Apurva Badithela

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Education

2018– expected 2024	PH.D. in Control and Dynamical Systems California Institute of Technology

Thesis: Formal Methods for Test and Evaluation of Safety-Critical Autonomous Systems
Advisor: Richard M. Murray
Committee: Aaron D. Ames, Joel W. Burdick, Eric V. Mazumdar, Tichakorn Wongpiromsarn

2014–2018	B.S. in Aerospace Engineering and Mechanics University of Minnesota, Twin-Cities

summa cum laude
Advisor: Peter J. Seiler

Preprints

2023 — Inigo Incer, Apurva Badithela, Josefine Graebener, Piergiuseppe Mallozzi, Ayush Pandey, Sheng-Jung Yu, Albert Beneveniste, Benoit Caillud, Richard M. Murray, Alberto Sangiovanni-Vincentelli, and Sanjit Seshia.
Pacti: Scaling Assume-Guarantee Reasoning for System Analysis and Design
Under Review. Submitted to ACM Transactions on Cyber-Physical Systems (T-CPS). ArXiv abs/2303.17751. [PDF][TOOL]

Peer-Reviewed Publications

2023 — Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.
Evaluation Metrics of Object Detection for Quantitative System-Level Analysis of Safety-Critical Autonomous Systems
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023. [PDF]
CPS-IoT Week Workshop on Perception for Safety-Critical Cyber-Physical Systems, 2023.

2023 — Apurva Badithela*, Josefine Graebener*, Inigo Incer*, and Richard M. Murray.
Reasoning over Test Specifications using Assume-Guarantee Contracts
Proceedings of the 15th NASA Formal Methods (NFM), 2023, pp 278-294. [PDF] [DOI]

2023 — Apurva Badithela*, Josefine Graebener*, Wyatt Ubellacker, Eric V. Mazumdar, Aaron D. Ames, and Richard M. Murray.
Synthesizing Reactive Test Environments for Autonomous Systems: Testing Reach-Avoid Specifications with Multi-Commodity Flows
IEEE International Conference on Robotics and Automation (ICRA), 2023. [PDF] [DOI]
Workshop on Envisioning an Infrastructure for Multi-Robot and Collaborative Autonomy

Testing and Evaluation, Robotics: Science and Systems (RSS), 2022.

2022 Josefine Graebener*, Apurva Badithela*, and Richard M. Murray.
Towards Better Test Coverage: Merging Unit Tests for Autonomous Systems.
Proceedings of the 14th *NASA Formal Methods (NFM), 2022, pp 133-155.* [PDF] [DOI]

2021 Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.
Leveraging Classification Metrics for Quantitative System-level Analysis of Temporal Logic Specifications.
60th *IEEE Conference on Decision and Control (CDC).* [PDF] [DOI]

2019 Apurva Badithela and Peter Seiler.
Analysis of the Heavy-ball Algorithm using Integral Quadratic Constraints.
2019 American Control Conference (ACC). [PDF] [DOI]

2017 Austin Nash, Apurva Badithela, and Neera Jain.
Dynamic Modeling of a Sensible Thermal Energy Storage Tank with an Immersed Coil Heat Exchanger under Three Operation Modes.
Journal of Applied Energy. [PDF] [DOI]

Employment

2021 Autonomy Research Intern in Behavior Planning and Prediction   Motional, Boston
Host: Eric Wolff
Project: Counterexample Guided Repair of Inverse Reinforcement Learning Planner

2017 ICES Moncrief Summer Research Fellow   University of Texas, Austin
Host: Ufuk Topcu
Mentor: Ivan Papusha
Project: Sparse Matrix Methods for Fast Real-time Model Predictive Control

2016 Summer Undergraduate Research Fellowship   Purdue University, West-Lafayette
Host: Neera Jain
Mentor: Austin L. Nash
Project: Dynamic Modeling and Validation of micro-CHP systems

Invited Talks

Dec 2023 Toyota Motor North America R&D. Toyota Research Institute, North America (TRINA).
Nov 2023 Autonomous Systems Lab (ASL) Group Meeting Talk. Stanford University.
Nov 2023 ECE Department Seminar. University of Michigan, Ann Arbor.
Nov 2023 Intelligent Robot Motion Lab (IRoM) Group Meeting Talk. Princeton University.
Oct 2023 Group Meeting Talk. University of Michigan, Ann Arbor.
Dec 2022 National Institute of Informatics, Tokyo.

Oct 2022	40th Southern California Controls Workshop.
Oct 2022	US-Japan Seminar on Autonomy, AI, Robotics, and Informatics.
Mar 2022	VeHiCAL Group Meeting Talk. University of California, Berkeley.
Dec 2020	VeHiCAL Group Meeting Talk. University of California, Berkeley.

Honors and Awards

2022	CMS and IST Gradient for Change Department award for contributions toward making Caltech a more diverse, equitable, and inclusive environment. California Institute of Technology
2022	CMS TA Fellow. EAS division award to support CMS department TAs in promoting inclusive learning. California Institute of Technology
2022	RSS Inclusion Fellow Conference Award Robotics: Science and Systems
2018	AIAA Guidance, Navigation and Control Undergraduate Conference Experience Award. American Institute of Aeronautics and Astronautics.
2016-2018	Robert and John McCollum Scholarship. Department Award University of Minnesota
2014-2018	Gold Global Excellence Scholarship. University-wide Award University of Minnesota

Mentoring

Summer 2023	Kimia Hassibi *(SURF)*, Jacob Alderete *(Undergraduate Researcher)* *Project:* Difficult test generation and Duckietown hardware
Fall 2021 – present	Ranai Srivastav *Undergraduate Researcher (Iowa State)* *Project:* Object Detection in Duckietown and Experiments for Validating Object Detection Algorithms
Summer 2022	Andy Dimnaku *(SURF Fellow)* *Project:* Optimization of Autonomous Vehicles Testing through Symmetry Mapping

| Summer 2022 | Edward Zhang, Frida Moreno, Gerard Decker *(FSRI Fellows)* |
| | *Project:* Setting up Duckietown as a Hardware Platform for Testing Autonomous Vehicles |

| Summer 2020 | Berlin Del Aguila *(WAVE Fellow)* |
| | *Project:* Synthesis of Static Test Environments for Automated Valet Parking |

Teaching

2022–23	CMS TA Fellow
Spring 2022	Teaching Assitant. Optimal Control (CDS 112 / Ae 103a). Caltech
Fall 2020	Teaching Assistant. Linear Systems Theory (CDS 131). Caltech
Fall 2019	Course Ombudsperson. Distributed Computing (CS 142). Caltech

Service

Diversity, Equity and Inclusion

2022–24	CMS H.B. Keller Colloquium Committee Member.
2020–21	Helped organize two workshops on Building Effective Research Collaborations for graduate students.
2021–22	Computing and Mathematical Sciences (CMS) Diversity, Equity and Inclusion (DEI) Steering Committee. Engaged in biweekly discussions on creating initiatives to foster inclusion in the department.
	Created and organized the CMS Climate Survey on graduate student experience. Organized a department town hall to communicate survey results and solicit feedback from the community. Submitted a written list of recommendations to CMS faculty. The climate survey template is being institutionalized in the CRA database as a reference for other schools.
2019–20	Organized a DEI and anti-racism town hall for CMS students and postdocs, and compiled a written document of recommendations to CMS faculty. Volunteer tutor in math and science for underrepresented students from Pasadena public schools through the Caltech RISE program.
2015–2016	Outreach Officer, AIAA. Organized and coordinated hands-on outreach activities at the Math and Science Family Fun Fair, Farnsworth Aeropsace Magnet and the Girls Inc! Eureka program.

Review Activities

2023	IEEE Transactions on Intelligent Transportation Systems (T-IST)
2022–24	IEEE International Conference on Robotics and Automation (ICRA)
2023	IEEE/RSJ Robotics and Automation Letters (RAL)
2023	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
2022	Transactions on Automatic Control (TAC)

References

Professor Richard M. Murray
Thomas E. and Doris Everhart Chair
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Professor Joel W. Burdick
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Professor Hadas Kress-Gazit
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