

JONATHAN M. BOSNICH

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EDUCATION

Northwestern University

Ph.D. in Mechanical Engineering
Advisor: Professor Todd Murphey
GPA: 3.63/4.00

Evanston, IL
2021 - Present

University of Colorado, Boulder

B.S. in Mechanical Engineering, *Summa Cum Laude*
B.A. in Mathematics, *With Distinction*
GPA: 3.91/4.00

Boulder, CO
2016 - 2020
2016 - 2020

Coursework

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

Programming

Python, MATLAB, Julia, LabVIEW, 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

Graduate Research Assistant
Advisor: Professor Todd Murphey

Evanston, IL
2021 - Present

- Developing a data-driven minimal-control-effort stabilizing feedback controller for nonlinear systems
- Used the Koopman operator framework to learn an approximately linear representation
- Derived explicit error bounds on learned eigenvalues by extending ResDMD to include control systems
- Applied feedback to the (LTI) Koopman dynamics that guarantees minimal-norm feedback gains via matrix nearness optimization

Bio-Inspired Perception and Robotics Lab, University of Colorado

Undergraduate Research Assistant
Advisor: Professor Sean Humbert

Boulder, CO
2018 - 2020

- 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

Mathematics Department, University of Colorado

Independent Research in Lie Theory
Advisor: Professor Keith Kearnes

Boulder, CO
Spring 2020

- 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 new Lie algebras, reducing 2048 possibilities to at most 85

Collective Dynamics and Control Lab, University of Maryland

Research Intern, Bio-Inspired Robotics REU

Advisor: Professor Derek Paley

College Park, MD

Summer 2019

- 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

Research Intern, Mathematics REU

Advisor: Professor Nathaniel Thiem

Boulder, CO

Summer 2018

- 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

Systems Engineer Intern

Boulder, CO

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

Systems Engineer

Boulder, CO

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

Graduate Teaching Assistant

Grader

Evanston, IL

Spring 2023

Fall 2023

- Taught 12 lectures in the Spring and 5 lectures in the Fall, covering topics such as constrained systems and Noether's theorem
- Received only positive course evaluations, with an emphasis on my approachability and helpfulness

Math Academic Resource Center, University of Colorado

Tutor

Boulder, CO

2018 - 2020

Applied Mathematics Department, University of Colorado

Learning Assistant for Calculus I & II

Boulder, CO

2017 - 2018

TEAMS Elementary School Engineering Program

Group Leader

Longmont, CO

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