

NICHOLAS ROBER

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EDUCATION

Massachusetts Institute of Technology PhD, Aeronautics and Astronautics	Cambridge, MA 2023 – Present
SM, Aeronautics and Astronautics Thesis: <i>BReach-LP: a Framework for Backward Reachability Analysis of Neural Feedback Loops</i>	2023
University of Iowa BSE, Mechanical Engineering	Iowa City, IA 2020

RESEARCH EXPERIENCE

Massachusetts Institute of Technology Graduate Research Assistant Aerospace Controls Lab Advisor: Jonathan How	Cambridge, MA 2021 – Present
<ul style="list-style-type: none">• Conduct industry-sponsored research on verification and synthesis of safe autonomous systems under uncertainty• Present and defend findings through written journal and conference submissions and presentations at group meetings, conferences, and workshops• Contribute to writing and conceptualization of funding proposals	
University of Iowa Undergraduate Research Assistant Cooperative Autonomous Systems Lab Advisor: Venanzio Cichella	Cambridge, MA 2019 – 2021
<ul style="list-style-type: none">• Designed algorithms for motion planning and obstacle avoidance of underwater vehicles• Compared adaptive and classical control methods and presented findings in a journal publication	

AWARDS

Outstanding Student Paper Award IEEE Aerospace Technical Committee <i>Backward Reachability Analysis of Neural Feedback Loops</i>	2023
Runner up, Best Paper Award ICML Workshop for Verification in Machine Learning <i>Backward Reachability Analysis of Neural Feedback Loops</i>	2022
Best Undergraduate Presentation The University of Iowa Department of Mechanical Engineering <i>Geometric Path Following for Underwater Vehicles</i>	2020

PUBLICATIONS

Refereed Journal Articles

- K. Mahesh, T. M. Paine, M. L. Greene, **N. Rober**, S. Lee, S. T. Monteiro, A. Annaswamy, M. R. Benjamin, and J. P. How, “Safe autonomy for uncrewed surface vehicles using adaptive control and reachability analysis,” *Transactions on Control Systems Technology (TCST)* (To Appear), 2025.
- **N. Rober** and J. P. How, “Constraint-aware refinement for safety verification of neural feedback loops,” *IEEE Control Systems Letters*, 2024.
- **N. Rober**, S. M. Katz, C. Sidrane, E. Yel, M. Everett, M. J. Kochenderfer, and J. P. How, “Backward reachability analysis of neural feedback loops: Techniques for linear and nonlinear systems,” *IEEE Open Journal of Control Systems*, 2023.

- **N. Rober**, M. Hammond, V. Cichella, J. E. Martin, and P. Carrica, “3D path following and L1 adaptive control for underwater vehicles,” *Ocean Engineering*, vol. 253, p. 110971, 2022.
- **N. Rober**, V. Cichella, J. Ezequiel Martin, Y. Kim, and P. Carrica, “Three-dimensional path-following control for an underwater vehicle,” *Journal of guidance, control, and dynamics*, vol. 44, no. 7, pp. 1345–1355, 2021.

Refereed Conference Articles

- **N. Rober**, K. Mahesh, T. M. Paine, M. L. Greene, S. Lee, S. T. Monteiro, M. R. Benjamin, and J. P. How, “Online data-driven safety certification for systems subject to unknown disturbances,” in *2024 IEEE International Conference on Robotics and Automation (ICRA)*, IEEE, 2024, pp. 9939–9945.
- **N. Rober**, M. Everett, S. Zhang, and J. P. How, “A hybrid partitioning strategy for backward reachability of neural feedback loops,” in *2023 American Control Conference (ACC)*, IEEE, 2023, pp. 3523–3528.
- **N. Rober**, M. Everett, and J. P. How, “Backward reachability analysis for neural feedback loops,” in *2022 IEEE 61st Conference on Decision and Control (CDC)*, IEEE, 2022, pp. 2897–2904.
- **N. Rober** and V. Cichella, “Geometric path following of underwater vehicles,” in *AIAA Scitech 2021 Forum*, 2021, p. 1678.

Theses

- **N. Rober**, “BReach-LP: A framework for backward reachability analysis of neural feedback loops,” M.S. thesis, Massachusetts Institute of Technology, Department of Mechanical Engineering, 2023.

TEACHING EXPERIENCE AND TRAINING

Mentorship

MIT

Undergraduate Students

Ryosei Tanakamura

Summer 2025 - Present

Luana Rampelotti

Summer 2025 - Present

Dylan Gaillard

Fall 2024 - Spring 2025

Guest Lectures

Northeastern University

Verifiable Machine Learning

2023, 2024

Pedagogical Training

MIT Communications Lab Training

2023-2024

- Participated in ten training sessions designed to teach graduate students how to become effective coaches in various aspects of technical communication.

Undergraduate Teaching Assistantship

The University of Iowa

Control of Mechanical Engineering Systems

Fall 2020

Advanced Linear Control Systems

Spring 2020

Introduction to Engineering Computing

Fall 2018, Fall 2019

Engineering Fundamentals I: Statics

Summer 2018, Summer 2019

PRESENTATIONS

American Control Conference (ACC), Talk

2025

International Conference on Robotics and Automation (ICRA), Talk

2024

Allerton Conference, Invited Talk

2023

American Control Conference (ACC), Talk

2023

Conference on Decision and Control (CDC), Talk

2022

ICML Workshop on Formal Verification of Machine Learning, Talk

2022

ICRA Workshop on Safe and Reliable Robot Autonomy under Uncertainty, Talk

2022

PROFESSIONAL ACTIVITIES

Community Services

Lead Organizer, Workshop on Formal Verification of Control Systems with NN Components, ACC 2025
Session Co-Chair, Safe Control I, ACC 2025
Volunteer, ACC 2025 2025

Institutional Services*Massachusetts Institute of Technology*

Fellow, AeroAstro Communications Lab 2023-2025
Mentor, Graduate Application Assistance Program 2024
Panelist, MIT Communications Lab Summer Institute 2024
Panelist, MIT Graduate Association of Aeronautics and Astronautics Seminar 2024
Student Liason, LiDS Seminar Speaker Series 2023
Mentor, Freshman Pre-Orientation Program 2022

University of Iowa

Panelist, New Student Seminar 2019

Review Activities*Journals*

AIAA Journal of Guidance, Control, and Dynamics (JGCD)
IEEE Control Systems Letters (L-CSS)
IEEE Open Journal of Control Systems (OJ-CSYS)
IEEE Transactions on Automation and Control (TAC)
Journal of Field Robotics (JFR)
Nonlinear Analysis: Hybrid Systems
Ocean Engineering

Conferences

Conference on Decision and Control (CDC)
Learning for Dynamics and Control (L4DC)

Workshops

Robotics Science and Systems 2024 Workshop: Towards Safe Autonomy (RSS)