JOSHUA MARK INOUYE
Curriculum Vitae
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Education

PhD, May 2012, Biomedical Engineering
Dissertation:

- "Bio-Inspired Tendon-Driven Systems: Computational Analysis, Optimization, and Hardware Implementation" PDF
- This thesis research is centered on the theoretical analysis and design optimization of bio-inspired tendon-driven systems such as prosthetic hands, robotic manipulators, and minimally-invasive surgical devices. A large part of this research is also dedicated to the study of the biomechanics of human grasping and manipulation.

Dissertation defended: February 2012.
University of Southern California, Los Angeles, CA
Advisor: Francisco Valero-Cuevas
GPA: 3.85

MS, December 2008, Biomedical Engineering
University of Southern California, Los Angeles, CA
GPA: 3.85

BS, May 2007, Mechanical Engineering
Georgia Institute of Technology, Atlanta, GA
GPA: 3.95

Peer-Reviewed Journal Publications

Inouye JM, Kutch JJ, Valero-Cuevas FJ. "A Novel Synthesis of Computational Approaches Enables Optimization of Task-Independent Grasp Quality of Tendon-Driven Hands." In press. PDF

Inouye JM, Kutch JJ, Valero-Cuevas FJ. "Optimization of Tendon Topology for Robotic Fingers: Prediction and Implementation." In review. Resubmitted February 2012 to IEEE/ASME Transactions on Mechatronics.

Inouye JM and Valero-Cuevas FJ. "Bettering the Human Hand: Anthropomorphic Tendon-Driven Robotic Hands can Exceed Human Grasping Capabilities." In preparation.

Inouye JM and Valero-Cuevas FJ. "A Novel Computational Approach Helps Explain and Reconcile Conflicting Experimental Findings on the Neural Control of Arm Endpoint Stiffness." In preparation.

Inouye JM and Valero-Cuevas FJ. "Computational Optimization and Experimental Evaluation of Grasp Quality for Tendon-Driven Hands Under Constraints." In preparation.

Book Chapters

All authors contributed equally to this work. Valero-Cuevas FJ, **Inouye JM**, Kutch JJ, Theodorou EA. "Mechanics of Tendon-Driven Systems: Consequences to the neuromuscular control of limbs and the design of robotic systems." In *The Human Hand: A Source of Inspiration for Robotic Hands*. Springer Tracts in Advanced Robotics. In Review.

Peer-Reviewed Full-Length Conference Publications

Inouye JM and Valero-Cuevas FJ. "Asymmetric Routings With Fewer Tendons Can Offer Both Flexible Endpoint Stiffness Control and High Force-Production Capabilities in Robotic Fingers." Proceedings of the 2012 IEEE RAS/EMBS International Conference on Biomedical robotics and Biomechatronics. Special section on bio-inspired design and control of robot hands. Rome, Italy, 2012. Oral presentation.

Peer-Reviewed Conference Abstracts

Inouye JM and Valero-Cuevas FJ. "A Novel Computational Approach Helps Explain and Reconcile Conflicting Experimental Findings on the Neural Control of Arm Endpoint Stiffness." Proceedings of the 22nd Annual Meeting of the Society for the Neural Control of Movement, Venice, Italy, 2012. Oral presentation.

Inouye JM and Valero-Cuevas FJ. "An optimized solution to the grasping problem: the fitness of the human hand." Proceedings of the 17th Biannual Meeting of the Canadian Society of Biomechanics. Vancouver, BC, 2012. PDF

Inouye JM, Kutch JJ, Valero-Cuevas FJ. "A novel methodology to compare grasp quality: application to two dominant tendon-driven designs." Proceedings of the 35th Annual Meeting of the American Society of Biomechanics, Long Beach, CA. August 13th, 2011. PDF

Inouye JM, Kutch JJ, Valero-Cuevas FJ. “Quantitative prediction of grasp impairment following peripheral neuropathies of the hand.” Proceedings of the 35th Annual Meeting of the American Society of Biomechanics, Long Beach, CA. August 13th, 2011. PDF

Raths C, **Inouye JM**, Valero-Cuevas FJ. “The Spatio-Temporal Structure of Force Variability in Static Grasp Suggests a Continually Active Neural Controller.” Proceedings of the ASME 2010 Summer Bioengineering Conference. Naples, FL. PDF

Inouye JM, Kutch JJ, Valero-Cuevas FJ. "A Comprehensive Computational Framework to Evaluate Grasp Quality of Tendon-Driven Hands with Arbitrary Topology". Proceedings of the 21st Annual Meeting of the Society for the Neural Control of Movement, San Juan, Puerto Rico, 2011. PDF

Invited Presentations

“A Novel Computational Approach Helps Explain and Reconcile Conflicting Experimental Findings on the Neural Control of Arm Endpoint Stiffness”
Oral presentation, 22nd Annual Meeting of the Society for the Neural Control of Movement.
Venice, Italy
April, 2012

“Regulation of Human Arm Stiffness in Heavily Dependent on Existence of Muscle Synergies”
Oral presentation, 16th Annual Fred S. Grodins Graduate Research Symposium.
Los Angeles, CA
April 7th, 2011.

“Dexterous Prostheses: Neural Control and Design Optimization”
Guest speaker, USC BME-452 (Introduction to Biomimetic Neural Engineering)
Instructor: Dr. Tuan Hoang
Los Angeles, CA
November 9th, 2011

“Analysis of Force Production and Passive Stiffness in Tendon-Driven Neuromuscular Systems”
Guest speaker, USC Division of Biokinesiology and Physical Therapy Seminar Series
Los Angeles, CA
October 27th, 2011

“The Mechanics of Engineered and Biological Tendon-Driven Systems”
Guest speaker with Francisco Valero-Cuevas
DLR, German Aerospace Center
Munich, Germany
October 20th, 2011

"Engineering in Robotics and Biology"
Guest speaker, USC EE-200 (Foundations of Electrical Engineering Systems)
Instructor: Professor Keith Chugg
Los Angeles, CA
October 5th, 2011

Other Publications

Inouye JM and Valero-Cuevas, FJ. "Regulation of Human Arm Stiffness in Heavily Dependent on Existence of Muscle Synergies." Proceedings of the 16th Annual Fred S. Grodins Graduate Research Symposium. Los Angeles, CA, 2011. PDF

Inouye JM, Kutch JJ, Valero-Cuevas, FJ. "Quantitative Comparison of Grasp Qualities of Two Tendon-driven Hands Using a Novel Methodology." Proceedings of the 15th Annual Fred S. Grodins Graduate Research Symposium. Los Angeles, CA, 2011. PDF

Inouye JM, Raths C, Valero-Cuevas, FJ. "Design and Fabrication of a Device for Studying Unstable Grasp Mechanics." Proceedings of the 14th Annual Fred S. Grodins Graduate Research Symposium. Los Angeles, CA, 2010. ****Best Poster Award**. PDF

Inouye JM, Ebramzadeh E, Sangiorgio S. "In Vitro Assessment of Allowable Bone Loss for Implantation of a Zweymuller Stem for Total Hip Arthroplasty Revision Surgery." Proceedings of the 13th Annual Fred S. Grodins Graduate Research Symposium. Los Angeles, CA, 2009. PDF

Inouye JM, Farrokhi S, Powers CM. "In-vivo Assessment of Patellofemoral Joint Stress Using a Finite-Element Analysis Approach." Proceedings of the 12th Annual Fred S. Grodins Graduate Research Symposium. Los Angeles, CA, 2008. PDF

Reviewer

IEEE Transactions on Robotics
Robotica
Journal of Biomechanics
IEEE International Conference on Robotics and Automation
International Journal of Humanoid Robotics

Research Experience

Brain-Body Dynamics Laboratory
University of Southern California, Los Angeles, CA
Research Assistant, August 2009-present
PhD Advisor: Professor Francisco Valero-Cuevas

- Computational modeling of tendon-driven human and robotic grasp using Matlab and computational geometry.
- Stiffness control of robotic fingers.

- Hardware implementation of optimized tendon-driven systems.
- Design and fabrication of device for studying unstable grasp dynamics.
- Markov-Chain Monte Carlo and other optimization techniques for biomimetic manipulator design.

Pathokinesiology Laboratory
Ranch Los Amigos National Rehabilitation Center, Downey, CA
Rehabilitation Engineering Research Intern, May 2009-August 2009
Supervisor: Professor Phillip Requejo

- Conducted wheelchair user motion capture studies and performed biomechanical analysis on data in Visual 3D.
- Design in SolidWorks and fabrication of experimental setup for studies on car transfers for patients with spinal cord injury.

USC Ph.D. Laboratory Rotations

- Implant Performance Laboratory, Orthopaedic Hospital, Los Angeles, CA
    - Wrote proposal for in-vitro tests to assess allowable amount of bone loss for a Zweymuller hip implant revision stem.
    - Designed and fabricated setup for testing of synthetic medial collateral ligaments on constrained condylar knee prostheses.
- Musculoskeletal Biomechanics Research Laboratory, USC, Los Angeles, CA
    - Developed 3D finite element model of knee from subject-specific MRI scans to develop therapies for patellofemoral pain.
    - Mesh creation and refinement for bone and cartilage modeling.
- Sports Biomechanics Research Laboratory, USC, Los Angeles, CA
    - Set up instrumentation for an impact tester that tests the dynamic response of various surfaces for use in computer models of biomechanical consequences of various sports-related movements.
    - LabView programming for data acquisition.

Musculoskeletal Research Laboratory
Georgia Institute of Technology, Atlanta, GA
Research Intern, May 2007-August 2007
Supervisor: Professor Robert Guldberg

- Designed parts for mechanical testing of trabecular bone samples in SolidWorks.
- Scanned and analyzed micro-CT images of fish jaw bones for finite-element analysis.

NSF Research Experience for Undergraduates
Oakland University, Rochester, MI
Automotive Research Intern, May 2006-August 2006
Supervisors: Professors Laila Guessous and Brian Sangeorzan

- Investigated blocking effect observed in intake valve airflow experimentally and theoretically.
- Designed and fabricated setup of high temperature, pulsating airflow experiment.

Teaching Experience

Teaching Assistant, August 2008-December 2009
University of Southern California, Los Angeles, CA

- BME-502: Advanced Studies of the Nervous System, Fall 2009
- BME-414: Rehabilitation Engineering, Spring 2009
- BME-501: Advanced Topics in Biomedical Systems, Spring 2009
- BME-101: Introduction to Biomedical Engineering, Fall 2008
- BME-404: Biomechanics, Fall 2008

Undergraduate Mentor, Summer 2010
Research Experience at the Biology-Mathematics Interface
Students: Devin von Stade, Kevin Oh

Industrial Experience

Statistical Consultant, July 2008
Universal Surveillance Systems-USS Corp, Rancho Cucamonga, CA

- Tag time and motion study—collected experimental data from timed trials of security tag use.
- Conducted independent statistical analysis and wrote a technical report on the observed differences among tags.

Materials Service Department Intern, May 2005-August 2005
Honda of America Manufacturing, Anna Engine Plant, Anna, OH

- Designed and fabricated stopper device for conveyor system.
- Created and utilized drawings of engine firing pallets in Catia and conveyor systems in AutoCAD.
- Miscellaneous shop work.

Mechanical Engineering Department Intern, May 2004-August 2004
Southern Nuclear Company, Plant Vogtle, Waynesboro, GA

- Wrote a network-based search program in Javascript to locate work order files.
- Worked on security design change plans and received instruction in welding.

Honors and Awards

- Nominated for the Alfred E. Mann Innovation in Engineering Doctoral Fellowship, 2011
- Best Poster Award, 14th Annual Fred S. Grodins Graduate Research Symposium, 2010
- University of Southern California Viterbi School of Engineering Fellowship, 2007
- Georgia Institute of Technology Richard K. Whitehead Memorial Award, 2007
- Westinghouse Scholarship, 2003
- Watson-Brown Scholarship, 2003
- Robert C. Byrd Scholarship, 2003
- Jabez-Hardin Scholarship, 2003
- Elks Club Scholarship, 2003
- National Beta Club Scholarship, 2003

Exams

- Exam P/1 (Probability) of the Society of Actuaries passed January 2009

Skills

Computer Skills:

- Adobe Illustrator
- LabView
- Visual 3D
- HTML
- Matlab
- R
- SPSS
- SAS
- SolidWorks
- SolidEdge
- AutoCAD
- CATIA

Machining skills: CNC mill, CNC lathe, band saw, drill press, etc.

Organizations and Activities

President, USC Alternative Careers in Science and Engineering PDF

- Recruited academic and industry professionals to be panelists at graduate student seminars on careers with a PhD.
- Recruited other board members.
- Obtained recognition as an official student organization.
- Registered with GPSS (Graduate and Professional Student Senate) to be able to get school funding for events.
- Organized meetings and managed events and correspondence with board members, panelists, student organization office, event caterers, and funding sources.

Founder and Head Coach, Greenbrier Middle School MATHCOUNTS team

- United States national math coaching and competition program for middle school students.
- Obtained official school recognition by finding a teacher to sponsor the club's initiation.
- Led weekly problem set practices.
- Registered and coached team for regional competition.

Facility Supervisor, Georgia Tech Campus Recreation Center

- Oversaw employees and controlled building activities to ensure safety and maintain a high level of customer satisfaction.
- Analyzed and researched customer complaints/problems to determine effective resolutions.
- Managed equipment and desk service.

Board Member, Trojan Investing Society

- Wrote articles of interest for the club newsletter. PDF1 PDF2
- Attended board meetings.
- Advertised club activities at the student involvement fair.

Vice President, USC Surf Club
- Organized transportation and equipment for surfing camping trips.
- Collected and handled club funds for dues, fundraising, and club equipment.

Judge, 13th Annual USC Undergraduate Symposium for Scholarly and Creative Work
American Society of Biomechanics
Society for Neural Control of Movement
American Society of Mechanical Engineers
Society of Automotive Engineers
National Society of Collegiate Scholars
Contributing Author, Trojan Investing Newsletter
Contributing Author, Bulls & Bears Press
USC Racquetball Club
PAC-10 Fitness Challenge
Georgia Tech Men's Volleyball Club