BLAKE R. BUCHANAN

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RESEARCH INTERESTS

My research interests lie at the interface of biologically inspired robotics, multi-robot systems, and applied mathematics. More specifically, I am interested in applying methods from dynamical systems, geometric mechanics, and optimal control to endow robots with control strategies capable of leveraging the dynamics of their environment.

EDUCATION

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

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

PUBLICATIONS / TALKS

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)

Buchanan, B., Travers, M. Choset, H., Kelly S. (2020, October). *Stability and Control of Chaplygin Beanies Coupled to a Platform Through Nonholonomic Constraints*. Presentation given at the ASME 2020 Dynamic Systems and Control Conference

EXPERIENCE

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

Geometric optimal control for nonholonomic mechanical systems

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 - Robotics 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

Experiment design and electronics development for biologically inspired terrestrial and aquatic robots

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

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 and implemented control for multiple nonholonomic agents on a movable platform

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 point vortex flows and studied stabilization methods for perturbations about certain 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

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, Julia, MATLAB, Wolfram Mathematica