

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 **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

NSF Graduate Research Fellowship
National Science Foundation, 2017-2020

Honorable Mention, Ford Foundation Fellowship
National Academies of Sciences, Engineering, and Medicine, 2017

Languages and Skills English (native), Spanish (basic)
Matlab, L^AT_EX, Solidworks, Python, HTML

Publications **Journal Papers**

[J1] D. Bruder, X. Fu, B. Gillespie, C. D. Remy, and R. Vasudevan. Data-driven control of soft robots using koopman operator theory. 2019a (*Accepted to IEEE Transactions on Robotics*)

[J2] 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

[J3] 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*, Freiburg/Breisgau, Germany, June 2019b. 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, 2019c
- [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 and Outreach

Reviewer

T-RO, ICRA, IROS, Soft Robotics

REACT Workshop for K-12 Educators

Robotics Track Lead, 2020

Robotics Activity Coordinator, 2018

RSS Pioneers

Program Committee Member, 2020

FIRST Robotics Competition

Mentor, 2015-2018

References

Ram Vasudevan
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Sridhar Kota
 Mechanical Engineering Dept.
 University of Michigan
 kota@umich.edu,+1 (734) 936-0357

C. David Remy
 Institute for Nonlinear Mechanics
 University of Stuttgart
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Brent Gillespie
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