

# Kai S. Yun

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## RESEARCH INTEREST

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My research is focused on **safe and high-performance control** of autonomous robots in the wild.  
My methodology encompasses **control theory**, **deep learning**, and their **intersection**.  
My vision is to develop a **unified framework** for highly reactive robot controllers in complex, dynamic environments.

## EDUCATION

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**Massachusetts Institute of Technology**, Cambridge, MA Class of 2029 (Expected)  
Doctor of Philosophy in **Mechanical Engineering** 5.00/5.00  
Advisor: Dr. Navid Azizan

**Carnegie Mellon University**, Pittsburgh, PA Class of 2025  
Master of Science in **Mechanical Engineering** 4.00/4.00  
Advisors: Dr. Changliu Liu, Dr. John M. Dolan  
\* *ATK-Nick G. Vlahakis Fellowship*, 2024 — 2025  
\* *Best Master's Research Paper 2025 Commencement Award*

**University of California, Berkeley**, Berkeley, CA Class of 2023  
Bachelor of Science in **Mechanical Engineering** 3.68/4.00  
Minor in **Electrical Engineering and Computer Science (EECS)**  
Military Service (Leave of Absence, 2019 — 2020)

## PUBLICATIONS & PREPRINTS

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\* Equal Contribution

- [C1] **Kai S. Yun**, Rui Chen, Chase Dunaway, John M. Dolan, Changliu Liu, “Safe Control of Quadruped in Varying Dynamics via Safety Index Adaptation”. Published in 2025 IEEE *International Conference on Robotics and Automation (ICRA)*, **Oral Presentation** in Atlanta, Georgia, 2025, [Website](#).
- [C2] Simin Liu\*, **Kai S. Yun\***, John M. Dolan, Changliu Liu, “Synthesis and Verification of Robust-Adaptive Safe Controllers”. Published in *European Control Conference (ECC)*, **Oral Presentation** in Stockholm, Sweden, 2024.
- [C3] Tianhao Wei, Hanjiang Hu\*, Luca Marzari\*, **Kai S. Yun\***, Peizhi Niu\*, Xusheng Luo, Changliu Liu, “ModelVerification.jl: a Comprehensive Toolbox for Formally Verifying Deep Neural Networks”. Published in 2025 *International Conference on Computer Aided Verification (CAV)*, 2025, [GitHub](#).
- [P1] **Kai S. Yun**, Navid Azizan, “ATOM-CBF: Adaptive Safe Perception-Based Control under Out-of-Distribution Measurements”. Submitted to Learning for Dynamics and Control Conference (L4DC), 2026. Preprint at [arxiv.org:2511.08741](https://arxiv.org/abs/2511.08741), 2025.
- [P2] Yifan Sun, Rui Chen, **Kai S. Yun**, Yikuan Fang, Sebin Jung, Feihan Li, Bowei Li, Weiye Zhao, Changliu Liu, “SPARK: A Modular Benchmark for Humanoid Robot Safety”. Preprint at [arxiv.org:2502.03132](https://arxiv.org/abs/2502.03132), 2025, [Website](#).
- [P3] Yifan Sun, Rui Chen, **Kai S. Yun**, Yikuan Fang, Sebin Jung, Weiye Zhao, Changliu Liu, “Safe Humanoid Autonomy and Teleoperation with Safe Set Algorithm”. Extended abstract published in *Joint 10th IFAC Symposium on Mechatronic Systems and 14th Symposium on Robotics*, 2025.

## RESEARCH EXPERIENCE

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**Laboratory for Information & Decision Systems (MIT)** Cambridge, MA  
Advisor: Dr. Navid Azizan Aug 2025 — Present

- Research on perception-based safe control theory under out-of-distribution measurements [P1].
- Research on learning-based robust and adaptive control of quadrotors.

**Intelligent Control Lab (Robotics Institute at CMU)** Pittsburgh, PA  
Advisors: Dr. Changliu Liu, Dr. John M. Dolan Jun 2023 — Jul 2025

- Research on safe humanoid autonomy and toolbox development (Unitree G1 platform) [P2, P3].
- Research on adaptive safe controller for quadrupeds in varying dynamics (Unitree Go2 platform) [C1].
- Research on algorithm development for synthesizing robust-adaptive safe controllers for robotic systems [C2].
- Developed [ModelVerification.jl](#), a Julia library containing state-of-the-art neural network verification algorithms [C3].

**Hybrid Robotics Lab** (Mechanical Engineering at UC Berkeley)

Berkeley, CA

Advisor: Dr. Koushil Sreenath

Aug 2021 — Apr 2022

- Research on *PPO-Worst-Case*, a novel safe reinforcement learning algorithm for worst-case scenarios.
- Developed simulations for legged robots in safety-critical scenarios.

**PROFESSIONAL EXPERIENCE**

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**Tesla, Inc.**

Palo Alto, CA

Vehicle Dynamics / Software Engineering Intern

May 2022 — Aug 2022

- Developed a correlation framework for comparing subjective vehicle evaluation and objective test data.
- Analyzed vehicle dynamics data to improve the ride, handling, and steering experiences of Models S, 3, and Semitruck.
- Tested Tesla vehicles and competitor vehicles with sensors and robots. Conducted vehicle tests on proving grounds.
- Developed automated ticketing, reporting, and logging systems utilizing internal software and corresponding API.

**NeuroCore.ai**

Seoul, South Korea

Reinforcement Learning Engineering Intern

Oct 2020 — Jul 2021

- Designed and developed RL training and deployment frameworks, which increased training efficiency by 84%.
- Developed simulators for Supply Chain Management (SCM) tasks for semiconductor manufacturers.
- These are currently deployed in South Korean semiconductor manufacturers, such as SK Hynix.

**TEACHING & LEADERSHIP EXPERIENCE**

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**Robotics Institute at CMU**

Pittsburgh, PA

Manager/Developer — [RoboticsKnowledgebase](#) (Funded by Google)

Oct 2024 — Present

Teaching Assistant — F1Tenth Autonomous Racing (16.663)

Jan 2025 — May 2025

Research Mentor — [Robotics Institute Summer Scholars \(RISS\)](#)

May 2024 — Aug 2024

Mentee: Chase Dunaway (Undergraduate at New Mexico Tech → Ph.D. at CMU)

**Mechanical Engineering Department at CMU**

Pittsburgh, PA

Teaching Assistant — Dynamic Systems and Controls (24.352)

Aug 2024 — Dec 2024

**Mechanical Engineering Department at UC Berkeley**

Berkeley, CA

Teaching Assistant — Statistics and Data Science for Engineers (ENG 178)

Jan 2023 — May 2023

**Republic of Korea Army**

South Korea

Squad Leader, Sergeant, K-1 Tank Mechanic — Combat Service Support (CSS)

Jan 2019 — Aug 2020

**SKILLS**

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- **Area of expertise:** Humanoids, Quadrupeds, Quadrotors, Safety Index, Control Barrier Function, Control Lyapunov Function, Model Learning, Safe Reinforcement Learning, Optimal Control, Adaptive Control, Polynomial Optimization.
- **Physical Robots/Machines:** Unitree G1, Unitree Go2, Pixhawk Drones, CrazyFlie, Sawyer, F1Tenth, Tanks.
- **Libraries:** PyTorch, TensorFlow, Isaac Sim, Gazebo, OpenAI Gym, PyBullet, Mosek, CasADi, PX4, Ray, Numpy.
- **Programming/OS/Tools:** Python, MATLAB, Julia, C++, ROS, ROS2, Linux, Git, Docker.
- **Other skills:** Jetson, OptiTrack, Vicon, OpenSim, SolidWorks,  $\LaTeX$ , Simulink, Scuba Diving.
- **Languages:** Fluent in English & Korean.

**SELECTED COURSES**

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**Carnegie Mellon University**

Provably Safe Robotics (16.883), Optimal Control &amp; Reinforcement Learning (16.745), Advanced Control Systems Integration (24.774), Engineering Optimization (24.785), Biomechanics of Human Movement (24.663).

**UC Berkeley**

Deep Reinforcement Learning (CS 285), Nonlinear Systems (EE C222), Machine Learning (CS 189), Robotic Manipulation &amp; Interaction (EECS C106B), Vehicle Dynamics and Control (ME 131), Dynamic Systems &amp; Feedback (ME 132), Mechatronics Design (ME 102B), Experimentation and Measurements (ME 103).