

# Apurva Badithela

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## Education

2018– Expected 2024	PhD in Control and Dynamical Systems <i>Thesis:</i> Formal Methods for Test and Evaluation, and Verification and Validation of Autonomy <i>Advisor:</i> Richard M. Murray <i>Committee:</i> Richard M. Murray, Aaron D. Ames, Joel W. Burdick, Eric V. Mazumdar	California Institute of Technology
2014– 2018	B.S. in Aerospace Engineering and Mechanics <i>summa cum laude</i> <i>Advisor:</i> Peter J. Seiler	University of Minnesota, Twin-Cities

## Publications

### JOURNAL ARTICLES

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. <i>Journal of Applied Energy.</i>
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### CONFERENCE PAPERS

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 <i>IEEE International Conference on Robotics and Automation, 2023. To appear.</i>
2022	Josefine Graebener*, Apurva Badithela*, and Richard M. Murray. Towards Better Test Coverage: Merging Unit Tests for Autonomous Systems. <i>14<sup>th</sup> NASA Formal Method Symposium, 2022.</i>
2021	Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray. Leveraging Classification Metrics for Quantitative System-level Analysis of Temporal Logic Specifications. <i>60<sup>th</sup> IEEE Conference on Decision and Control.</i>

- 2019 Apurva Badithela and Peter Seiler.  
Analysis of the Heavy-ball Algorithm using Integral Quadratic Constraints.  
*American Control Conference.*
- PRE-PRINTS
- 2023 Josefine Graebener\*, Apurva Badithela\*, Denizalp Goktas, Wyatt L. Ubellacker, Eric V. Mazumdar, Aaron D. Ames, Richard M. Murray.  
Reactive Test Synthesis for Discrete Decision-Making Systems using Network Flows  
*Submitted to Robotics: Science and Systems. Under Review.*
- 2023 Inigo Incer, Apurva Badithela, Josefine Graebener, Piergiuseppe Mallozzi, Ayush Pandey, Sheng-Jung Yu, Albert Beneveniste, Benoit Caillud, Richard M. Murray, Alberto Sangiovanni-Vincentelli, Sanjit Seshia.  
Pacti: Scaling Assume-Guarantee Reasoning for System Analysis and Design  
*Submitted to Computer Aided Verification (CAV). Under Review.*
- 2023 Apurva Badithela\*, Josefine Graebener\*, Inigo Incer\*, and Richard M. Murray.  
Reasoning over Test Specifications using Assume-Guarantee Contracts  
*Submitted to NASA Formal Methods Symposium. Under Review.*
- 2022 Apurva Badithela, Tichakorn Wongpiromsarn, and Richard M. Murray.  
Evaluation Metrics for Object Detection for Autonomous Systems  
*Submitted to IEEE International Conference on Robotics and Automaton, 2023.*
- 2020 Apurva Badithela and Richard M. Murray.  
Synthesis of Static Test Environments for Generating Sequence-like Behaviors in Autonomous Systems  
*Submitted to 13<sup>th</sup> NASA Formal Methods Symposium, 2021.*

## 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

## 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.  
Departmental Award  
University of Minnesota
- 2014-2018 Gold Global Excellence Scholarship.  
University-wide Award  
University of Minnesota

## Teaching

### CALTECH

- Spring'22 Optimal Control (CDS 112 / Ae 103a).  
Fall'20 Linear Systems Theory (CDS 131).

## Mentoring

- 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 <i>FSRI Fellows</i> <i>Project: Setting up Duckietown as a Hardware Platform for Testing Autonomous Vehicles</i>
Summer 2020	Berlin Del Aguila <i>WAVE Fellow</i> <i>Project: Synthesis of Static Test Environments for Autonomy</i>

## Talks

Dec 2022	National Institute of Informatics, Tokyo.
Oct 2022	US-Japan Seminar on Autonomy, AI, Robotics, and Informatics.
Jul 2022	Workshop on Envisioning an Infrastructure for Multi-Robot and Collaborate Autonomy Testing and Evaluation, Robotics: Science and Systems
May 2022	NASA Formal Methods
Mar 2022	University of California, Berkeley.
Dec 2021	IEEE 60 <sup>th</sup> Conference on Decision and Control.
Dec 2020	University of California, Berkeley.

## Service

### DIVERSITY AND INCLUSION

2020–	Member of the Computing and Mathematical Sciences (CMS) Diversity, Equity and Inclusion (DEI) Steering Committee. Engage in bi-weekly discussions on creating initiatives to foster inclusion in the department. <ul style="list-style-type: none"> <li>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.</li> <li>Organized a diversity town hall for CMS students and postdocs, and compiled a written document of recommendations to CMS faculty.</li> </ul>
2020– 2021	Helped organize two workshops on Building Effective Research Collaborations for graduate students.
2022–	Helped organize two workshops on Building Effective Research Collaborations for graduate students.

### REVIEW ACTIVITIES

- IEEE International Conference on Robotics and Automation (ICRA) 2023
- Transactions on Automatic Control (TAC) 2022

- IEEE International Conference on Robotics and Automation (ICRA) 2022
- 60<sup>th</sup> IEEE Conference on Decision and Control (CDC) 2021