Kwang Hak Kim

Ph.D. Student, University of California San Diego, La Jolla, CA
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EDUCATION

Ph.D. Student in Mechanical and Aerospace Engineering Sept. 2022 – Present
University of California San Diego, La Jolla, CA

M.S. in Mechanical Engineering Sept. 2022 – May 2024
University of California San Diego, La Jolla, CA GPA: 3.84/4.00

B.S. in Aerospace Engineering Aug. 2016 – May 2020
The University of Texas at Austin, Austin, TX GPA: 3.82/4.00

RESEARCH EXPERIENCE

Graduate Student Researcher La Jolla, CA
Nonlinear and Adaptive Control Laboratory (UCSD) Sept. 2022 — Present
Advisors: Prof. Miroslav Krstić and Prof. Mamadou Diagne

- Developed novel stabilization and safety-critical control strategies for the unicycle parking problem
- Designed safety filters for efficient and safe autonomous traffic management on aircraft carrier decks
- Presented findings to the Office of Naval Research (ONR) program managers and engaged in invited technical discussions with the Naval Air Warfare Center Aircraft Division (NAWCAD)
- Applied advanced nonlinear control and analysis methods to develop algorithms with provable guarantees of stability, robustness, performance, and safety

Undergraduate Research Assistant Austin, TX
Autonomous Systems Group (UT Austin) Jun. 2019 — Feb. 2020
Advisor: Prof. Ufuk Topcu

- Investigated the logistical problem of a multi-agent system in a confined space such as a warehouse
- Synthesized and designed state-based controllers for multi-quadcopter systems using Slugs (reactive synthesis tool)
- Implemented controllers through AirSim in Unreal Engine environments using Python
- Designed and assembled Unreal Engine environments for quadcopter simulations

Undergraduate Research Assistant Intern Seoul, South Korea
eXtreme Energy Laboratory (Seoul National Uni.) Jun. 2019 — Feb. 2020
Advisor: Prof. Jai Ick Yoh

- Analyzed the impact velocity and precision of a needless syringe design for medical applications
- Researched and experimented extreme temperature endurance materials for electrodes

OTHER EXPERIENCES AND PROJECTS

Instructional Assistant (UCSD) La Jolla, CA
Nonlinear Systems (MAE 281A) and Linear Control (MAE 142B) Jan. 2025 — Jun. 2025

- Awarded **MAE PhD Outstanding Teaching Assistant of the Year**, recognized for exceptional student support and instructional contributions.
- Led weekly discussion sections and office hours to clarify complex concepts and collaborated with faculty to refine course materials and provide consistent learning outcomes across sections.

NASA's 2020 RASC-AL Competition Finalist (Theme 5) Austin, TX
Project Autoponics - Team Lead Aug. 2019 — Jun. 2020

- Awarded 11,000 USD funding award for prototype and concept development from the National Institute of Aerospace
- Facilitated and organized the design of an autonomous plant habitat for the Lunar Gateway space station
- Presented as team lead at the RASC-AL 2020 Virtual Forum

Aerial Robotics Autonomy Protocol Project Austin, TX
Aerial Robotics Course Project Jan. 2020 — May 2020

- Developed an autonomy protocol for an autonomous quadcopter flight competition using C++
- Implemented the A* path planning algorithm in a 3D mapped space for optimal flight trajectory

- Optimized flight time and trajectory by using the polynomial smoothing method

Republic of Korea Air Force South Korea
Air Defense Artillery Brigade Oct. 2020 — Jul. 2022

- Led training of 20+ recruits in technical maintenance and tactical protocols
- Performed maintenance and operation of tactical air defense artillery equipment

PUBLICATIONS

Journal Papers

[J1] **K. H. Kim**, M. Diagne and M. Krstić, *"Constant-Sum High-Order Barrier Functions for Safety Between Parallel Boundaries,"* in IEEE Control Systems Letters, vol. 9, pp. 1447-1452, 2025

[J2] V Todorovski, **K. H. Kim**, A Astolfi, and M Krstić, *"Nonholonomic Robot Parking by Feedback—Part I: Modular Strict CLF Designs,"* submitted to IEEE Transactions on Automatic Control, Available: arXiv:2511.15119

[J3] **K. H. Kim**, V Todorovski, and M Krstić, *"Nonholonomic Robot Parking by Feedback—Part II: Nonmodular, Inverse Optimal, Adaptive, Prescribed/Fixed-Time and Safe Designs,"* submitted to IEEE Transactions on Automatic Control, Available: arXiv:2511.15219

[J4] M Krstić, **K. H. Kim**, and V Todorovski, *"Dubins Vehicle Stabilization: Deadbeat Parking and Asymptotic 'Spinaway',"* submitted to Automatica.

Conference Papers

[C1] **K. H. Kim**, M Diagne, M Krstić, *"Robust Control Barrier Function Design for High Relative Degree Systems: Application to Unknown Moving Obstacle Collision Avoidance,"* in American Control Conference (ACC), Denver, CO, 2025

[C2] **K. H. Kim**, V Todorovski, and M Krstić, *"Inverse Optimal Feedback and Gain Margins for Unicycle Stabilization,"* submitted to the American Control Conference (ACC) 2026, Available: arXiv:2509.25563

[C3] V Todorovski, **K. H. Kim**, and M Krstić, *"Modular Design of Strict Control Lyapunov Functions for Global Stabilization of the Unicycle in Polar Coordinates,"* submitted to the American Control Conference (ACC) 2026, Available: arXiv:2509.25575

[C4] M Krstić, V Todorovski, **K. H. Kim**, and A Astolfi, *"Integrator Forwarding Design for Unicycles with Constant and Actuated Velocity in Polar Coordinates,"* submitted to the American Control Conference (ACC) 2026, Available: arXiv:2509.25579

[C5] M Krstić, **K. H. Kim**, and V Todorovski, *"Half-Global Deadbeat Parking for Dubins Vehicle,"* submitted to the American Control Conference (ACC) 2026, Available: arXiv:2509.25571

INVITED TALKS

- RoboGrads Feed the Intellect (FTI) Seminar Nov. 2024
- MAE Student Seminar Nov. 2024

SKILLS

- **Nonlinear control:** Lyapunov-based design (CLF/CBF), QP-based safety filters, inverse optimal and adaptive control, nonovershooting control, prescribed-time stabilization
- **Linear control:** PID and lead–lag compensator design, LQR, linear MPC, Bode and frequency-response analysis
- **Signals & data analysis:** Basic filtering (low/high-pass), spectral analysis (DFT/FFT), introductory system identification
- **Software:** MATLAB, Python, C++, Simulink, Git, SolidWorks
- **Languages:** English (native), Korean (native)

AWARDS

- MAE PhD Outstanding Teaching Assistant of the Year (UCSD) Jun. 2025
- Steve K. Sin Endowed Presidential Scholarship in Engineering (UT Austin) Jan. 2020
- University Honors (UT Austin) Aug. 2016 - May 2020