

# Kwang Hak Kim

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

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**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

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**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

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**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**  
Air Defense Artillery Brigade

South Korea  
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

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### 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

### 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

### Manuscripts in Review

- [R1] 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
- [R2] **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
- [R3] M. Krstić, **K. H. Kim**, and V. Todorovski, “*Dubins Vehicle Stabilization: Deadbeat Parking and Asymptotic ‘Spinaway’*,” submitted to Automatica.
- [R4] **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
- [R5] 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
- [R6] 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
- [R7] 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

## SKILLS

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- **Autonomy & control:** Lyapunov-based methods (CLF/CBF), quadratic program safety filters, PID, LQR, linear MPC
- **Learning-based methods:** Introductory reinforcement learning (policy gradient, actor-critic, Q-learning)
- **Signals & data analysis:** Basic filtering (low/high-pass), spectral analysis (DFT/FFT), introductory system identification
- **Software:** MATLAB, Python, C++, Simulink, ROS 2, Git, SolidWorks
- **Languages:** English (native), Korean (native)

## INVITED TALKS

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

## AWARDS

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- 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