

# Sheng Cheng

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## EDUCATION

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<b>Ph.D. in Electrical Engineering, Control</b>	08/2021
University of Maryland, College Park, MD	Advisor: Dr. Derek Paley
<b>M.S. in Electrical Engineering, Control</b>	08/2018
University of Maryland, College Park, MD	Advisor: Dr. Nuno Martins
<b>B.Eng. in Control Science and Engineering, Automation</b>	07/2014
Harbin Institute of Technology, Harbin, China	Advisor: Dr. Yong'an Zhang

## ACADEMIC POSITIONS

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<b>Postdoctoral Research Associate</b>	08/2021—08/2025
University of Illinois Urbana-Champaign, Urbana, IL	Advisor: Dr. Naira Hovakimyan

## RESEARCH INTERESTS

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Aerial robotics; aerial manipulation; advanced air mobility; optimization; adaptive control

## SELECTED PUBLICATIONS

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*Under review and articles (\* equal contributions, † mentored students, # corresponding author)*

- UR1. Z. Han<sup>†</sup>, B. Mo<sup>†</sup>, **S. Cheng**<sup>#</sup>, R. Wang, Z. Wang, J. Gao, H. Pham, V. Ho, N. Hovakimyan, “Grasping as Anchoring: Expanding Urban Perching with a Hybrid Gripper for Aerial Robots”, under review, 2025.
- UR2. **S. Cheng**, R. Tao, Y. Gu, S. Wang, X. Wang, N. Hovakimyan, “Task-Parameter Nexus: Task-Specific Parameter Learning for Model-Based Control,” under review, 2025.
- UR3. H. Pham<sup>†\*</sup>, **S. Cheng**<sup>\*,#</sup>, Z. Han, C. Yang, Q. Luu, N. Hovakimyan, V. Ho, “Collision-resilient Quadrotor with Tombo Propellers and L1Quad,” under review, 2025.

*Journal articles*

- J1. C. Yang<sup>†</sup>, J. Yu<sup>†</sup>, **S. Cheng**<sup>#</sup>, Z. Han, J. Gao, B. Mo, N. Hovakimyan, “Failure Detection and Recovery for Quadrotors in the Presence of Severe Rotor Failures with Multiple Model L1 Adaptive Controller,” *IEEE Robotics and Automation Letters*, 11(1), pp. 346-353, January 2026.
- J2. S. M. Rajkumar, C. Yang, Y. Gu, **S. Cheng**, N. Hovakimyan, D. Goswami, “Linear Model Predictive Control for Quadrotors with an Analytically Derived Koopman Model,” *IEEE Robotics and Automation Letters*, 10(12), pp. 13018—13025, December 2025.
- J3. L. Krishna<sup>†</sup>, **S. Cheng**, J. Li, N. Hovakimyan, Q. Nguyen, “DiffCoTune: Differentiable Co-Tuning for Cross-domain Robot Control,” *IEEE Robotics and Automation Letters*, 10(11), pp. 11347-11354, November 2025.
- J4. H. Lee<sup>†</sup>, **S. Cheng**<sup>#</sup>, Z. Wu, J. Lim, R. Siegwart, N. Hovakimyan, “Geometric Tracking Control of Omnidirectional Multirotors for Aggressive Maneuvers,” *IEEE Robotics and Automation Letters*, 10(11), February 2025.
- J5. Z. Wu<sup>\*†</sup>, **S. Cheng**<sup>\*,#</sup>, P. Zhao, A. Gahlawat, K. A. Ackerman, A. Lakshmanan, C. Yang, J. Wu, N. Hovakimyan “L1Quad: L1 Adaptive Augmentation of Geometric Control for Agile Quadrotors with Performance Guarantees,” *IEEE Transactions on Control Systems Technology*, 33(2), pp. 597-612, March 2025.
- J6. **S. Cheng**, M. Kim<sup>\*</sup>, L. Song<sup>\*</sup>, C. Yang, Y. Jin, S. Wang, N. Hovakimyan, “DiffTune: Auto-Tuning through Auto-Differentiation,” *IEEE Transactions on Robotics*, vol. 40, pp. 4085-4101, July 2024.
- J7. R. Tao<sup>\*†</sup>, **S. Cheng**<sup>\*,#</sup>, X. Wang, S. Wang, N. Hovakimyan, “DiffTune-MPC: Closed-Loop Learning for Model Predictive Control”, *IEEE Robotics and Automation Letters*, 9(8), pp. 7294-7301, July 2024.
- J8. Q. Chen<sup>†</sup>, **S. Cheng**<sup>#</sup>, N. Hovakimyan, “Simultaneous Spatial and Temporal Assignment for Fast UAV Trajectory

Optimization using Bilevel Optimization,” IEEE Robotics and Automation Letters, 8(6), pp. 3860-3867, June 2023.

- J9. **S. Cheng** and D. A. Paley, “Cooperative estimation and control of a diffusion-based spatiotemporal process using mobile sensors and actuators,” Autonomous Robot, May 2023.
- J10. **S. Cheng** and D. A. Paley, “Optimal guidance and estimation of a 2D diffusion-advection process by a team of mobile sensors,” Automatica, vol. 137, p. 110112, March 2022.
- J11. **S. Cheng** and D. A. Paley, “Optimal control of a 2D diffusion-advection process with a team of mobile actuators under jointly optimal guidance,” Automatica, vol. 133, p. 109866, August 2021.
- J12. **S. Cheng** and N. C. Martins, “An optimality gap test for a semidefinite relaxation of a quadratic program with two quadratic constraints,” SIAM Journal on Optimization, vol. 31, no. 1, pp. 866-886, March 2021.
- J13. A. Wolek, **S. Cheng**, D. Goswami, and D. A. Paley, “Cooperative mapping and target search over an unknown occupancy graph using mutual information,” IEEE Robotics and Automation Letters, 5(2), pp. 1071-1078, 2020.

#### *Conference papers*

- C1. **S. Cheng**<sup>#</sup>, Z. Han, R. Wang, N. Hovakimyan, “Throw Maneuver: Exact Trajectories for Invariant Target Hitting in Robotic Throw”, accepted for presentation at 2026 International Conference on Robotics and Automation, 2026.
- C2. M. Kim<sup>†</sup>, H. Che, B. Chandaka, B. Pramuanpornsatid, C. Yang, **S. Cheng**, X. Wang, N. Hovakimyan, S. Wang “MUSE: Multimodal Uncertainty Quantification of State Estimation”, accepted for presentation at 2026 International Conference on Robotics and Automation, 2026.
- C3. D. Zhang, R. Tao<sup>†</sup>, **S. Cheng**, N. Hovakimyan, M. Mueller, “A Simulation Evaluation Suite for Robust Adaptive Quadcopter Control,” accepted for presentation at 2026 American Control Conference, 2026.
- C4. Q. Chen<sup>†</sup>, J. Li, **S. Cheng**<sup>#</sup>, N. Hovakimyan, Q. Nguyen, “Autotuning Bipedal Locomotion MPC with GRFM-Net for Efficient Sim-to-Real Transfer,” accepted for presentation at IROS, 2025.
- C5. J. L. Bullock<sup>†</sup>, **S. Cheng**, N. Hovakimyan, A.C. Trujillo, “Robust Path-following Controller for Multirotor Vehicles in Uncertain Wind Conditions,” in Proceedings of AIAA SciTech 2025 Forum, p. 1121, 2025.
- C6. M. Kim<sup>†</sup>, **S. Cheng**, Naira Hovakimyan, “Autotuning the Unified Control and Generalized Control Allocation for VTOL Vehicles Using DiffTune,” in Proceedings of AIAA SciTech 2025 Forum, p. 1122, 2025.
- C7. J. Kim, J. L. Bullock, **S. Cheng**, Naira Hovakimyan, “Smooth Reference Command Generation and Control for Transition Flight of VTOL Aircraft Using Time-Varying Optimization,” in Proceedings of AIAA SciTech 2025 Forum, p. 1123, 2025.
- C8. J. L. Bullock, L. Song, G. Puthumanaim, Y. Li, **S. Cheng**, M. Ornik, S. Mitra and N. Hovakimyan. "Verification of a Collision Avoidance Controller for a Lift + Cruise Vehicle," in Proceedings of AIAA SciTech 2025 Forum, p. 1323, 2025.
- C9. C. Tao<sup>†</sup>, **S. Cheng**<sup>#</sup>, Y. Zhao, F. Wang, N. Hovakimyan, “An Optimization-Based Planner with B-spline Parameterized Continuous-Time Reference Signals,” in Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems, pp. 3100-3107, 2024.
- C10. Y. Gu<sup>†</sup>, **S. Cheng**<sup>#</sup>, N. Hovakimyan, “Proto-MPC: An Encoder-Prototype-Decoder Approach for Quadrotor Control in Challenging Winds”, in Proceedings of 6<sup>th</sup> Learning for Dynamics and Control, pp. 1674–1775, 2024.
- C11. J. L. Bullock<sup>†</sup>, **S. Cheng**, A. Patterson, M. Acheson, N. Hovakimyan, I. Gregory, “Reference Command Optimization for the Transition Flight Mode of a Lift Plus Cruise Vehicle,” in Proceedings of 2024 AIAA SciTech Forum, p. 0721, 2024.
- C12. L. Song<sup>†</sup>, **S. Cheng**, N. Hovakimyan, S. Mitra, “Verification of Design Specifications in  $L_1$  Adaptive Control” in Proceedings of 2024 AIAA SciTech Forum, p. 1165, 2024.
- C13. A. Bansal, Y. Zhao, J. Zhu, **S. Cheng**, Y. Gu, H. Yoon, H. Kim, N. Hovakimyan, L. Sha, “Synergistic Perception and Control Simplex for Verifiable Safe Vertical Landing,” in Proceedings of 2024 AIAA SciTech Forum, p. 1167, 2024.

- C14. L. Song<sup>†</sup>, Y. Li, **S. Cheng**, P. Zhao, S. Mitra, N. Hovakimyan, “Verification of  $\mathcal{L}_1$  Adaptive Control using Verse Library: A Case Study of Quadrotors,” In Proceedings of the ACM/IEEE 14th International Conference on Cyber-Physical Systems (with CPS-IoT Week 2023), pp.245–246, San Antonio, TX, 2023.
- C15. **S. Cheng**, L. Song<sup>†</sup>, M. Kim, S. Wang, N. Hovakimyan, “DiffTune+: Hyperparameter-Free Auto-Tuning using Auto-Differentiation,” In Proceedings of 5<sup>th</sup> Learning for Dynamics and Control Conference, pp. 170-183, PMLR, *Selected for oral presentation (9.5% acceptance rate)*, 2023.
- C16. Z. Wu<sup>†</sup>, **S. Cheng**, K. A. Ackerman, A. Gahlawat, A. Lakshmanan, P. Zhao, and N. Hovakimyan, “ $\mathcal{L}_1$  Adaptive Augmentation for Geometric Tracking Control of Quadrotors,” 2022 International Conference on Robotics and Automation, pp. 1329–1336, Philadelphia, PA, 2022.
- C17. **S. Cheng** and D. A. Paley, “Optimal guidance of a team of mobile actuators for controlling a 1D diffusion process with unknown initial conditions,” 2021 American Control Conference, pp. 1497-1502, New Orleans, LA, 2021.
- C18. **S. Cheng** and D. A. Paley, “Optimal guidance and estimation of a 1D diffusion process by a team of mobile sensors,” 2020 IEEE Conference on Decision and Control, pp. 1222–1228, Jeju Island, South Korea, 2020.
- C19. **S. Cheng** and D. A. Paley, “Optimal control of a 1D diffusion process with a team of mobile actuators under jointly optimal guidance,” American Control Conference, pp. 3449-3454, Denver, CO, 2020.
- C20. **S. Cheng** and N. C. Martins, “Reaching a target in a time-costly area using a two-stage optimal control method,” American Control Conference, pp. 4903-4910, Philadelphia, PA, 2019.

*Posters, Demos, and Workshop Papers*

- MISC1. Z. Han<sup>†</sup>, **S. Cheng**, J. Gao, H. Pham, V. Ho, N. Hovakimyan, “Perching and Grasping by a Dual-Purpose Hybrid Gripper for Aerial Robots,” presented at the 2025 ICRA Workshop *25 years of Aerial Robotics: Challenges and Opportunities*, 2025.
- MISC2. **S. Cheng**, Y. Gu, R. Tao, S. Wang, X. Wang, N. Hovakimyan, “Task-Parameter Nexus for Learning Task-Specific Parameters in Model-Based Control,” presented as a poster at ICRA@40, 2024.
- MISC3. L. Song<sup>†</sup>, **S. Cheng**, N. Hovakimyan, “Meta-Learning-Inspired Control Auto-Tuning with Verified Robustness,” presented as a poster at the *Formal methods techniques in robotics systems: Design and control Workshop* at IEEE/RSJ International Conference on Intelligent Robots and Systems, 2023.
- MISC4. C. Ray<sup>†</sup>, **S. Cheng**, N. Hovakimyan, “An Educational Quadrotor Testbed for  $\mathcal{L}_1$  Adaptive Control,” demonstrated on-site at IEEE/RSJ International Conference on Intelligent Robots and Systems, 2023 | [\[code\]](#)
- MISC5. **S. Cheng**, M. Kim, L. Song, Z. Wu, S. Wang, N. Hovakimyan, “DiffTune: Auto-Tuning through Auto-Differentiation,” presented as an invited poster at 2023 Hyundai Vision Conference, 2023
- MISC6. **S. Cheng**, M. Kim, L. Song, Z. Wu, S. Wang, N. Hovakimyan, “DiffTune: Auto-Tuning through Auto-Differentiation,” presented as a late breaking poster at the American Control Conference, 2023
- MISC7. **S. Cheng**, M. Kim, L. Song, Z. Wu, S. Wang, N. Hovakimyan, “An Auto-Tuning Framework for Controllers using Auto-Differentiation,” orally presented at the *Learning to Adapt and Improve in the Real World Workshop* at the Conference on Robot Learning, 2022

**SEMINARS and PRESENTATIONS**

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<b>Invited speaker</b> , ICRA 2025 Workshop: Autonomy Under Duress – Robots in Wildland Fire	05/2025
<b>Invited seminar</b> , Future Leaders in Robotics and AI Seminar, University of Maryland	04/2025
<b>Panelist</b> , “Exploring the Role of Models in Building Intelligent Robots” at CSL Student Conference, UIUC	02/2025
<b>Job talk</b> , Department of Mechanical Engineering, Boston University	02/2025
<b>Job talk</b> , Department of Mechanical Engineering, University of Alabama	01/2025
<b>Job talk</b> , Department of Electrical and Computer Engineering, University of North Carolina at Charlotte	12/2024
<b>Invited seminar</b> , Reliable Autonomous Systems Lab at MIT	12/2024
<b>Invited seminar</b> , Long Feng Science Forum at CUHK-Shenzhen	08/2023

<b>Invited seminar</b> , Robotics and Perception Group at the University of Zurich	07/2023
<b>Oral presentation</b> , 5 <sup>th</sup> Learning for Dynamics and Control (9.5% acceptance rate)	06/2023
<b>Invited seminar</b> , Robotics Seminars @ Illinois, University of Illinois Urbana-Champaign	03/2023
<b>Invited seminar</b> , Secure Learning Lab, University of Illinois Urbana-Champaign	02/2023
<b>Invited seminar</b> , Robotics and Controls Seminar, University of North Carolina at Charlotte	02/2023
<b>Job talk</b> , Advanced Controls Research Laboratory, University of Illinois Urbana-Champaign	05/2021
<b>Oral presentation</b> , SIAM Conference on Applications of Dynamical Systems	05/2021
<b>Oral presentation</b> , American Control Conference	05/2021
<b>Oral presentation</b> , IEEE Conference on Decision and Control	12/2020
<b>Oral presentation</b> , American Control Conference	07/2020
<b>Oral presentation</b> , American Control Conference	07/2019

### SELECTED HONORS AND AWARDS

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<b>Future Leaders in Robotics and AI</b> , University of Maryland.	01/2025
<b>Excellent Reviewer</b> , AIAA Journal of Guidance, Control, and Dynamics.	12/2022
<b>Student Travel Support Award</b> , 2020 IEEE Conference on Decision and Control.	12/2020
<b>Student Travel Award</b> , 2020 American Control Conference.	06/2020
<b>Future Faculty Fellow</b> , A. James Clark School of Engineering, University of Maryland.	12/2018
<b>George Corcoran Award</b> , Department of Electrical and Computer Engineering, University of Maryland.	09/2016
<b>International Teaching Fellowship</b> , University of Maryland.	10/2015
<b>Distinguished Teaching Assistant Award</b> , ECE Department, University of Maryland.	05/2015
<b>Outstanding Undergraduate Thesis Award</b> , Harbin Institute of Technology.	07/2014

### TEACHING EXPERIENCE

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<b>Lecturer</b> , "Advanced Dynamics of Aerospace Systems" (co-teaching with Dr. Derek Paley)	01/2021–05/2021
<b>Teaching Assistant Training &amp; Development Fellow</b> , ECE Department, University of Maryland.	08/2015–05/2016
<b>International Teaching Fellow Mentor</b> , University of Maryland.	10/2015–05/2016
<b>Teaching Assistant</b> , ECE Department, University of Maryland.	08/2014–05/2016

### PROFESSIONAL SERVICES

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<b>Associate Editor</b> , 10 <sup>th</sup> IEEE Conference on Control Technology and Applications	02/2026
<b>Session Chair</b> , Aerial Robots: Trajectory Planning and Control, 2025 ICRA	05/2025
<b>Session Co-Chair</b> , Visual Servoing and Tracking, 2025 ICRA	05/2025
<b>Co-organizer</b> , A Tutorial on Autonomy and Advanced Air Mobility: Aviation Paradigm Change, ACC 2025	07/2025
<b>Session Chair</b> , Towards Safe Autonomous Flight III (GNC-19), AIAA SciTech 2025	01/2025
<b>Session Chair</b> , Control Techniques for AAM Autonomy (GNC-28), AIAA SciTech 2024	01/2024
<b>Session Co-Chair</b> , Motion and Path Planning I, 2023 IROS	10/2023
<b>Co-organizer</b> , Workshop on Robust and Resilient Autonomy: Progress and Challenges, IFAC World Congress	07/2023
<b>Co-organizer</b> , the GN&C Workshop, 2023 AIAA SciTech Forum	01/2023
<b>Coordinator</b> , AVIATE Seminar, University of Illinois Urbana-Champaign	10/2022–present

### PROFESSIONAL ACTIVITIES AND AFFILIATIONS

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**Journal Reviewer:** Science Robotics; IEEE Robotics and Automation Letters; IEEE Transactions on Control Systems Technology; IEEE Transactions on Automatic Control; IEEE Transactions on Aerospace and Electronic Systems; IEEE Transactions on Industrial Informatics; Automatica; Journal of Guidance, Control, and Dynamics; IEEE Control Systems Letters; Robotics; Sensors.

**Conference Reviewer:** RSS; ICRA; IROS; CoRL; L4DC; CDC; ACC; IFAC WC; SciTech; CASE; and DARS-SWARM.

**Member:** IEEE CSS Technical Committee on Intelligent Control.

## MENTORED STUDENTS

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### *Ph.D. students*

Hung Tien Pham (Visiting student from Japan Advanced Institute of Science and Technology)	01/2024–08/2024
Ran Tao (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2023–08/2025
Ziyin Han (Mechanical Engineering, University of Illinois Urbana-Champaign)	08/2023–08/2025
John Bullock (Electrical and Computer Engineering, University of Illinois Urbana-Champaign)	09/2022–08/2025
Yuliang Gu (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2022–08/2025
Chengyu Yang (Mechanical Engineering, University of Illinois Urbana-Champaign)	06/2023–08/2025
Lin Song (Mechanical Engineering, University of Illinois Urbana-Champaign)	07/2022–08/2025
Chuyuan Tao (Mechanical Engineering, University of Illinois Urbana-Champaign)	03/2022–08/2025
Minkyung Kim (Mechanical Engineering, University of Illinois Urbana-Champaign)	02/2022–08/2025
Masamichi Kosuge (Visiting student from Keio University)	12/2021–03/2022
Hyungyu Lee (Mechanical Engineering, University of Illinois Urbana-Champaign)	12/2021–08/2025
Michael Aramyan (Mechanical Engineering, University of Illinois Urbana-Champaign)	10/2021–08/2025
Zhuohuan Wu (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2021–02/2023

### *Master students*

Bihao Mo (Computer Engineering, University of Illinois Urbana-Champaign)	08/2024–08/2025
Junjie Gao (Computer Engineering, University of Illinois Urbana-Champaign)	06/2024–08/2025
Yang Zhao (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2023–05/2024
Koushik Udayachandran (Aerospace Engineering, University of Illinois Urbana-Champaign)	03/2023–05/2023
Rong Wang (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2022–02/2023
Charlie Ray (Aerospace Engineering, University of Illinois Urbana-Champaign)	06/2022–05/2023
Chengyu Yang (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2022–05/2023
Jiahao Yu (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2022–12/2022

### *Undergraduate students*

Rong Wang (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2024–08/2025
Jiang Ding (Mechanical Engineering, University of Illinois Urbana-Champaign)	12/2024–08/2025
Yuxuan Nai (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2024–08/2025
Shishir Bhatta (Computer Science, University of Illinois Urbana-Champaign)	09/2023–12/2023
Junjie Gao (Computer Engineering, University of Illinois Urbana-Champaign)	05/2023–05/2024
Yiquan Jin (Mechanical Engineering, University of Illinois Urbana-Champaign)	03/2023–07/2023
Chenhao Xu (Computer Science, University of Illinois Urbana-Champaign)	10/2022–05/2023
Di Liang (Computer Science, University of Illinois Urbana-Champaign)	10/2022–12/2023
Donggu Lee (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2022–05/2023
Jae Lee (Mechanical Engineering, University of Illinois Urbana-Champaign)	08/2022–05/2023
Casey Li (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2022–05/2023
Zhongchun Yu (Mechanical Engineering, University of Illinois Urbana-Champaign)	05/2022–05/2023
Youyou Yu (Computer Engineering, University of Illinois Urbana-Champaign)	05/2022–05/2023
Qianzhong Chen (Mechanical Engineering, University of Illinois Urbana-Champaign)	01/2022–12/2022
Simon Ge (Computer Engineering, University of Illinois Urbana-Champaign)	01/2022–05/2023
Albert Kwan (Aerospace Engineering, University of Illinois Urbana-Champaign)	12/2021–05/2022
Clive Chung (Mechanical Engineering, University of Illinois Urbana-Champaign)	09/2021–05/2023
Ezra Bregin (Aerospace Engineering, University of Maryland)	09/2020–05/2021
Charles Flanagan (Aerospace Engineering, University of Maryland)	09/2019–05/2020

Joshua Yuan (Summer Research Student, University of Maryland)  
Aniket Goel (Aerospace Engineering, University of Maryland)

05/2019–08/2019  
09/2018–05/2019