Kathleen Fitzsimons

Northwestern University
Mechanical Engineering
Neuroscience and Robotics Laboratory

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EDUCATION

Ph.D. Candidate, Mechanical Engineering
Northwestern University, Evanston, IL — Anticipated 2020
Thesis: Physical Human-Robot Interaction for Assistance and Training Using Information Metrics
Advisor: Todd D. Murphey, Ph.D.

M.S., Mechanical Engineering
Northwestern University, Evanston, IL — 2017
Thesis: Model-based Assistance for Human-in-the-loop Control

B.S., Mechanical Engineering
Michigan State University, East Lansing, MI — 2013

RESEARCH EXPERIENCE

Neuroscience and Robotics Laboratory — September 2014 – Present
Northwestern University, Evanston, IL

- Developed haptic interface based on dynamic assessment and conducted human subject experiments to show efficacy of assistance.
- Conducted two large scale experiments using a minimal intervention principle for task-based assistance and training through physical human robot interaction.
- Characterized information content as a measure of the quality of motion for the purposes of distinguishing between persons with deficits.

NSF Center for Compact and Efficient Fluid Power
Undergraduate Research Assistant, University of Illinois Urbana-Champaign — May – August 2013

- Assessed options for portable power of walk-assist device in Human Dynamics & Controls Lab.

Orthopaedic Biomechanics Laboratory — September 2009 – December 2013
Undergraduate Research Assistant, Michigan State University, East Lansing, MI

- Generated a computational model of the foot-ankle complex, validated with cadaveric data.
- Developed subject-specific models for torque prediction using plantar pressure sensors.

TEACHING EXPERIENCE

Teaching Assistant, Northwestern University — April – June 2018

- Collaborated with my advisor to develop a course in Active Learning.
- Wrote and delivered five lectures on topics related to optimal control, active search, and information-based control.

Grader, Northwestern University September 2015 – Present

- Graded assignment and participated in office hours for Machine Dynamics during Fall 2015–2018.
- Held weekly office hours in addition to grading assignments and reports for Mechanics of Sports during Spring 2017–2018

Tutor, MSU Mechanical Engineering Learning Center September – December 2013

- Held open office hours for students enrolled in Dynamics, Mechanics of Deformable Solids, and Thermodynamics.

HONORS and AWARDS

- National Defense Science & Engineering Graduate Research Fellowship 2016
- Northwestern Univ. Mechanical Engineering Graduate Leadership and Service Award 2015
- National Science Foundation Graduate Research Felloship 2014
- Tau Beta Pi Endowed Scholarship 2013
- Tau Beta Pi Conrad Supplemental Award Scholarship 2013
- Agnes Hunt and Claude Marshall Cade Endowed Scholarship 2012
- Dr. Charles R. St. Clair, Jr. Endowed Scholarship 2012
- Charles and Mary Jane Spalding Engineering Scholarship 2011

PUBLICATIONS

[10] A. Prabhakar, **K. Fitzsimons**, and T. D. Murphey. Information-based control for Learning from Demonstration. In Progress.

[9] **K. Fitzsimons**, A. Kalinowska, J. P. Dewald, and T. D. Murphey. Task-Based Hybrid Shared Control for Training Through Forceful Interaction. *International Journal of Robotics Research*. Submitted.

[8] **K. Fitzsimons**, A. M. Acosta, J. P. Dewald, and T. D. Murphey. Ergodicity Reveals Assistance and Learning from Physical Human-Robot Interaction. *Science: Robotics.* 4(29), 2019.

[7] T. Berrueta, A. Pervan, **K. Fitzsimons**, and T. D. Murphey. Dynamical System Segmentation for Information Measures in Motion. *Robotics and Automation Letters*, 4(1):169–176, 2018.

[6] A. Kalinowska, **K. Fitzsimons**[1], J. P. Dewald, and T. D. Murphey. Online User Assessment for Minimal Intervention During Task-Based Robotic Assistance. In *Robotics: Science and Systems*, 2018.

[5] **K. Fitzsimons**, E. Tzorakoleftherakis, and T. D. Murphey. Optimal human-in-the-loop interfaces based on Maxwell's Demon. In *American Control Conference (ACC)*, pages 4397–4402, July 2016.

[4] B. T. Weaver, **K. Fitzsimons**, J. Braman, and R. Haut. The role of shoe design on the prediction of free torque at the shoe–surface interface using pressure insole technology. *Sports biomechanics*, 15(3):370–384, 2016.

[1] A. Kalinowska and K.Fitzsimons contributed equally to this work.

[3] B. T. Weaver, **K. Fitzsimons**, J. E. Braman, and R. C. Haut. Torque prediction at the shoe–surface interface using insole pressure technology. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, 227(4):219–225, 2013.

[2] B. T. Weaver, **K. Fitzsimons**, J. E. Braman, and R. C. Haut. The Use of Plantar Insole Pressure Sensors to Predict the Free Torque Produced at the Shoe-Surface Interface During Internal Rotation of the Body Relative to a Planted Foot. In *ASME Bioengineering Conference*, pages V01BT38A003–V01BT38A003. American Society of Mechanical Engineers, 2013.

[1] K. D. Button, F. Wei, E. G. Meyer, **K. Fitzsimons**, and R. C. Haut. Determination of in situ ankle ligament strains in cases of high and medial ankle sprains. In *ASME Bioengineering Conference*, pages 275–276. American Society of Mechanical Engineers, 2012.

PROFESSIONAL ACTIVITIES

Reviewer for Robotics: Science and Systems 2019
IEEE, Student Member 2015-Present
Mechanical Engineering Graduate Student Society Executive Board 2015-Present

- Professional Development Chair 2018
- Social Activities Chair 2016
- Recruitment Chair 2015
- Peer Mentor 2015-2018

Tau Beta Pi, *Vice President* December 2012-December 2013
Pi Tau Sigma, *Vice President & Secretary* May 2013-December 2013
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INVITED TALKS

An Information-Theoretic Approach to Evaluation and Control of Human-Robot Motion.
University of Minnesota, MN Feb. 2019
Michigan State University, MI April 2019