BLAKE R. BUCHANAN

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SUMMARY

I research and implement novel geometric methods for accomplishing control and coordination for biologically inspired multi-robot systems as part of the research staff in the Biorobotics Lab at Carnegie Mellon University. I am currently seeking career opportunities that allow me to leverage and apply my experience to impactful problems in the fields of artificial intelligence and robotics.

EXPERIENCE

The Robotics Institute at Carnegie Mellon University August 2020 - Present
Biorobotics Lab, Research Staff

- Introduced a novel perspective in finding optimal controls for nonholonomic multi-robot systems in dynamic environments using geometric optimal control techniques
- Investigated the role of symmetries in a robot's shape space for identifying and deploying families of gaits for affecting locomotion and environment manipulation
- Developed software in Python, Julia, and MATLAB programming languages to test and validate dynamical systems and control strategies

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

- Proved stability of an underactuated elastically driven robot in a dynamic environment
- Made progress in proving the stability of a *multi-agent* nonholonomic locomoting system in a dynamic environment
- Developed a simulation and implemented a PID controller for a novel impulsively actuated two-dimensional aquatic vehicle in an inviscid fluid

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

- Designed and developed a robot that contributed to published research concerning the effects of elastic elements on the locomotion of biologically inspired snake robots

University of North Carolina at Charlotte May 2016 - May 2018
Faculty Lab, Undergraduate Research Assistant

- Designed experiments and developed motion control electronics for biologically inspired terrestrial and aquatic robots
- Developed an affordable RTK-based differential positioning Raspberry Pi package to track the position of biologically inspired terrestrial and aquatic robots

University of North Carolina at 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

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

PUBLICATIONS

B. Buchanan, T. Dear, S.D. Kelly, M. Travers, H. Choset, (2021) "The Geometric Structure of Externally Actuated Planar Locomoting Systems in Ambient Media," *arXiv.org Preprint, Submitted to IEEE Transactions on Robotics*, (PDF)

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)

TALKS

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 (mp4)

PROJECTS

Swimming In Potential Flow (GitHub)

- Implemented a two-dimensional fluid model of a flexible Joukowski foil in point vortex flows using the Julia programming language

PID Control for Planar Aquatic Vehicle in Point Vortex Flows (Project Website)

- Developed a dynamic model for a novel fluid-propulsive aquatic vehicle in an ideal fluid that exerts control over its motion using impulsive fluid-ejection events
- Implemented PID control for stabilization of aquatic vehicle about specified set points

NASA Student Launch Initiative 2016-2017 (UNC Charlotte)

- Identified and addressed critical failure modes in both mechanical and electronic designs for launch vehicle and payload subsystems
- Developed and documented protocols for ensuring proper separation of launch vehicle sections, parachute deployment, and altimeter function
- Participated in preliminary design, critical design, flight readiness, and launch readiness reviews and developed associated documentation

Junior Design, Pick-and-place Robot Development (UNC Charlotte)
Engineer / Project Lead

- Developed software and hardware for magnetically manipulating stainless steel spheres
- Ensured project plan was current and that project tasks were completed on time

COURSEWORK

Underactuated Robots / Machine Learning / Kinematics, Dynamics, and Control / Convex Optimization / Optimal Control / Advanced Topics in Dynamics / Computer Vision / Nonlinear Control

PROGRAMMING

Python, Julia, MATLAB, Wolfram Mathematica