

Cyndia Cao

PHD CANDIDATE · MECHANICAL ENGINEERING · UNIVERSITY OF CALIFORNIA, BERKELEY

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My goal is to use my research experience to deploy technology from the lab into the field in order to address technical barriers to mitigating climate change, such as long-duration storage, green hydrogen generation, and carbon capture. I am a hands-on, experimentally-driven, and theory-motivated builder who enjoys adapting to the challenge at hand.

Education

University of California, Berkeley

Berkeley, CA

PHD - MECHANICAL ENGINEERING

2018-present

- NASA Space Technology Research Fellow (2019)
- Advisors: Hannah Stuart, Dennis Lieu
- Thesis: *Roving around the moon and Mars: strategic wheel slip control and active weight redistribution for augmenting wheeled mobility*

Massachusetts Institute of Technology

Cambridge, MA

B.S. - MECHANICAL ENGINEERING

2013 - 2017

- Advisors: Alex Slocum, David Trumper
- Thesis: *Exploration of configurations of wave energy converters to mechanically drive a seawater uranium harvester*

Skills

Programming Python, MATLAB, Arduino (C/C++), Simulink

Solid Modeling NX, Fusion 360, SolidWorks, AutoCAD, ANSYS Structural

Coursework: Mechatronics Electric Motor Design, Power Electronics, MEMS, Hamiltonian & Lagrangian Dynamics

Coursework: Controls Model Predictive Control, State Estimation, Reinforcement Learning

Professional Experience

Embodied Dexterity Group, UC Berkeley

Berkeley, CA

GRADUATE STUDENT RESEARCHER

Aug 2018 - Present

- Explored the impact of wheel-ground contact loads and drive controls on the mobility of rovers traversing loose, sandy terrain and climbing large obstacles via extensive test campaigns motivated by specialized terrain models
- Performed mobility validation testing with NASA's VIPER (lunar rover) team, and led testing and data analysis to evaluate the sensitivity of VIPER mobility performance with load threshold controllers
- Extended granular resistive force theory models and used the resulting insight to achieve up to 10% increase in slope-climbing efficiency for wheeled rovers and, for VIPER, a 35% increase in traversal velocity in extreme-sinkage simulant

Apple

Cupertino, CA

WATCH PRODUCT DESIGN INTERN

Jan 2018 - Aug 2018

- Analyzed users' wrist interactions in various water sports to quantify impact loads and environmental factors, then develop validation tests including machine requirements and SOPs
- Produced GD&T drawings and tolerance stacks for small, complex assemblies

SpaceX

Hawthorne, CA

MECHANISMS INTERN

Aug 2017 - Dec 2017

- Upgraded propulsion tubing, including manufacturing tooling, and verified its structural integrity via FEA in ANSYS
- Tested electrical components under vibration, shock, and separation loads for flight qualification

NASA Jet Propulsion Laboratory

Pasadena, CA

MECHANISMS INTERN

May 2016 - Aug 2016

- Fabricated high fidelity 1/20 scale configuration models of Starshade, an external occulter for finding exoplanets, as prototyping tools for science and engineering parties

Publications

- T. M. Huh, **C. Cao**, J. Aderibigbe, D. Moon, H. S. Stuart, "Walk-Burrow-Tug: Legged anchoring analysis using RFT-based granular limit surfaces." (In press.)
- C. Cao**, A. Rogg, A. Tardy, "Actuated Suspension Tuning Characterization of the VIPER Lunar Rover," in *2023 IEEE Aerospace Conference*, Mar. 2023.
- C. Cao**, C. Creager, D. Lieu, H. S. Stuart, "Mobility experiments assessing performance of front-back differential drive velocity on sandy terrain," in *2021 International Society for Terrain-Vehicle Systems Conference (ISTVS)*, Sep. 2021.
- C. Cao**, D. K. Lieu, H. S. Stuart, "Dynamic Analysis of Gyroscopic Force Redistribution for a Wheeled Rover," in *Earth and Space 2021*, Apr. 2021, pp. 318–327. doi: 10.1061/9780784483374.032.
Awarded Best Student Paper.
- L. K. Treers, **C. Cao**, H. S. Stuart, "Granular Resistive Force Theory Implementation for Three-Dimensional Trajectories." *IEEE Robotics and Automation Letters*, Vol 6 (2), p. 1887-1894, Feb. 2021

Teaching Experience

FIRST Robotics Team 5419

Berkeley, CA

LEAD TECHNICAL MENTOR

Sept 2019 - Present

- Mentored 30-60 high school students as they built a 120 pound robot in 7 weeks starting in January
- Fostered students' critical thinking upon facing structural failures, CAD & fabrication inconsistencies, and/or controls and electrical issues

Summer Science Program

Boulder, CO & Socorro, NM

TEACHING ASSISTANT

Summer 2017 & 2019

- Tutored high school seniors in orbital mechanics and programming to track near-Earth asteroids and calculate their orbital elements
- Assisted students with homework and telescope observation sessions and organized social events

Additional Experiences

Aug 2018 - May 2019	ENG25 – Visualization for Design , Graduate Student Instructor	UC Berkeley
Jan 2017	FabLab Irbid , Visiting Lecturer	Irbid, Jordan
Jan 2016	Institute of Vocational Education Tsing Yi , Robotics Mentor	Hong Kong, China
Sept 2011 - Dec 2012	FIRST LEGO League , Robotics Mentor	Bloomfield, MI