

# Daniel Bruder

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## Education

### **University of Michigan**

Ph.D., Mechanical Engineering, 2020  
M.S., Mechanical Engineering, 2020  
Fields: Robotics and Control

### **Harvard University**

B.S., Engineering Sciences, 2013  
Honors: Magna Cum Laude

## Research

### **School of Engineering and Applied Sciences, Harvard University**

Postdoctoral Researcher, 2020-present

### **Mechanical Engineering Dept, University of Michigan**

Graduate Student Researcher, 2015-2020  
Project: Design, modeling, and control of soft robots

### **School of Engineering and Applied Sciences, Harvard University**

Undergraduate Student Researcher, 2011  
Project: Design of mitral valve repair surgical device

## Teaching

### **Mechanical Engineering Dept, University of Michigan**

Graduate Student Instructor, Robot Kinematics and Dynamics, 2017  
Graduate Student Instructor, Designs in Nature and Engineering, 2016

### **Jalen Rose Leadership Academy, Promise Schools Detroit**

Full-time Mathematics Teacher, Algebra and Geometry, 2013-2015

### **School of Engineering and Applied Sciences, Harvard University**

Design Specialist, Capstone Design Course, 2012-2013

### **Physics Dept, Harvard University**

Teaching Assistant, Lab Electronics: Analog and Digital Circuit Design, 2011

### **Mathematics Dept, Harvard University**

Course Assistant, Calculus, Series, and Differential Equations, 2009-2010  
Course Assistant, Functions and Calculus, 2009

## Awards and Fellowships

### **NSF Graduate Research Fellowship**

National Science Foundation, 2017-2020

### **Richard and Eleanor Towner Prize for Outstanding Ph.D. Research**

University of Michigan, 2019

### **NextProf Nexus Travel Grant**

Georgia Institute of Technology, 2019

### **Best Systems Paper Finalist, Best Student Paper Finalist**

Robotics: Science and Systems Conference, 2019

### **RSS Pioneers Travel Grant**

Robotics: Science and Systems Conference, 2019

### **Honorable Mention, Ford Foundation Fellowship**

National Academies of Sciences, Engineering, and Medicine, 2017

## Languages and Skills

English (native), Spanish (basic)

Matlab, L<sup>A</sup>T<sub>E</sub>X, Solidworks, Python, HTML

## Publications

### **Journal Papers**

- [J1] D. Bruder, X. Fu, B. Gillespie, C. D. Remy, and R. Vasudevan. Koopman-based control of a soft continuum manipulator under variable loading conditions. 2021 (*Accepted to IEEE Robotics and Automation Letters*)
- [J2] D. Bruder, X. Fu, and R. Vasudevan. Advantages of bilinear koopman realizations for the modeling and control of systems with unknown dynamics. *IEEE Robotics and Automation Letters*, 6(3):4369–4376, 2021. doi: 10.1109/LRA.2021.3068117
- [J3] D. Bruder, X. Fu, R. B. Gillespie, C. D. Remy, and R. Vasudevan. Data-driven control of soft robots using koopman operator theory. *IEEE Transactions on Robotics*, pages 1–14, 2020. doi: 10.1109/TRO.2020.3038693
- [J4] D. Bruder, A. Sedal, R. Vasudevan, and C. D. Remy. Force generation by parallel combinations of fiber-reinforced fluid-driven actuators. *IEEE Robotics and Automation Letters*, 3(4):3999–4006, Oct 2018. ISSN 2377-3766. doi: 10.1109/LRA.2018.2859441

- [J5] A. Sedal, D. Bruder, J. Bishop-Moser, R. Vasudevan, and S. Kota. A continuum model for fiber-reinforced soft robot actuators. *Journal of Mechanisms and Robotics*, 10(2):024501, 2018

### Conference Papers

- [C1] S.M. Danforth, M. Kohler, D. Bruder, A.R. Davis Rabosky, and T.Y. Moore. Emulating duration and curvature of coral snake anti-predator thrashing behaviors using a soft-robotic platform. 2020. (*Accepted to ICRA 2020*)
- [C2] D. Bruder, B. Gillespie, C. D. Remy, and R. Vasudevan. Modeling and control of soft robots using the koopman operator and model predictive control. In *Proceedings of Robotics: Science and Systems*, FreiburgimBreisgau, Germany, June 2019a. doi: 10.15607/RSS.2019.XV.060
- [C3] D. Bruder, C. D. Remy, and R. Vasudevan. Nonlinear system identification of soft robot dynamics using koopman operator theory. In *Robotics and Automation (ICRA), 2019 IEEE International Conference on*. IEEE, 2019b
- [C4] D. Bruder, A. Sedal, J. Bishop-Moser, S. Kota, and R. Vasudevan. Model based control of fiber reinforced elastofluidic enclosures. In *Robotics and Automation (ICRA), 2017 IEEE International Conference on*, pages 5539–5544. IEEE, 2017
- [C5] A. Sedal, D. Bruder, J. Bishop-Moser, R. Vasudevan, and S. Kota. A constitutive model for torsional loads on fluid-driven soft robots. In *ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, pages V05AT08A016–V05AT08A016. American Society of Mechanical Engineers, 2017

### Workshop and Meeting Presentations

- [P1] D. Bruder. Leveraging Data and the Koopman Operator to Build Control-oriented Models of Soft Robots. *Modeling Soft Robots: A Discussion on Capabilities and Limitations of Numerous Techniques*. 2020
- [P2] D. Bruder. Modeling and Control of Soft Robots Using the Koopman Operator. *Engineering Research Symposium, University of Michigan*. 2019
- [P3] D. Bruder, R. Vasudevan. Leveraging Data to Model and Control Soft Robots. *Robotics: Science and Systems Pioneers*. 2019

- [P4] T. Y. Moore, D. Bruder, A. Davis Rabosky, R. Vasudevan. Decoupling Coupled Anti-Predator Signals with a Bio-Inspired Snake Robot. *Society for Integrative and Comparative Biology Annual Meeting*. 2019
- [P5] D. Bruder, A. Sedal, R. Vasudevan, and C. D. Remy. Model-Based Method for Estimating the Workspace of Soft Manipulators. *Workshop on Soft Robot Modeling and Control at IROS*. 2018
- [P6] D. Bruder, A. Sedal, R. Vasudevan, and C. D. Remy. Model-Based Control of Parallel Combinations of Soft Actuators. *Midwest Robotics Workshop (poster)*. 2018
- [P7] R. B. Gillespie, C. D. Remy, D. Bruder, A. Sedal. Don't Bite the Hand that Feeds You: Soft Robots For Eldercare. *Toyota Research Institute Annual Meeting*. 2018
- [P8] D. Bruder, A. Sedal, J. Bishop-Moser, S. Kota, and R. Vasudevan. Model Based Control of Fiber Reinforced Elastofluidic Enclosures. *Midwest Robotics Workshop (poster)*. 2017
- [P9] D. Bruder, R. Vasudevan, C.D. Remy. Design and Modeling of Soft Robotic Arm Modules. *Toyota Research Institute Annual Meeting (poster)*. 2017

## Service & Outreach

### **Reviewer**

T-RO, RA-L, T-MECH, ICRA, IROS, RoboSoft, Soft Robotics, Mechatronics, Automatica

### **REACT Workshop for K-12 Educators**

Robotics Track Lead, 2020

Robotics Activity Coordinator, 2019

### **RSS Pioneers**

Program Committee Member, 2020

### **FIRST Robotics Competition**

Mentor, 2015-2018

Press

**How To Do Grad School (podcast)**

[Daniel Bruder - Teaching, Collaborations, & Getting Started in Research](#),  
Sept. 24, 2020

**The Michigan Engineer News Center**

[Grad student's ventilator design sparks conversations with doctors and engineers](#),  
Apr. 17, 2020