MATTHEW KELLY

(845) · 594 · 1517 ◇ mpk72@cornell.edu
1070 Teeter Road ◇ Ithaca, NY 14850

EDUCATION

Cornell University, Ithaca NY - GPA 3.84
M.S. Mechanical Engineering *August 2014*
Ph.D. Mechanical Engineering (**minor:** computer science) *May 2016, expected*
Award: National Science Foundation Graduate Fellowship

Tufts University, Medford MA - GPA 3.97
B.S. Mechanical Engineering (**minor:** music) *May 2011*
Summa Cum Laude with Highest Thesis Honors
Awards: Mechanical Engineering Prize, Benjamin G. Brown Scholarship

RESEARCH & WORK EXPERIENCE

Cornell Biorobotics and Locomotion Lab November 2011 - Present
Ph.D. Research, Advisor: Andy Ruina *Ithaca, NY*

· My website: **www.matthewpeterkelly.com** . It includes well documented code for a variety of simple examples, some of my research code, several tutorials (some interactive), all publications, and a variety of small projects and reports.
· Developed significant expertise in trajectory optimization. Implemented multiple shooting, direct collocation, orthogonal collocation on a variety of systems, including several walking robot models.
· Simulation of the Cornell Ranger walking robot, two versions: one in Java, designed for user interaction, and another using Matlab and C for high speed and accuracy.
· Wrote Matlab toolboxes for function approximation using orthogonal polynomials, rational bezier curves, and high-order splines. Includes features for non-linear model fitting, and calculus.
· Designed non-linear controllers for simple models of walking using variations on genetic algorithms, dynamic programming, and trajectory libraries.

Tufts Biomechanical Engineering Lab November 2009 - August 2011
Advisor: Thomas James *Medford, MA*

· Design, fabrication, and testing of a novel sagittal bone saw.
· Results: two proptotype saws and a test fixture, 400 hours of machine shop work, two full experiments, a conference presentation, journal publication, and a patent application.

MIT Non-Newtonian Fluids Lab January 2011 - August 2011
Advisor: Gareth McKinley (MIT), Chris Rogers (Tufts) *Cambridge, MA*

· Non-linear control design and implementation on a filament-stretching rheometer (FiSER).
· Software: programmed a GUI in LabVIEW as well as real-time data acquisition, analysis, and control.
· Hardware: National Instruments cRIO and FPGA.

FALA Technologies June 2008 - August 2008
Summer Intern *Kingston, NY*

· Used SolidWorks to generate 3D models and drawings; designed a mobile base for small robotic arm.

TEACHING EXPERIENCE

Head Teaching Assistant: Dynamics Cornell University, Spring 2013

- Management responsibility for 12 teaching staff and logistics for 180 students.
- Taught recitation and lab.

Teaching Assistant: Mechatronics Lab Cornell University, Fall 2012

- Lab TA working with analog circuits and microprocessors for small robots.

TECHNICAL STRENGTHS

Programming

- Linux and Windows operation systems.
- Matlab, Java, C/C++, HTML/CSS/JavaScript, LabVIEW, LaTeX

Trajectory Optimization

- Experience implementing multiple shooting, direct collocation, and orthogonal collocation methods.
- SNOPT, IPOPT, FMINCON for solving non-linear programming problems.
- GPOPS II for trajectory optimization with adaptive meshing.

Simulation

- Implemented simulations on hundreds of models, including many walking robots.
- Time-stepping and finite-state-machine methods.
- Interactive simulations in Java, fast and accurate simulations using compiled Matlab.

Control

- Markov Decision Process, dynamic programming, reinforcement learning.
- Function approximation, trajectory libraries, trajectory tracking.
- Model-based estimation: Kalman filter, EKF, UKF, particle filter.
- Genetic algorithms, neural nets.

Mechanical Engineering

- In 2009 I built a trebuchet with a one-ton counter-weight and 40-foot arm.
- Machine design, SolidWorks modeling.
- Machine shop: manual mill & lathe, CNC Mill.
- Woodworking and cabinetry.

PUBLICATIONS

Kelly, M. P. , Ruina, Andy, "Non-linear robust control for inverted-pendulum 2D walking," International Conference on Robotics and Automation, Seatle, WA, May 26-30, 2015.

James, T. P., **Kelly, M. P.**, Lannin, Pearlman, J. J., and Saigal, A., "Sagittal Bone Saw with Orbital Blade Motion for Improved Cutting Efficiency," Journal of Medical Devices, 2013.

Mary Jane Shultz, **Matthew Kelly** , Leonid Paritsky, and Julia Wagner, "A Theme-Based Course: Hydrogen as the Fuel of the Future" J. Chem. Ed. 2009, 86 (9), p1051.

PATENTS

James, T. P. and **Kelly, M. P.**, "Novel Blade Path to Introduce Impulsive Thrust Loading in Sagittal Sawing," U.S. Patent 61/495,678, Filed Jun. 10, 2011.