Marc D. Killpack
Assistant Professor of Mechanical Engineering
Brigham Young University

Contact Information

Brigham Young University
435 CTB
Provo, UT 84602, USA

Voice: (801) 422-6342
E-mail: marc_killpack@byu.edu
Personal Website: http://mkillpack.weebly.com/

Education

Georgia Institute of Technology, Atlanta, Georgia USA

Ph.D., Robotics (Woodruff School of Mechanical Engineering), November 2013

- Dissertation Topic: "Model Predictive Control with Haptic Feedback for Robot Manipulation in Cluttered Scenarios"
- Advisor: Dr. Charles C. Kemp - Associate Professor (Wallace H. Coulter Department of Biomedical Engineering)
- Co-advisor: Dr. Wayne J. Book - Professor (Woodruff School of Mechanical Engineering)
- Areas of Expertise - Controls, Mechanics and Dynamics, Perception (e.g. computer vision, 3D and haptic sensing)
- Minor - Mathematics
- GPA - 4.0

Ecole Nationale Superieure d'Arts et de Metiers, Metz, France

Master Professionnel in Mechanical Engineering, December 2008

- School is ranked among the French top ten engineering schools
- Emphasis in Manufacturing and Material Science

Georgia Institute of Technology (Georgia Tech Lorraine), Metz, France

M.S. in Mechanical Engineering, December 2008

- Emphasis in Dynamics and Controls
- GPA - 4.0

Brigham Young University, Provo, Utah USA

B.S. in Mechanical Engineering, April 2007

- Emphasis in Classical Controls and Unmanned Air Vehicles
- GPA - 3.87

Research Experience

Georgia Institute of Technology, Atlanta, Georgia USA

Graduate Research Assistant **January 2009 - November 2013**

Research performed in the Robotics Ph.D. program

- Worked on DARPA Maximum Mobility and Manipulation fully funded project using tactile and proximity sensing for manipulation in clutter
- Developed teleoperation capabilities for three different robots (EL-E, Cody and the PR2)

- Designed a mechanical system for automated testing and learning for robot manipulation with the PR2 robot
- Participated on a project for military casualty extraction using perception and base control of an omnidirectional mobile manipulator
- Built a novel odometry system for an omnidirectional Mecanum-wheel base and implemented LQR and PID control for comparison
- Programmed a vision tracking system for non-rigid cloth to help automate garment manufacturing

Internship (CIRAM - French Laboratory) **January 2008 - December 2008**

Performed research on modeling of unstable buckling and deformation during metal forming processes at the Centre d'Innovation et de Recherche Associe Metz

- Used Fortran to develop code for testing a new finite element formulation in Abaqus software
- Validated code for unstable limit-point buckling benchmark tests using Riks method
- Worked in a foreign laboratory functioning completely in French including writing and presenting technical reports
- Produced a journal publication with my French academic advisors

Undergraduate Research Assistant **May 2006 - April 2007**

Worked in the Multi-AGent Intelligent Cooperation and Control Lab (MAGICC) at Brigham Young University.

- Built electronic and mechanical components of UAVs
- Wrote controller and simulation code in C and C++ using OpenGL and Qt
- Fabricated multiple versions of delta-wing UAVs for the lab including kevlar-epoxy coating of UAVs

Research Interests in Robotics

- model predictive control
- optimal estimation and control
- adaptive control and filtering
- shared control
- teleoperation
- tactile and force sensing
- 2D and 3D perception for manipulation
- robot dynamics and mechanics
- mechanical robot design and optimization

Publications

A. Jain*, **M. Killpack***, A. Edsinger, and C. Kemp, "Manipulation in Clutter with Whole-Arm Tactile Sensing", Internationl Journal of Robotics Research (accepted), 2012
$*$ - equally contributing authors

M. Killpack, F. Abed-Meraim and T. Balan, "Limit-point buckling analysis using the assumed strain continuum shell element SHB8PS", Journal of Mechanical Science and Technology, 2011, Springer

Refereed Conference Publications

M. Killpack, T. Deyle, C. Anderson, C. Kemp, "Visual Odometry and Control for an Omnidirectional Mobile Robot with a Downward-Facing Camera," Proceedings of the International Conference on Intelligent Robots and Systems, 2010.

W. J. Book, R. Winck, **M. Killpack**, J. Huggins, S. Dickerson, T. Collins, R. Prado and S. Jayaraman, "Automated garment manufacturing system using novel sensing and actuation," Proceedings of the International Symposium on Flexible Automation, 2010.

C.-H. King, **M. Killpack**, and C. Kemp, "Effects of force feedback and arm compliance on teleoperation of an assistive robot for hygiene," Proceedings of Eurohaptics, 2010.

T. Bhattacharjee, A. Jain, S. Vaish, **M. Killpack** and C. Kemp, "Tactile Sensing over Articulated Joints with Stretchable Sensors," IEEE World Haptics Conference, 2013.

P. Grice, **M. Killpack**, A. Jain, S. Vaish, J. Hawke, and C. Kemp, "Whole-arm Tactile Sensing for Beneficial and Acceptable Contact During Robotic Assistance," International Conference on Rehabilitation Robotics, 2013.

M. Killpack and C.C. Kemp, "Fast Reaching in Clutter While Regulating Forces Using Model Predictive Control" IEEE-RAS International Conference on Humanoid Robots, 2013. - Nominated for Best Paper.

Technical Reports and Papers in Preparation

M. Killpack, J. Mathews, K. Hawkins and C. Kemp, "A Robotic Playpen: A System for High-Throughput Data Collection for Robot Manipulation," 2012.

M. Killpack, "Automated Tracking and Estimation for Control of Non-rigid Cloth," 2012.

Teaching Interests

- introduction to robotics
- classical and linear control systems
- optimal estimation and filtering
- digital controls
- optimal controls
- system dynamics
- kinematics and dynamics of rigid bodies
- computer vision and perception
- numerical methods and programming
- instrumentation
- materials and mechanics of materials

Teaching Experience

Teaching Practicum (Dynamics) **August - December 2010**

Presented three lectures on undergraduate dynamics (equations of motion and forces for moving rigid bodies) and held weekly office hours for students.

Teaching Assistant (Linear Controls) **August - December 2009**

Explained concepts during weekly office hours and graded papers for a graduate level linear controls course.

Teaching Assistant (Experimental Methodology) **January - May 2009**

Led two laboratory sections per week for an undergraduate experimentation and technical writing class. Experiments ranged from using thermocouples to measure temperature, to estimating viscosity of a fluid, to writing code for a micro-controller.

French Teacher **July 2004 - April 2007**

Taught service volunteers in a two month intensive French language course.

Professional Experience

Flowserve Corporation, Springville, Utah USA
Research and Development Engineer **April - August 2007**

- Contributed on a team which developed algorithms for PID flow control diagnostics
- Prototyped implementation of algorithms in software and hardware
- Tested and analyzed performance of algorithms with hardware in the loop

Missionary Training Center, Provo, Utah USA
Language Instructor and Zone Coordinator **August 2004 - April 2007**

- Planned daily lessons in French for volunteers and supervised ten other teachers
- Prepared and presented technical training for 40 teachers over a period of three weeks

Honors and Awards

- Glenn Fellowship and G.W. Woodruff-Stipend from Georgia Tech
- Full funding for dual Masters degree program at Georgia Tech Lorraine in France
- Heritage Scholarship, Brigham Young University (four year full-tuition)
- Tau Beta Pi, (national engineering honor society)
- Golden Key International Honor Society
- "Advanced High" rating for OPI in French from the American Council on the Teaching of Foreign Languages
- Eagle Scout award from Boy Scouts of America

Academic Service

- Mentored three different undergraduate students while they contributed to research efforts in the Healthcare Robotics Lab
- Reviewer for conference papers from Humanoids 2010 (1 article), ICRA 2010/2011/2012 (4 articles), and IROS 2012 (1 article), ICRA 2013 (2 articles)
- Reviewer for journal papers from IEEE Transactions on Robotics (2010), Springer Autonomous Robots (2012), IEEE/ASME Transactions on Mechatronics (2012)

Community Service

- Gave 10 hours of community service per week through religious leadership responsibilities (2006-2012)
- Lived in France for two years as a church service missionary (2002-2004)
- Served for three years in a Boy Scouts of America troop as either an assistant scoutmaster or a troop committee member (2009, 2011-2012)
- Helped coach high school and YMCA soccer teams (2006, 2012)

Technical Skills

Prototyping and Hardware (managed the Healthcare Robotics Laboratory's machine shop for three years)

- *Experienced:* 3D printer (with ABS plastic), 2D laser cutter, drill press, bandsaw, mitre saw, manual circular saw, tablesaw, radial arm saw, router, belt and disk sander
- *Familiar:* CNC mill, knee mill, lathe

Programming/Mathematical Languages and Libraries

- *Experienced:* C/C++, Python, ROS, ODE Physics Simulation, OpenCV, Matlab, Simulink, LabView, LaTeX
- *Familiar:* Bash Scripting, Visual Basic, Fortran, Qt, OpenGL, Nvidia Physics Simulation, Mathematica

Commercial Software and Operating Systems

- *CAD and Finite Element Analysis:* ProE, SolidWorks, Abaqus, Ansys, common Windows spreadsheet and presentation software
- *Operating Systems:* Unix/Linux (Ubuntu and Suse), Windows