

# Ryan Kazuo Cosner

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## RESEARCH INTERESTS

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*I study nonlinear dynamics and control in the context of safety critical systems with the goal of developing and deploying provably safe systems. I am particularly interested in the impact of vision and perception-based sensing systems on the control loop. My research can be categorized generally as: **guaranteeing safety in feedback control in the context of perception-based state uncertainty.***

## EDUCATION

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### California Institute of Technology

PhD, Mechanical Engineering

MS, Mechanical Engineering: Robotics, Controls, and Dynamics Emphasis

Pasadena, CA

Sep. 2019 – June 2024

Sep. 2019 – June 2021

### University of California, Berkeley

BS, Mechanical Engineering

Berkeley, CA

Aug. 2015 – May 2019

## RESEARCH

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### AMBER Lab - Professors Aaron D. Ames and Katherine L. Bouman

June 2020 – Present

- Developed theory for controllers which guarantee safety in the context of state uncertainty
- Designed a method for Self-Supervised Vision-based Uncertainty Estimation
- Developed theory for guaranteed safety using multirate controllers
- Deployed controllers on custom Segway and Quadruped simulations and hardware

### BEST Lab - Professor Alice Agogino

May 2017 – May 2019

- Developed motor system for 6-bar tensegrity robot
- Performed drop tests and analysed impact data

### CalWave Power Technologies - Professor Reza Alam

May 2018 – May 2020

- Developed adjustable mooring system for renewable wave energy converter
- Performed experimental study on the effects of surface perforations on energy absorption

## PUBLICATIONS

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1. *Self-Supervised Online Learning for Safety-Critical Control using Stereo Vision.*  
**Ryan K. Cosner\***, Ivan D. Jimenez Rodriguez\*, Tamas G. Molnar, Wyatt Ubellacker, Yisong Yue, Aaron D. Ames, Katherine L. Bouman.  
Submitted to the International Conference on Robotics and Automation (ICRA), 2022.
2. *Enforcing Motion Primitive Transitions via Flow-Control Barrier Functions.*  
Wyatt Ubellacker, **Ryan K. Cosner**, Tamas G. Molnar, Andrew W. Singletary, Aaron D. Ames.  
Submitted to the International Conference on Robotics and Automation (ICRA), 2022.
3. *A Constructive Method for Designing Safe Multirate Control for Differentially-Flat Systems.*  
Devansh R. Agrawal\*, Hardik Parwana\*, **Ryan K Cosner\***, Ugo Rosolia, Aaron D. Ames, Dimitra Panagou.  
Submitted to IEEE Control Systems Letters, 2021.
4. *Model-Free Safety-Critical Control for Robotic Systems.*  
Tamas G. Molnar, **Ryan K. Cosner**, Andrew W. Singletary, Wyatt Ubellacker, Aaron D. Ames.  
arXiv preprint arXiv:2109.09047, 2021. Submitted to IEEE Robotics and Automation Letters.
5. *Measurement-Robust Control Barrier Functions: Certainty in Safety with Uncertainty in State.*  
**Ryan K. Cosner**, Andrew W. Singletary, Andrew J. Taylor, Tamas G. Molnar, Aaron D. Ames.  
arXiv preprint arXiv:2104.14030, 2021. To appear at IROS 2021.

6. *Multi-rate Control Design under Input Constraints via Fixed-Time Barrier Functions.*  
Kunal Garg, **Ryan K. Cosner**, Ugo Rosolia, Aaron D. Ames, Dimitra Panagou.  
IEEE Control Systems Letters, 2021.
7. *Episodic Learning for Safe Bipedal Locomotion with Control Barrier Functions and Projection-to-State Safety*  
Noel Csomay-Shanklin\*, **Ryan K. Cosner\***, Min Dai\*, Andrew J. Taylor, Aaron D. Ames.  
Learning for Dynamics and Control Conference (L4DC), 2021.
8. *Guaranteeing Safety of Learned Perception Modules via Measurement-Robust Control Barrier Functions.*  
Sarah Dean, Andrew J. Taylor, **Ryan K. Cosner**, Benjamin Recht, and Aaron D. Ames.  
Conference on Robotic Learning (CoRL), 2020.  
Best Student Paper Finalist.

## INTERNSHIPS

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<b>Squishy Robotics, Mechatronics Intern</b>	Summer 2019
<ul style="list-style-type: none"> <li>• Redesigned the robots main electronics capsule and PCB</li> <li>• Added hardware and software for high-speed collection of impact acceleration data</li> </ul>	
<b>Ford Motor Company, Electrical Testing and Autonomous Vehicle Intern</b>	Summer 2018
<ul style="list-style-type: none"> <li>• Restructured vehicle cold-start test to combine multiple tests into one streamlined procedure</li> <li>• Optimized code for processing of autonomous vehicle data to reduce computation time</li> </ul>	
<b>LA Biomed, Summer Fellow</b>	Summer 2015
<ul style="list-style-type: none"> <li>• Developed a method to test for MPS II without the use of radioactive material</li> </ul>	
<b>The Boeing Company, Summer Intern</b>	Summer 2014
<ul style="list-style-type: none"> <li>• Designed a tactile tool for quick iterative design of satellites</li> <li>• Analyzed the thermal properties of carbon-nanotube composites for use as radiative insulators</li> </ul>	

## SERVICE AND OUTREACH

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<b>Caltech RISE, Volunteer Tutor</b>	September 2019 - Present
<ul style="list-style-type: none"> <li>• Tutored Pasadena Unified students struggling in math and science</li> </ul>	
<b>Southland Triathlon Series, Volunteer Founder and Race Coordinator</b>	June 2020 - January 2021
<ul style="list-style-type: none"> <li>• Organized a three free virtual races to keep people fit and connected despite social distancing</li> </ul>	
<b>UC Berkeley, Campus Tour Guide and Ambassador</b>	January 2016 - May 2019
<ul style="list-style-type: none"> <li>• Introduced prospective students to campus and helped them understand the application process</li> </ul>	
<b>United Technologies for Kids, Volunteer Teacher</b>	January 2017-August 2017
<ul style="list-style-type: none"> <li>• Developed and taught introductory design, electronics, and coding courses for middle and high school students</li> </ul>	

## TECHNICAL TOOLS

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**Languages:** MATLAB, Python, C++, LabVIEW, Latex  
**Packages:** Simulink, MATLAB Control Systems Toolbox, CVX, CVXPY, Numpy, Pandas, SciPy, Keras, Tensorflow, OpenCV (Python & C++)  
**Software:** Solidworks, Autodesk Fusion 360, Cura, Autodesk EAGLE, ROS

## AWARDS

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Best Student Paper Finalist: <i>Conference on Robotic Learning</i>	2021
Graduate Student Fellowship, <i>Rose Hills Foundation</i>	2020
High Honors at Graduation, <i>UC Berkeley</i>	2019
Alexander and Ethel Levens Mechanical Engineering Award, <i>UC Berkeley</i>	2017
Regents' and Chancellor's Scholar, <i>UC Berkeley</i>	2015-2019
Chevron Academic Scholar, <i>Chevron, El Segundo</i>	2015
Eagle Scout, <i>BSA Troop 860, Hermosa Beach</i>	2014