BLAKE R. BUCHANAN

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RESEARCH

My research currently spans the fields of biologically inspired robotics, dynamical systems, geometric mechanics, collective behavior, and multi-agent systems.

EDUCATION

Carnegie Mellon University School of Computer Science August 2018 - August 2020
Master of Science in Robotics Cumulative GPA: 3.76 / 4.00
Robotics Institute

University of North Carolina at Charlotte January 2015 - May 2018
Bachelor of Science in Mechanical Engineering Cumulative GPA: 3.487 / 4.000
Department of Mechanical Engineering and Engineering Science
Cum Laude

PRESENTATIONS, PROCEEDINGS, AND PUBLICATIONS

B. Buchanan (2020) "Mechanics and Control of Coupled Interactions in Ambient Media," Master's Thesis, Carnegie Mellon University, Pittsburgh, PA. (PDF)

B. Buchanan, M. Travers, H. Choset, and S. D. Kelly (2020) "Stability and Control of Chaplygin Beanies Coupled to a Platform through Nonholonomic Constraints," *ASME DSCC 2020* (PDF).

T. Dear, B. Buchanan, R. Abrajan-Guerrero, S. D. Kelly, M. Travers, and H. Choset, (2019) "Locomotion of a multi-link nonholonomic snake robot with passive joints," *International Journal of Robotics Research* (PDF).

Buchanan, B. (2019, May). *Modeling and Dynamics of Planar Swimmers Coupled through Wake Vorticity.* Presentation given at the 2019 SIAM Conference on Applications of Dynamical Systems (DS19)

EXPERIENCE

The Robotics Institute at Carnegie Mellon University August 2020 - Present
Biorobotics Lab - Researcher

· Mechanics of collective behavior, nonholonomic mechanics, and swimming locomotion

The Robotics Institute at Carnegie Mellon University August 2018 - August 2020
Biorobotics Lab - Graduate Research Assistant

· Nonholonomic mechanics, Lagrangian reduction, locomotion, multi-agent systems
· Mathematical foundations for snake robot locomotion
· Mathematical modeling of vortex shedding from solid bodies in inviscid fluids

The Robotics Institute at Carnegie Mellon University May 2017 - August 2017
Biorobotics Lab - Mechanical Engineering Intern

· Developed a robot for conducting fundamental research concerning the effects of passive elements on the locomotion of biologically inspired snake robots

UNC Charlotte May 2016 - May 2018
Faculty Lab - Undergraduate Researcher

· Conducted experiments for a passively compliant underactuated snake robot
· Developed an affordable electronics package for RTK-based differential positioning to track small biologically inspired aquatic robots to within decimeter-level accuracy

UNC Charlotte January 2016 - May 2018
Department of Mechanical Engineering - Undergraduate Teaching Assistant

· Delivered supplemental lectures for undergraduate dynamics courses
· Assisted students in learning the PTC Creo CAD package

CONFERENCES ATTENDED

Society for Industrial and Applied Mathematics Conference on Dynamical Systems (2019)

American Society of Mechanical Engineers Dynamic Systems and Control Conference (2020)

COURSE PROJECTS

Bipedal Walking - Optimal Control and Reinforcement Learning (Carnegie Mellon)
Title: Trajectory Optimization for a Five-link Bipedal Walking Robot

· Implemented direct collocation trajectory optimization to find optimal trajectories for a cart-pole swing-up task and a single-step task for a five-link bipedal walking model

Underactuated Robot Swarm - Math Fundamentals for Robotics (Carnegie Mellon)
Title: Investigating the Behavior of an Underactuated Robot Swarm

· Developed a dynamic model for multiple Chaplygin beanies on a movable platform
· Showed dynamic entrainment in passively compliant agents through periodic forcing of one agent

Rigid Bodies and Point Vortices - Kinematics, Dynamics, and Control (Carnegie Mellon)
Title: The Dynamics of a Planar Rigid Body in the Presence of Point Vortices: Stabilizing to the Föppl Equilibrium

· Characterized the basin of attraction for a circular cylinder in Föppl equilbria
· Attempted stabilization of perturbations from Föppl equilibria

Senior Design, Design Optimization of a Swimming Robot (UNC Charlotte)
Researcher / Project Lead

· Optimized the distribution of elastic elements in an underactuated articulated swimming robot model using reinforcement learning

RELEVANT COURSEWORK

Underactuated Robots	Machine Learning	Kinematics, Dynamics, and Control
Math Fundamentals for Robotics	Convex Optimization	Computer Vision
Optimal Control	Advanced Topics in Dynamics	Nonlinear Control

TECHNICAL STRENGTHS

Computer Languages Python, MATLAB, Wolfram Mathematica