCE

Dartmouth College, Ice Fluid Dynamics Lab

June 2025 – Present

Undergraduate Researcher

Supervisor: Prof. Colin R. Meyer

- Derived the governing equations for permafrost thaw from first principles using a mushy-layer continuum formulation, then developed a 1D finite volume solver that tracks Darcy velocity, temperature, and phase composition to identify the regimes that lead to a frozen steady-state profile.
- Nondimensionalized the governing equations to group behavior into dimensionless parameters such as Stefan and Péclet numbers; currently characterizing steady profiles in the high- and low-soil-fraction limits, with the low-fraction limit expected to recover sea-ice-like behavior.
- Validated the simulation against the analytical steady-state temperature profile in the limit of negligible latent heat, achieving a normalized RMSE below 1%.

Vassar College, Mathematics and Statistics Department

September 2025 – Present

Independent Study

Supervisor: Prof. Andy Borum

- Formulated and analyzed the optimal control of n planar agents with $n + 1$ controls (independent forward speeds and a shared turn rate) to build a framework for modeling swarm behavior.
- Bypassed the inconclusive Pontryagin Maximum Principle test by reparameterizing the problem with a spatial independent variable, showing that a positive shared turn rate is sufficient for optimality.
- Defined a geometric optimality condition on the initial controls: reduced the dynamics for n agents to a simple pendulum equation and showed that initial energy above the saddle energy keeps the shared turn rate nonnegative, guaranteeing optimality. Currently characterizing the time until the turn rate first reaches zero for trajectories starting below the saddle energy.

PUBLICATIONS & PRESENTATIONS

A Mushy-Layer Approach to Permafrost Thaw

In preparation

Journal of Fluid Mechanics (target submission: June 2027), with C. R. Meyer

- Developed a continuum model of permafrost thaw using a mushy-layer formulation, with validated steady-state solutions in the latent-heat-neglected limit.
- Presented preliminary results at the Dartmouth Undergraduate Research Poster Session.

Optimal Collective Motion of Planar Multi-Agent Systems

In preparation

ESAIM: COCV (target submission: August 2027), with A. Borum

- Derived a geometric optimality condition for n planar agents with $n + 1$ controls by reducing the dynamics to a pendulum equation.
- Presented methods and optimality results at the Hudson River Undergraduate Mathematics Conference (HRUMC 2026).

SKILLS

MATLAB, Numerical Methods, L^AT_EX, Python, Mathematica, SolidWorks.

SELECTED PROJECTS

NASA RASC-AL Senior Capstone (Team of 17)

Sept. 2026 – Present

- Design an integrated system for building and maintaining durable transit pathways on the Moon.
- Lead the resource-transfer subteam, modeling heat transfer, phase change, and pipe flow.

Qualitative Analysis of Nonlinear Systems

January 2026 – May 2026

- Analyzed three nonlinear systems (the HKB model of bimanual coordination, the FitzHugh–Nagumo neuron model, and a torque-driven rigid body) using phase portraits, bifurcation diagrams, and parameter-plane analysis.
- Derived conditions for saddle-node and pitchfork bifurcations in the HKB and FitzHugh–Nagumo models, and for Hopf bifurcations in the FitzHugh–Nagumo model, mapping each in the parameter plane.
- Identified a subcritical pitchfork and saddle-node folds in the HKB model, and used a trapping region with Poincaré–Bendixson to establish limit cycles in the FitzHugh–Nagumo model.
- Applied a state-feedback torque to a rigid body, producing chaotic rotation when the feedback acts on all three principal axes, and characterized the transition to chaos using bifurcation diagrams.

Controlling and Simulating Dynamical Systems

September 2025 – December 2025

- Designed a PD landing controller for a quadrotor with nonlinear ground effect, linearized about its equilibrium, and tested closed-loop landings across randomized trials in MATLAB.
- Checked controllability of a torque-driven rigid body and designed pole-placement state feedback to stabilize rotation about its intermediate axis, which is unstable without control.
- Designed state feedback with integral action for a motor-driven arm with a free joint, tracking a piecewise reference with $\pi/2$ jumps and reducing steady-state error relative to state feedback alone.
- Designed LQG controllers (infinite-horizon LQR with a Kalman filter) for a self-balancing two-wheeled robot steering along a random road, and for an unpowered glider maximizing flight distance; the glider's Kalman filter estimated three unmeasured states from two sensed angles.

Dual-Box Retrieval Robot

January 2024 – August 2024

- Built a MATLAB model of a 2D two-armed robot that grasps two boxes simultaneously, solving for joint configurations with Newton's method and smoothing paths with cubic splines; achieved a 94% grasp success rate across randomized environments.
- Independently extended the model to 7 degrees of freedom by splitting a link into two arms, and solved the resulting underdetermined system with a minimum-norm Newton method, converging on all 300 test boxes across 30 environments.
- Visualized the solution set of the underdetermined system with numerical continuation, using null-space initial guesses to trace solution curves in 7-dimensional configuration space.

Identifying Tree Species from Leaf Images using PCA

January 2024 – May 2024

- Built a MATLAB principal component analysis (PCA) classifier for leaf images from the UC Irvine Leaf dataset, computing the dominant eigenvectors of the image covariance matrix with the power method, using matrix-vector products so the full covariance matrix was never formed.
- Classified 30 held-out leaf images from 10 species by their distance to each species' eigenspace, reaching 87% accuracy (26/30) with the dominant eigenvector and 90% (27/30) with the two most dominant eigenvectors.

WORK EXPERIENCE

Teaching Assistant, Dartmouth College

January 2025 – Present

- Assist in Systems labs on impedance, system identification, and second-order dynamics, guiding students through experimental procedures and data analysis.
- Coordinate a team of TAs to complete grading on schedule, and run homework help sessions to assist students in navigating problems.

Dual-Degree Ambassador, Dartmouth College

September 2026 – Present

- Plan events that connect incoming dual-degree students with fifth-year students.
- Host information sessions for current and incoming dual-degree students.

Tutor, Elite College Prep

June 2025 – August 2026

- Tutored high school students for 5–12 hours per week in SAT preparation and in courses such as Calculus I.

EXTRACURRICULAR ACTIVITIES

Dartmouth Formula Racing — Dartmouth College

October 2026 – Present

Suspension and Controls Engineer

- Working on introducing traction control and torque vectoring for current car setup.

Math Major's Committee

September 2025 – May 2026

Co-President

- Organized weekly social and academic events for the math major community.
- Coordinated student presentation opportunities to build speaking and presentation skills.

Varsity Swimming

September 2023 – March 2026

- Trained 15+ hours per week while competing at the varsity level.
- Former school record holder; twice named Liberty League Rookie of the Week.