NICHOLAS ROBER

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EDUCATION

Massachusetts Institute of Technology — Cambridge, MA
PhD, Aeronautics and Astronautics — 2023 – Present

SM, Aeronautics and Astronautics — 2023
Thesis: *BReach-LP: a Framework for Backward Reachability Analysis of Neural Feedback Loops*

University of Iowa — Iowa City, IA
BSE, Mechanical Engineering — 2020

RESEARCH EXPERIENCE

Massachusetts Institute of Technology — Cambridge, MA
Graduate Research Assistant | Aerospace Controls Lab — 2021 – Present
Advisor: Jonathan How

- 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 — Cambridge, MA
Undergraduate Research Assistant | Cooperative Autonomous Systems Lab — 2019 – 2021
Advisor: Venanzio Cichella

- 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 — 2023
IEEE Aerospace Technical Commitee
Backward Reachability Analysis of Neural Feedback Loops

Runner up, Best Paper Award — 2022
ICML Workshop for Verification in Machine Learning
Backward Reachability Analysis of Neural Feedback Loops

Best Undergraduate Presentation — 2020
The University of Iowa Department of Mechanical Engineering
Geometric Path Following for Underwater Vehicles

PUBLICATIONS

Refereed Journal Articles

- **Rober, Nicholas** and J. P. How, "Constraint-aware refinement for safety verification of neural feedback loops," *IEEE Control Systems Letters*, 2024.
- **Rober, Nicholas**, S. M. Katz, C. Sidrane, *et al.*, "Backward reachability analysis of neural feedback loops: Techniques for linear and nonlinear systems," *IEEE Open Journal of Control Systems*, 2023.
- **Rober, Nicholas**, M. Hammond, V. Cichella, *et al.*, "3D path following and L1 adaptive control for underwater vehicles," *Ocean Engineering*, vol. 253, p. 110 971, 2022.
- **Rober, Nicholas**, V. Cichella, J. Ezequiel Martin, *et al.*, "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

- **Rober, Nicholas**, K. Mahesh, T. M. Paine, *et al.*, "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.
- **Rober, Nicholas**, M. Everett, S. Zhang, *et al.*, "A hybrid partitioning strategy for backward reachability of neural feedback loops," in *2023 American Control Conference (ACC)*, IEEE, 2023, pp. 3523–3528.
- **Rober, Nicholas**, 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.
- **Rober, Nicholas A** and V. Cichella, "Geometric path following of underwater vehicles," in *AIAA Scitech 2021 Forum*, 2021, p. 1678.

Theses

- **Rober, Nicholas**, "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
Dylan Gaillard Fall 2024 - Present

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

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
AIAA Scitech Forum, Talk 2021

PROFESSIONAL ACTIVITIES

Community Services
Organizer, Workshop on Formal Verification of Control Systems with NN Components, ACC 2025
Co-Chair, ACC, Safe Control I 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

IEEE Control Systems Letters (L-CSS)
IEEE Transactions on Automation and Control (TAC)
Nonlinear Analysis: Hybrid Systems
Ocean Engineering

Conferences

Learning for Dynamics and Control (L4DC)

Workshops

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