

# Anushri Dixit

✉ adixit@caltech.edu  
🌐 anushridixit.com

🏠 1200 E California Blvd, MC 104-44, Pasadena, CA, 91106  
🌐 <https://www.linkedin.com/in/anushri-dixit-675a40b7/>

## Education

- 2017 – 2023 📖 **Ph.D., California Institute of Technology** in Computing and Mathematical Sciences.  
Option: Control and Dynamical Systems.
- 2013 – 2017 📖 **B.Sc., Georgia Institute of Technology** in Electrical Engineering.  
Thesis title: *System Dynamics-Based Mapping for Closed Loop Control*.

## Work Experience

- 2017 – 2023 📖 **Graduate Research Assistant (RA), Prof. Joel Burdick**  
**Risk-Aware Model Predictive Control (MPC):** In MPC settings, uncertainty is considered either in a robust sense (worst-case analysis that is risk-averse) or using the expected cost with chance constraints (risk-neutral). My work combines these two ideas into one framework through the use of risk measures that allow a more continuous transition between being averse or neutral to risk and provide distributional robustness based on the risk-level chosen.
- Developed a theoretical framework for risk-aware MPC in the presence of randomly moving obstacles using coherent risk measures. This framework provides confidence guarantees on recursive feasibility and finite-time task completion.
  - Developed an online, data-driven method for a moving agent to predict the paths of dynamically moving obstacles and avoid them using a risk-aware planning scheme.
  - Provided a Conditional Value-at-Risk reformulation of the MPC optimization problem for a discrete-time linear system with additive disturbances that is distributionally robust in the expected cost and chance constraints.
- JPL collaboration:** Worked on motion planning over extreme terrain as a member of Team CoSTAR (Collaborative SubTerranean Autonomous Resilient Robots) participating in the DARPA Subterranean Challenge.
- Applied risk measure theory to traversability evaluation and planning in unstructured terrain.
  - Developed algorithms for detecting various risk sources including, a) LIDAR-based detection of semantic features like mud and water, b) negative obstacle detection and c) proprioceptive tilt detection (recovery behavior).
  - Developed a method for modeling the kinematics of tracked vehicles on flat ground and stairs.
- Research interests:* Stochastic motion planning, robotics, control theory, probability theory.
- 2015 – 2017 📖 **Undergraduate RA, Intelligent Vision and Automation Laboratory**  
Studied the control and planning of legged locomotion in quadrupedal robots.  
Received President's Undergraduate Research Award in Summer 2015 for the design and implementation of a quadruped.
- 2016 📖 **Summer Intern, DELL**  
Analyzed and drove recommendations for contextual awareness using sensors.  
Tested ambient light sensors and human proximity sensors so that they could be integrated with the Intel Sensor Hub.

## Teaching Experience

- 2021-2022 📖 **Graduate Teaching Assistant, Advanced Robotics (ME 234a and ME 243b).**  
Helped design part of the course and taught 3 weeks (9+ hours) of lectures on MPC.  
Held laboratory sessions and office hours for students and graded assignments.
- 2019 📖 **Summer Undergraduate Research Fellowships (SURF) program Mentor.**  
Mentored undergraduate students to build an autonomous RC car for the DARPA Subterranean Challenge featured in <https://www.caltech.edu/about/news/caltech-undergrads-build-robot-darpa-challenge>
- 2018 – 2019 📖 **Graduate Teaching Assistant, Robotics (ME 133a and ME 134b).**  
Held laboratory sessions and office hours for 30+ students and graded assignments.
- 2015 – 2017 📖 **Undergraduate Teaching Assistant, Differential Equations (MATH 2552).**  
Held recitation sessions for 30+ students and received positive feedback from students and lecturer. Proctored and graded quizzes as well as exams.

## Skills and Coursework

- Relevant courses 📖 **Robotics and Control:** Robotics, Nonlinear Control, Optimal Control and Estimation, Computational Computer Vision, Introduction to AI, Data Structures and Algorithms, **Applied Math:** Mathematical Optimization, Linear Analysis, Probability in High Dimensions, Probability Theory and Stochastic Processes, **Machine Learning:** Predictive Control and Neural Network Theory, Machine Learning and Data Mining, Data-Driven Modeling of Dynamical Systems.
- Coding 📖 C++, MATLAB, ROS, Java, Python

# Research Publications (\* indicates equal contribution)

## Journal Articles

- 1 **Dixit, A.**, Ahmadi, M., & Burdick, J. W. (2022a). Distributionally robust model predictive control with total variation distance. *IEEE Control Systems Letters*, 6, 3325–3330. [doi:10.1109/LCSYS.2022.3184921](https://doi.org/10.1109/LCSYS.2022.3184921)
- 2 Wei\*, S. X., **Dixit\***, A., Tomar, S., & Burdick, J. W. (2022). Moving obstacle avoidance: A data-driven risk-aware approach. *IEEE Control Systems Letters*, 7, 289–294. [doi:10.1109/LCSYS.2022.3181191](https://doi.org/10.1109/LCSYS.2022.3181191)
- 3 Agha, A., Otsu, K., Morrell, B., Fan, D. D., Thakker, R., Santamaria-Navarro, A., ... Burdick, J. (2021). NeBula: Quest for robotic autonomy in challenging environments; TEAM CoSTAR at the DARPA subterranean challenge. *Journal Field Robotics*. Retrieved from <https://arxiv.org/abs/2103.11470>

## Journal Articles under review

- 1 Akella, P., **Dixit, A.**, Ahmadi, M., Burdick, J. W., & Ames, A. D. (2022). *Sample-based bounds for coherent risk measures: Applications to policy synthesis and verification*. [doi:10.48550/ARXIV.2204.09833](https://doi.org/10.48550/ARXIV.2204.09833)
- 2 **Dixit, A.**, Ahmadi, M., & Burdick, J. W. (2022b). *Risk-averse receding horizon motion planning*. arXiv: 2204.09596 [eess.SY]




## Conference Proceedings

- 1 Dey, S., Fan, D., Schmid, R., **Dixit, A.**, Ahmadi, M., & Burdick, J. W. (2022). PrePARE: predictive proprioception for agile failure event detection in robotic exploration of extreme terrains. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
- 2 Ahmadi, M., **Dixit, A.**, Burdick, J. W., & Ames, A. D. (2021). Risk-averse stochastic shortest path planning. In *Conference on Decision and Control*. Retrieved from <https://arxiv.org/abs/2103.14727>
- 3 **Dixit, A.**, Ahmadi, M., & Burdick, J. W. (2021). Risk-Sensitive Motion Planning using Entropic Value-at-Risk. In *European control conference*. Retrieved from <https://arxiv.org/abs/2011.11211>
- 4 Fan\*, D. D., Otsu\*, K., Kubo, Y., **Dixit, A.**, Burdick, J., & Agha-Mohammadi, A.-A. (2021). STEP: Stochastic traversability evaluation and planning for safe off-road navigation. In *Robotics: Science and Systems*. Retrieved from <https://arxiv.org/abs/2103.02828>


## Preprints and Working Papers

- 1 **Dixit\***, A., Fan\*, D. D., Otsu, K., Dey, S., Agha-Mohammadi, A.-A., & Burdick, J. W. (2022). STEP: Stochastic Traversability Evaluation and Planning for Risk-Aware Off-road Navigation; Results from the DARPA Subterranean Challenge.
- 2 **Dixit\***, A., Lindemann\*, L., Akella\*, P., Chapman\*, M., Ahmadi, M., Ames, A., & Burdick, J. W. (2022). Risk-Aware Planning, Control, and Verification: A Review of Tail Risk Measures in Robotics.
- 3 **Dixit\***, A., Lindemann\*, L., Wei, S., & Burdick, J. W. (2022). Dynamic Obstacle Prediction using Conformal Inference.
- 4 **Dixit, A.**, & Burdick, J. W. (2020). The Kinematics of Tracked Vehicles via the Power Dissipation Method. Retrieved from <https://arxiv.org/abs/2004.05176>



## Awards and Fellowships

- 2022  **Southern California Robotics Symposium Rising Star**
- 2021  **DE Shaw Zenith Fellowship**
- 2015  **President's Undergraduate Research Award**

## Service

-  Reviewer for Automatica, Field Robotics, IEEE Control Systems Letters (L-CSS), Conference on Decision and Control (CDC), American Control Conference (ACC).

## Outreach

- 2019 – 2021  **Visiting Scientist, Caltech Center for Teaching, Learning, and Outreach**  
Provided hands-on science lessons at a elementary school in Pasadena as a part of a teaching program called Visiting Scientists.
- 2015 – 2016  **Chief Technical Officer, Robogals Global**  
Oversaw the maintenance and development of the myRobogals portal, Robogals Global website while managing a software team of 4-5 engineers.  
Responded to user requests and assisted Robogals chapters with website technical support essential for organizing the annual Robogals conference.