JONATHAN M. BOSNICH

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EDUCATION

Northwestern University — Evanston, IL
Ph.D. in Mechanical Engineering — 2021 - Present
Advisor: Professor Todd Murphey
GPA: 3.63/4.00

University of Colorado, Boulder — Boulder, CO
B.S. in Mechanical Engineering, *Summa Cum Laude* — 2016 - 2020
B.A. in Mathematics, *With Distinction* — 2016 - 2020
GPA: 3.91/4.00

Coursework
(*Pure Math*) Point-Set Topology, Real Analysis, Abstract Algebra, Lie Theory (Independent Study)
(*Applied Math*) Data-Driven Dynamical Systems*, Applied Dynamical Systems*, Nonlinear Optimization*, Distributed Optimization*, Linear Systems*, Active Learning*, Stochastic Processes*, Numerical Analysis
(*graduate course)

Programming
Python, MATLAB, Julia, ROS

PAPERS IN PREPARATION

J. M. Bosnich, G. Mamakoukas, T. D. Murphey, "Data-Driven Minimal-Norm Stabilization of Nonlinear Systems Using the Koopman Operator"

RESEARCH EXPERIENCE

Interactive & Emergent Autonomy Lab, Northwestern University — Evanston, IL
Graduate Research Assistant — 2021 - Present
Advisor: Professor Todd Murphey

- Developing a minimal-norm data-driven controller that guarantees stabilization of nonlinear systems
- Learned model from data using the Koopman operator/residual dynamic mode decompsoition (ResDMD)
- Derived explicit error bounds on model eigenvalues by extending ResDMD to control-affine systems
- Applied matrix nearness optimization to develop minimal-norm feedback gains that guarantee stability

Bio-Inspired Perception and Robotics Lab, University of Colorado — Boulder, CO
Undergraduate Research Assistant — 2018 - 2020
Advisor: Professor Sean Humbert

- Extracted state information from a system of distributed sensors by projecting data onto basis functions
- Developed a data-driven method for choosing optimal basis functions by solving integral operator equations
- Used a Galerkin approximation of the singular value expansion to solve integral operator equations
- Investigated analytic and data-driven methods for modeling and controlling an array of soft actuators

Mathematics Department, University of Colorado — Boulder, CO
Independent Research in Lie Theory — Spring 2020
Advisor: Professor Keith Kearnes

- Worked on the unsolved classification of 10-dimensional simple Lie algebras over the two-element field
- Used the adjoint representation and spectral graph theory to study the only known Lie algebra of this type
- Formulated and programmed criteria for admissible Lie algebras, reducing 2048 possibilities to at most 85

Collective Dynamics and Control Lab, University of Maryland College Park, MD
Research Intern, Bio-Inspired Robotics REU Summer 2019
Advisor: Professor Derek Paley

- Created a soft-robotic gripper that adapts the force it applies to an object via sensory feedback control
- Implemented PID control law in MATLAB, fabricated the soft gripper, and integrated the system
- Delivered final presentation to the REU cohort, lab members, and PIs, and was awarded best presentation

Mathematics Department, University of Colorado Boulder, CO
Research Intern, Mathematics REU Summer 2018
Advisor: Professor Nathaniel Thiem

- Sought an algebraic relationship relating the partitions of an integer n and of a set with n elements
- Employed techniques from algebraic combinatorics and graph theory to search for this relationship

ENGINEERING EXPERIENCE

Spectra Logic Corporation Boulder, CO
Systems Engineer Intern 2020 - 2021

- Wrote a Python program that queried and analyzed CAN communication metrics stored in a SQL database
- Identified performance degradation by visualizing data from different sources in a single multi-plot chart
- Conducted tests, collected data, and performed statistical analysis to investigate robot positioning issues

Mechanical Engineering Capstone Project Boulder, CO
Systems Engineer 2019 - 2020
Client: National Oceanic and Atmospheric Administration (NOAA)

- Designed hardware and software for aircraft-mounted atmospheric LiDAR scanner to track wildfires
- Implemented feedback controller in LabVIEW that ensured a steady scan in the presence of aircraft motion

TEACHING EXPERIENCE

Mechanical Engineering 314 - Machine Dynamics, Northwestern University Evanston, IL
Teaching Assistant Spring 2023
Grader Fall 2023

- Taught total of 17 lectures, and received high praise from the students and instructor (Todd Murphey)
- Topics I covered: Euler-Lagrange equations, constraints, external forces, Noether's theorem, impacts

Math Academic Resource Center, University of Colorado Boulder, CO
Tutor 2018 - 2020

Applied Mathematics Department, University of Colorado Boulder, CO
Learning Assistant for Calculus I & II 2017 - 2018

TEAMS Elementary School Engineering Program Longmont, CO
Group Leader 2015 - 2017

HONORS

Ted Belytschko Fellowship (one of two recipients; Northwestern Mechanical Engineering)	2021
Walter P. Murphy Fellowship (Northwestern Mechanical Engineering)	2021
NSF GRFP Honorable Mention	2021
Outstanding Undergraduate of the College of Engineering (CU, Boulder)	2020
Outstanding Undergraduate of the Mechanical Engineering Department (CU, Boulder)	2020
College of Engineering Dean's list (CU, Boulder)	2016 - 2020
Engineering Honors Program (CU, Boulder)	2016 - 2020
Phi Beta Kappa (academic fraternity; CU, Boulder)	2018 - 2020
Pi Mu Epsilon (math honor society; CU, Boulder)	2018 - 2020
Valedictorian (Berthoud High School)	2016