

# NOEL M. NAUGHTON

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## EDUCATION

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<b>PH.D. IN MECHANICAL ENGINEERING</b> University of Illinois at Urbana-Champaign, Urbana, IL	2016 – 2019
<b>M.S. IN MECHANICAL ENGINEERING</b> University of Illinois at Urbana-Champaign, Urbana, IL	2014 – 2016
<b>B.S. IN MECHANICAL ENGINEERING   MINOR IN CATHOLIC STUDIES; <i>magna cum laude</i></b> University of Saint Thomas, Saint Paul, MN	2010 – 2014

## FELLOWSHIPS & GRANTS

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<b>BECKMAN INSTITUTE POSTDOCTORAL FELLOWSHIP</b> Three-year independent research fellowship & \$25,000 research grant (total: \$200,000)	2021 – present
<b>MISTLETOE RESEARCH FELLOWSHIP</b> Unfettered Research Grant (\$10,000) & Mistletoe Startup Collaboration participant	2020 – 2021
<b>NSF GRADUATE RESEARCH FELLOWSHIP</b> Three-year fellowship providing tuition support and living stipend (total: \$100,000)	2016 – 2019
<b>XSEDE STARTUP ALLOCATION</b> 100,000 CPU hours & 1000 GPU hours on SDSC Comet cluster	2018 – 2019

## PEER-REVIEWED PUBLICATIONS

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Chang HS, Halder U, Shih CH, **NAUGHTON N**, Gazzola M, and Mehta P. *Energy Shaping Control of a Muscular Octopus Arm Moving in Three Dimensions*. PROCEEDINGS OF THE ROYAL SOCIETY A, 2023; 479:20220593 [10.1098/rspa.2022.0593](https://doi.org/10.1098/rspa.2022.0593)

Zhang X, **NAUGHTON N**, Parthasarathy T, and Gazzola M. *Friction modulation in limbless, three-dimensional gaits and heterogeneous terrains*. NATURE COMMUNICATIONS, 2021; 12:6076. [10.1038/s41467-021-26276-x](https://doi.org/10.1038/s41467-021-26276-x).

**NAUGHTON N**, Sun J, Tekinalp A, Chowdhary G, and Gazzola M. *Elastica: A compliant mechanics environment for soft robotic control*. IEEE ROBOTICS AND AUTOMATION LETTERS, 2021; 6(2):3389-3396. [10.1109/LRA.2021.3063698](https://doi.org/10.1109/LRA.2021.3063698).

Chang HS, Halder U, Gribkova E, Tekinalp A, **NAUGHTON N**, Gazzola M, and Mehta P. *Controlling a CyberOctopus soft arm with muscle-like actuation*. 60<sup>th</sup> IEEE CONFERENCE ON DECISION AND CONTROL (CDC), 2021; p.1383-1390. [10.1109/CDC45484.2021.9683318](https://doi.org/10.1109/CDC45484.2021.9683318).

Sullivan D, Wu X, Gallo N, **NAUGHTON N**, Georgiadis J, and Pelegri A. *Sensitivity analysis of effective transverse viscoelastic and diffusional properties of tissue with myelinated axons*. PHYSICS IN MEDICINE AND BIOLOGY, 2021; 66(3)s:035027. [10.1088/1361-6560/aba0cc](https://doi.org/10.1088/1361-6560/aba0cc)

**NAUGHTON N**, Tennyson C, and Georgiadis J. *Lattice Boltzmann method for simulation of diffusion magnetic resonance imaging physics in multiphase tissue models*. PHYSICAL REVIEW E, 2020; 102.4:043305. [10.1103/PhysRevE.102.043305](https://doi.org/10.1103/PhysRevE.102.043305).

**NAUGHTON N** and Georgiadis J. *Global sensitivity analysis of skeletal muscle dMRI: Effects of microstructural and pulse parameters*. MAGNETIC RESONANCE IN MEDICINE, 2020; 83:1458-1470. [10.1002/mrm.28014](https://doi.org/10.1002/mrm.28014)

**NAUGHTON N** and Georgiadis J. *Comparison of two-compartment exchange and continuum models of dMRI in skeletal muscle*. PHYSICS IN MEDICINE AND BIOLOGY, 2019; 64(15):155004. [10.1088/1361-6560/ab2aa6](https://doi.org/10.1088/1361-6560/ab2aa6)

**NAUGHTON N** and Georgiadis J. *Connecting Diffusion MRI to Skeletal Muscle Microstructure: Leveraging Meta-Models and GPU-acceleration*. PROCEEDINGS OF THE PRACTICE AND EXPERIENCE IN ADVANCED RESEARCH COMPUTING (PEARC '19). 2019; p7. [10.1145/3332186.3333054](https://doi.org/10.1145/3332186.3333054)

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NAUGHTON N, Plourde B, Stark J, Hodis S, Abraham J. *Impacts of waveforms on the fluid flow, wall shear stress, and flow distribution in cerebral aneurysms and the development of a universal reduced pressure*. JOURNAL OF BIOMEDICAL SCIENCE AND ENGINEERING. 2014; 7(01):7. [10.4236/jbise.2014.71002](https://doi.org/10.4236/jbise.2014.71002).

### PUBLICATIONS IN PROCESS (AVAILABLE UPON REQUEST)

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#### SUBMITTED

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Shih CH, NAUGHTON N, Halder U, Chang HS, Kim SH, Gillette R, Mehta P, and Gazzola M. *Hierarchical control and learning of a foraging CyberOctopus*. [arXiv:2302.05811](https://arxiv.org/abs/2302.05811). (In revision; Advanced Intelligent Systems).

Tekinapl A, NAUGHTON N, Kim SH, Halder U, Mehta P, Kier W, and Gazzola M. *Topology, dynamics, and control of an octopus-analog muscular hydrostat*. [arXiv:2304.08413](https://arxiv.org/abs/2304.08413).

Cahoon S, Gallo N, Harris C, Washington T, NAUGHTON N, Julian A, Stanevicutie A, Georgiadis J, Vaicik M. *Correlating the Regional Microstructure of Decellularized Porcine Myocardium to Shear Mechanics*. (Submitted).

#### IN PREPARATION

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NAUGHTON N, Shivam K, Tekinapl A, Kim SH, and Gazzola M. *Control of a neuromuscular soft arm with reservoir computing*. (In preparation).

NAUGHTON N, Cahoon S, Gallo N, and Georgiadis J. *Accelerated, physics-based inversion of diffusion MRI signal for inference of skeletal muscle microstructure*. (In preparation).

NAUGHTON N, Cahoon S, and Georgiadis J. *Histology-based simulations of dMRI in skeletal muscle*. (In preparation).

Guzman RP, NAUGHTON N, Majumdar S, Damon B, and Kersh ME. *Assessment of mechanically induced changes in fiber microstructure using diffusion tensor imaging*. (In preparation).

### AWARDS

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BECKMAN IMAGE OF RESEARCH AWARD – University of Illinois at Urbana-Champaign	2022
MAGNETIC MOMENT VIDEO FINALIST – ISMRM Annual Meeting, Montreal, Canada	2019

### PROFESSIONAL EXPERIENCE

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BECKMAN INSTITUTE POSTDOCTORAL FELLOW – U. of Illinois at Urbana-Champaign Project: <i>Modeling dMRI tractography-based muscle architectures with Cosserat rods</i>	2021 – present
MISTLETOE STARTUP COLLABORATION – Momental Foundation, Redwood, CA Provided consulting services to startup company <i>JetPack Aviation</i> developing thermal insulation system for protection of electrical components.	2020 – 2021
POSTDOCTORAL RESEARCH ASSOCIATE – University of Illinois at Urbana-Champaign Project: <i>A CyberOctopus that Learns, Evolves, and Adapts</i>	2020 – 2021
ASSISTANT ROWING COACH – University of Illinois Rowing Club, Urbana, IL	2015 – 2018
GRADUATE RESEARCH ASSISTANT – University of Illinois at Urbana-Champaign	2014 – 2016
DESIGN ENGINEER – Water Tank Solutions, St. Paul, MN	2014

### TEACHING EXPERIENCE

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GRADUATE TEACHING ASSISTANT – University of Illinois at Urbana-Champaign, Urbana, IL Introduction to Heat Transfer Lab – Fall 2019 List of teachers ranked as excellent by their students; received additional designation of <b>outstanding</b> .	2019
Conductive Heat Transfer	2017

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### UNDERGRADUATE TEACHING ASSISTANT – University of St. Thomas, St. Paul, MN

Introduction to Fluid Mechanics Lab	2014
Finite Element Analysis	2014
Introduction to Heat Transfer	2013

### COMMUNITY OUTREACH & SERVICE

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GOOGLE SUMMER OF CODE – Lead (2022) and associate (2023) mentor for PyElastica suborg.	2022, 2023
NCSA-NVIDIA AI HACKATHON – Developed hackathon problem and served as jury member	2020
STEM OUTREACH CLASSROOM EVENT – Urbana Middle School, Urbana, IL	2019
MENTORING UNDERGRADUATES IN SCIENCE AND ENGINEERING (MUSE)	2018 – 2019
Mentored two undergraduate students in data processing and visualization	
STEM OUTREACH CLASSROOM TALK – Trinity at River Ridge High School, Eagan, MN	2014
AFTERSCHOOL STEM TUTOR – Tutor-Mentor Program, University of St. Thomas	2011 – 2012

### INVITED TALKS

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“Understanding the mechanics and control of octopus arms.” Lecture and Performance Series, January 24, 2022. Trinity at River Ridge High School, Eagan, MN (Lecture to entire student body).

“Using lattice Boltzmann simulations to analyze dMRI physics in skeletal muscle.” Anomalous Relaxation and Diffusion Study Group, September 17, 2020. Centre for Advanced Imaging, The University of Queensland, Australia. Virtual talk.

### PROFESSIONAL SOCIETIES

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American Society of Mechanical Engineers (ASME)  
American Physical Society (APS)  
International Society for Magnetic Resonance in Medicine (ISMRM)  
Society of Catholic Scientists (SCS)

### PROFESSIONAL SERVICE

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#### PEER REVIEWING - JOURNALS

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Science Robotics  
IEEE Transactions on Robotics  
IEEE Robotics and Automation Letters  
Journal of Experimental Biology

#### PEER REVIEWING - CONFERENCES

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IEEE International Conference on Robotics and Automation (ICRA)  
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)  
IEEE International Conference on Soft Robotics (RoboSoft)  
ASME Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)  
International Conference on Biomimetic and Biohybrid Systems (Living Machines Conference)

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### PATENTS

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Plourde B, Abraham J, Plourde D, Pakonen R, Gikling A, and **NAUGHTON N.** WTS LLC, 2016. *Fluid heating system*. U.S. Patent Application 14/954,292.

### CONFERENCE ABSTRACTS

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**NAUGHTON N**, Ostadi Moghaddam A, Kersh M, Koyejo S, Wagoner Johnson A, and Damon B. *Diffusion MRI characterizes microstructural changes of the cervix during pregnancy*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB<sup>3</sup>C). Vail, Colorado (June 2023).

**NAUGHTON N**, Ostadi Moghaddam A, Kersh M, Koyejo S, Majumdar S, Wagoner Johnson A, and Damon B. *Diffusion Tensor Imaging of tendon and ligament: Influence of crimping behavior and microstructural variations*. International Society of Magnetic Resonance in Medicine (ISMRM). Toronto, Canada (June 2023).

Tekinapl A, **NAUGHTON N**, Kim SH, Halder U, Mehta P, Kier W, and Gazzola M. *Topology, dynamics, and control of an octopus muscular hydrostat*. APS March Meeting, Las Vegas, Nevada, (March 2023).

Pineda Guzman R, **NAUGHTON N**, Majumdar S, and Kersh M. *Effect of Fatigue Loading on Microstructural and Diffusion Imaging Properties of Ligament-Mimicking Fibers*. Orthopaedic Research Society (ORS) 2023 Annual Meeting. Dallas, Texas (February 2023).

Pineda Guzman R, **NAUGHTON N**, Sutton B, and Kersh M. *Predicting the mechanics of knee ligaments via Diffusion Weighted Imaging (DWI) and tissue-mimicking model materials*. Summer Biomechanics, Bioengineering, and Biotransport Conference (SB<sup>3</sup>C). Cambridge, Maryland (June 2022).

**NAUGHTON N**, Ciobanu L, Majumdar S, Gazzola M, and Sutton B. *Octopus rubescens as a model for the development and validation of muscle DTI tractography*. International Society of Magnetic Resonance in Medicine (ISMRM). London, England (May 2022).

**NAUGHTON N** and Georgiadis J. *A lattice Boltzmann method for simulation of diffusion-weighted MRI in biological tissue*. APS March Meeting, (March 2021), Virtual Meeting.

Zhang X, **NAUGHTON N**, Parthasarathy T, and Gazzola M. *Terrestrial limbless gait selection through friction modulation*. APS March Meeting, (March 2021), Virtual Meeting.

Cahoon S, Gallo N, **NAUGHTON N**, Anderson A, and Georgiadis J. *Regional Intrinsic Properties of Axons and Glia from in vivo MRElastography of Human Corpus Callosum*. Biomedical Engineering Society Annual Meeting, (October 2020), Virtual Meeting.

Gallo N, Cahoon S, Anderson A, **NAUGHTON N**, Pelegri A, and Georgiadis J. *Variation of In Vivo Anisotropic MRE Metrics in Corpus Callosum: Effect of Aging*. International Society of Magnetic Resonance in Medicine Annual Meeting (August 2020), Virtual Meeting. **Magna Cum Laude**

**NAUGHTON N**, Gallo N, Anderson A, and Georgiadis J. *Comparison of dMRI Models for Skeletal Muscle Microstructure Estimations with Numerical Simulations and Myocardial Porcine Phantom*. International Society of Magnetic Resonance in Medicine Annual Meeting (May 2019), Montreal, Canada.

**NAUGHTON N**, Jain A, and Georgiadis J. *Polynomial Meta-Model of Bloch-Torrey Equation for Track-based Regularization of Microstructural Inversion*. International Society of Magnetic Resonance in Medicine Annual Meeting (May 2019), Montreal, Canada.

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**NAUGHTON N**, Wang A, and Georgiadis J. *Fascicle Ellipticity as an Explanation of Transverse Anisotropy in Diffusion MRI Measurements of Skeletal Muscle*. International Society of Magnetic Resonance in Medicine Annual Meeting (May 2019), Montreal, Canada.

**NAUGHTON N**, Gallo N, Anderson A, and Georgiadis J. *Microstructural Parameter Estimation of Skeletal Muscle using Random Forest Model of dMRI*. International Society of Magnetic Resonance in Medicine Annual Meeting (May 2019), Montreal, Canada.

**NAUGHTON N**, Gallo N, Vaicik M, Anderson A, Sutton B, and Georgiadis J. *Estimation of Extracellular Matrix Diffusion Properties in Decellularized Porcine Myocardium from DTI*. International Society of Magnetic Resonance in Medicine Annual Meeting (June 2018), Paris, France.

**NAUGHTON N** and Georgiadis J. *Effect of Exercise on Myocellular Lipid Content and Diffusion Tensor Imaging Measurements*. Biomedical Engineering Society Annual Meeting (October 2017), Phoenix, Arizona.

**NAUGHTON N** and Georgiadis J. *Effect of Sarcolemma Water Permeability on Muscle DTI Measures Following Exercise*. Biomedical Engineering Society Annual Meeting, (October 2016), Minneapolis, Minnesota.