

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-robot systems.

EDUCATION

Carnegie Mellon University School of Computer Science
Master of Science in Robotics
Robotics Institute

August 2018 - Present
Cumulative GPA: 3.76 / 4.00

University of North Carolina at Charlotte
Bachelor of Science in Mechanical Engineering
Department of Mechanical Engineering and Engineering Science
Cum Laude

January 2015 - May 2018
Cumulative GPA: 3.487 / 4.00

Catawba Valley Community College
Associates in Science

August 2012 - December 2014
Cumulative GPA: 3.66 / 4.00

PRESENTATIONS, PROCEEDINGS, AND PUBLICATIONS

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

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

T. Dear, B. Buchanan, R. Abrejan-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*.

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
Biorobotics Lab - Graduate Research Assistant

August 2018 - Present

- Nonholonomic mechanics, Lagrangian reduction, and locomotion studies pertaining to multi-agent systems
- Mathematical foundations for snake robot locomotion
- Vortex shedding from solid bodies in inviscid fluids

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

May 2017 - August 2017

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

- Studied basic model predictive control algorithms for underactuated nonlinear systems

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
- Wrote and implemented python scripts for execution of differential positioning software on the Raspberry Pi platform

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
- Graded assignments for Engineering Mechanics and Introduction to Engineering courses

CONFERENCES ATTENDED

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

ACADEMIC PROJECTS

Underactuated Robots Graduate Course Project

August 2018 - December 2018

Title: Bifurcation parameters in multi-agent dynamical systems

- Studied the role of bifurcations in multi-agent dynamical systems related to swarms of bees
- Obtained bifurcation plots given the reduced equations for a dynamical system of decision-making in bee swarms

Senior Design, Design Optimization of a Swimming Robot

August 2017 - May 2018

Researcher / Project Lead

- The objective of this project was to optimize the distribution of elastic elements in an underactuated articulated swimming robot
- Studied methods for design optimization with an objective to build and verify a physical realization of the optimized design
- Researched methods from optimal control and reinforcement learning

RELEVANT COURSEWORK

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|--------------------------------|---------------------|-----------------------------------|
| Underactuated Robots | Machine Learning | Kinematics, Dynamics, and Control |
| Math Fundamentals for Robotics | Convex Optimization | Computer Vision |

TECHNICAL STRENGTHS

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|---------------------------|-------------------------------------|
| Computer Languages | Python, MATLAB, Wolfram Mathematica |
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