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Curriculum vitae last updated on May 23, 2012

EDUCATION

- Ph.D. 2006** Mechanical Engineering, Stanford University, Stanford, California, USA
Dissertation: Characterizing and Controlling the High-Frequency Dynamics of Haptic Interfaces
Advisor: Dr. Günter Niemeyer
- M.S. 2002** Mechanical Engineering, Stanford University, Stanford, California, USA
Specialization: Robotics, Mechatronics, Design, and Controls
- B.S. 2000** Mechanical Engineering, Stanford University, Stanford, California, USA
With Distinction

POSITIONS HELD

- 2007-present **Skirkanich Assistant Professor of Innovation**, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania
- 2010-present Member, Bioengineering Graduate Group, University of Pennsylvania
- 2006-2007 Postdoctoral Research Fellow, Department of Mechanical Engineering, NSF ERC for Computer-Integrated Surgical Systems and Technology, Johns Hopkins University
Advisor: Dr. Allison M. Okamura
- 2000-2006 Research and Teaching Assistant, Department of Mechanical Engineering, Stanford University

RESEARCH INTERESTS

My research leverages scientific knowledge about the human sense of touch to create haptic interfaces that enable a user to interact with virtual objects and distant environments as though they were real and within reach. Our key insight in this area has been that the high-frequency accelerations of a hand-held tool convey rich tactile information that is necessary to make the interaction feel real, though this type of feedback has typically been omitted from haptic simulations and teleoperation systems. This work led us to realize that autonomous robots can also benefit from attending to the dynamic tactile cues that occur as they manipulate objects in their environment. By studying applications such as medical simulation, robotic minimally invasive surgery, stroke rehabilitation, personal computing, and personal robotics, I seek to elevate and formalize our understanding of haptic feedback while simultaneously uncovering new opportunities for its use in interactions between humans, computers, and machines.

SELECTED AWARDS AND HONORS

- 2012 IEEE Robotics and Automation Society Early Career Award
2012 Best Hands-on Demonstration (of 47 entries, three-way tie), IEEE Haptics Symposium
2012 Three finalists for Best Hands-on Demonstration, IEEE Haptics Symposium
2012 Finalist for Best Poster, IEEE Haptics Symposium
2011 Citation for Meritorious Service as a Reviewer, IEEE Transactions on Haptics

- 2011 PopTech Science and Public Leadership Fellow
- 2011 Participant, National Academy of Engineering's U.S. Frontiers of Engineering Symposium
- 2011 Best Poster in Session (of 17 posters), American Urological Association Annual Meeting
- 2011 Best Associate Editor, IEEE International Conference on Robotics and Automation
- 2011 Outstanding Reviewer, IEEE Transactions on Instrumentation and Measurement
- 2010 Popular Science Brilliant 10
- 2010 Ford Motor Company Award for Faculty Advising, SEAS, University of Pennsylvania
- 2010 Finalist for Best Poster, IEEE Haptics Symposium
- 2009 National Science Foundation CAREER Award
- 2009 Early Career Spotlight Talk (keynote speaker), Robotics: Science and Systems Conference
- 2009 Best Hands-on Demonstration, IEEE World Haptics Conference
- 2008 Citation for Meritorious Service as a Reviewer, IEEE Transactions on Haptics
- 2007 Best Haptic Technology Paper, IEEE World Haptics Conference
- 2004-2005 Achievement Rewards for College Scientists (ARCS) Fellowship
- 2004 Best Student Paper, Dynamic Systems and Controls Division, ASME IMECE
- 2004 Best Poster, Medicine Meets Virtual Reality Conference
- 2000-2003 National Science Foundation Graduate Research Fellowship
- 2000-2001 MacDonal Memorial Fellowship, Stanford University
- 2000-2001 Tau Beta Pi Fellowship
- 2000-2001 Mayfield Fellow, Stanford Technology Ventures Program
- 2000 Henry Ford II Scholar, #1 Graduating Student in School of Engineering, Stanford University
- 2000 Henry O. Fuchs Memorial Award for Excellence in Mechanical Design, Stanford University
- 2000 Best of Program, Senior Design Competition, James F. Lincoln Arc Welding Foundation
- 1999 ASME Kenneth Andrew Roe Scholarship
- 1999 Phi Beta Kappa Honor Society, elected Junior Year
- 1999 Tau Beta Pi Engineering Honor Society, elected Junior Year
- 1998 Cap and Gown, the Stanford Women's Honor Society, elected Junior Year
- 1996-1999 Scholar Athlete Award, Varsity Volleyball, Stanford University

PUBLICATIONS

Journal Articles

- [J1] Seungmoon Choi and Katherine J. Kuchenbecker. Vibrotactile rendering: Perception, technology, and applications. Under review.
- [J2] Joseph M. Romano, Jordan P. Brindza, and Katherine J. Kuchenbecker. ROS open-source audio recognizer: ROAR: Environmental sound detection tools for robot programming. Under review.
- [J3] Joseph M. Romano and Katherine J. Kuchenbecker. Methods for robotic tool-mediated haptic surface recognition. Under review.
- [J4] Karlin Bark, William McMahan, Austin Remington, Jamie Gewirtz, Alexei Wedmid, David I. Lee, and Katherine J. Kuchenbecker. In vivo validation of VerroTouch: Tactile feedback of tool vibrations for robotic surgery. Under review.
- [J5] Andrew A. Stanley and Katherine J. Kuchenbecker. Evaluation of tactile feedback methods for wrist rotation guidance. Accepted with minor revisions to *IEEE Transactions on Haptics*, 2012.
- [J6] Netta Gurari, Katherine J. Kuchenbecker, and Allison M. Okamura. Perception of springs with visual and proprioceptive motion cues: Implications for prosthetics. Accepted with minor revisions to *IEEE Transactions on Systems, Man, and Cybernetics: Part A*, 2012.

- [J7] Joseph M. Romano and Katherine J. Kuchenbecker. Creating realistic virtual textures from contact acceleration data. Accepted to *IEEE Transactions on Haptics*, 2011.
- [J8] Joseph M. Romano, Kaijen Hsiao, Günter Niemeyer, Sachin Chitta, and Katherine J. Kuchenbecker. Human-inspired robotic grasp control with tactile sensing. *IEEE Transactions on Robotics*, 27(6):1067–1079, December 2011.
- [J9] William McMahan, Jamie Gewirtz, Dorsey Standish, Paul Martin, Jacquelyn Kunkel, Magalie Lilavois, Alexei Wedmid, David I. Lee, and Katherine J. Kuchenbecker. Tool contact acceleration feedback for telerobotic surgery. *IEEE Transactions on Haptics*, 4(3):210–220, July–September 2011.
- [J10] Amy Blank, Allison M. Okamura, and Katherine J. Kuchenbecker. Identifying the role of proprioception in upper-limb prosthesis control: Studies on targeted motion. *ACM Transactions on Applied Perception*, 7(3):1–23, June 2010.
- [J11] Stephen Kim, Geoffrey Spencer, George Makar, Nuzhat Ahmad, David Jaffe, Gregory Ginsberg, Katherine J. Kuchenbecker, and Michael Kochman. Lack of discriminatory function for endoscopy skills on a computer-based simulator. *Surgical Endoscopy*, 24(12):3008–3015, 2010.
- [J12] Katherine J. Kuchenbecker and Günter Niemeyer. Induced master motion in force-reflecting teleoperation. *ASME Journal of Dynamic Systems, Measurement, and Control*, 128(4):800–810, December 2006.
- [J13] Katherine J. Kuchenbecker, Jonathan P. Fiene, and Günter Niemeyer. Improving contact realism through event-based haptic feedback. *IEEE Transactions on Visualization and Computer Graphics*, 12(2):219–230, March/April 2006.
- [J14] William R. Provancher, Mark R. Cutkosky, Katherine J. Kuchenbecker, and Günter Niemeyer. Contact location display for haptic perception of curvature and object motion. *International Journal of Robotics Research*, 24(9):691–702, September 2005.

Book Chapters/Collections

- [B1] Allison M. Okamura, Katherine J. Kuchenbecker, and Mohsen Mahvash. Measurement-based modeling for haptic rendering. In Ming Lin and Miguel Otaduy, editors, *Haptic Rendering: Algorithms and Applications*, chapter 21, pages 443–467. A. K. Peters, May 2008.

Peer-Reviewed Conference Papers

- [C1] Rahul Chaudhari, Burak Çizmeçi, Katherine J. Kuchenbecker, Seungmoon Choi, and Eckehard Steinbach. Low bitrate source-filter model based compression of vibrotactile texture signals in haptic teleoperation. Under review.
- [C2] William McMahan and Katherine J. Kuchenbecker. Spectral subtraction of robot motion noise for improved vibrotactile event detection. Accepted for oral presentation at EuroHaptics, 2012.
- [C3] Rebecca M. Pierce and Katherine J. Kuchenbecker. A data-driven method for determining natural human-robot motion mappings in teleoperation. Accepted for poster presentation at IEEE BioRob, 2012.
- [C4] Heather Culbertson, Joseph M. Romano, Pablo Castillo, Max Mintz, and Katherine J. Kuchenbecker. Refined methods for creating realistic haptic virtual textures from tool-mediated contact acceleration data. In *Proc. IEEE Haptics Symposium*, pages 385–391, March 2012.
- [C5] Andrew A. Stanley, Simon K. Healey, Matthew R. Maltese, and Katherine J. Kuchenbecker. Recreating the feel of the human chest in a CPR manikin via programmable pneumatic damping. In *Proc. IEEE Haptics Symposium*, pages 37–44, March 2012.
- [C6] Yunqing Wang and Katherine J. Kuchenbecker. HALO: Haptic alerts for low-hanging obstacles in white cane navigation. In *Proc. IEEE Haptics Symposium*, pages 527–532, March 2012.

- [C7] Steven R. Gray, Joseph M. Romano, Jordan Brindza, Soonkyum Kim, Katherine J. Kuchenbecker, and Vijay Kumar. Planning manipulation and grasping tasks with a redundant arm. In *Proc. ASME International Design Engineering Technical Conferences*, number DETC2011-47453, 2011.
- [C8] Karlin Bark, Preeya Khanna, Rikki Irwin, Pulkit Kapur, Steven A. Jax, Laurel J. Buxbaum, and Katherine J. Kuchenbecker. Lessons in using vibrotactile feedback to guide fast arm motions. In *Proc. IEEE World Haptics Conference*, pages 355–360, June 2011.
- [C9] Peter Y. Huang, Jacquelyn A. Kunkel, Jordan Brindza, and Katherine J. Kuchenbecker. Haptically assisted golf putting through a planar four-cable system. In *Proc. IEEE World Haptics Conference*, pages 191–196, June 2011.
- [C10] Andrew A. Stanley and Katherine J. Kuchenbecker. Design of body-grounded tactile actuators for playback of human physical contact. In *Proc. IEEE World Haptics Conference*, pages 563–568, June 2011.
- [C11] Katherine J. Kuchenbecker, Jamie Gewirtz, William McMahan, Dorsey Standish, Paul Martin, Jonathan Bohren, Pierre J. Mendoza, and David I. Lee. VerroTouch: High-frequency acceleration feedback for telerobotic surgery. In Astrid M. L. Kappers, Jan B. F. van Erp, Wouter M. Bergmann Tiest, and Frans C. T. van der Helm, editors, *Haptics: Generating and Perceiving Tangible Sensations, Proc. EuroHaptics, Part I*, volume 6191 of *Lecture Notes in Computer Science*, pages 189–196. Springer, July 2010.
- [C12] Nils Landin, Joseph M. Romano, William McMahan, and Katherine J. Kuchenbecker. Dimensional reduction of high-frequency accelerations for haptic rendering. In Astrid M. L. Kappers, Jan B. F. van Erp, Wouter M. Bergmann Tiest, and Frans C. T. van der Helm, editors, *Haptics: Generating and Perceiving Tangible Sensations, Proc. EuroHaptics, Part II*, volume 6192 of *Lecture Notes in Computer Science*, pages 79–86. Springer, July 2010.
- [C13] Joseph M. Romano, Takashi Yoshioka, and Katherine J. Kuchenbecker. Automatic filter design for synthesis of haptic textures from recorded acceleration data. In *Proc. IEEE International Conference on Robotics and Automation*, pages 1815–1821, May 2010.
- [C14] Kyle N. Winfree, Joseph M. Romano, Jamie Gewirtz, and Katherine J. Kuchenbecker. Control of a high fidelity ungrounded torque feedback device: The iTorqU 2.1. In *Proc. IEEE International Conference on Robotics and Automation*, pages 1347–1352, May 2010.
- [C15] Pulkit Kapur, Mallory Jensen, Laurel J. Buxbaum, Steven A. Jax, and Katherine J. Kuchenbecker. Spatially distributed tactile feedback for kinesthetic motion guidance. In *Proc. IEEE Haptics Symposium*, pages 519–526, March 2010. Finalist for Best Poster Award.
- [C16] William McMahan, Joseph M. Romano, Amal M. Abdul Rahuman, and Katherine J. Kuchenbecker. High frequency acceleration feedback significantly increases the realism of haptically rendered textured surfaces. In *Proc. IEEE Haptics Symposium*, pages 141–148, March 2010.
- [C17] Quentin Lindsey, Neil Tenenholz, David I. Lee, and Katherine J. Kuchenbecker. Image-enabled force feedback for robotic teleoperation of a flexible tool. In *Proc. IASTED International Conference on Robotics and Applications*, pages 224–233, November 2009.
- [C18] Meng Yang, Jingwan Lu, Alla Safonova, and Katherine J. Kuchenbecker. GPU methods for real-time haptic interaction with 3D fluids. In *Proc. IEEE International Workshop on Haptic Audio-Visual Environments and Games (HAVE)*, pages 24–29, November 2009.
- [C19] William McMahan and Katherine J. Kuchenbecker. Haptic display of realistic tool contact via dynamically compensated control of a dedicated actuator. In *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 3171–3177, October 2009.

- [C20] Katherine J. Kuchenbecker, Joseph M. Romano, and William McMahan. Haptography: Capturing and recreating the rich feel of real surfaces. In Cédric Pradalier, Roland Siegwart, and Gerhard Hirzinger, editors, *Robotics Research: the 14th International Symposium (ISRR 2009)*, volume 70 of *Springer Tracts in Advanced Robotics*, pages 245–260. Springer, 2011.
- [C21] Joseph M. Romano and Katherine J. Kuchenbecker. The AirWand: Design and characterization of a large-workspace haptic device. In *Proc. IEEE International Conference on Robotics and Automation*, pages 1461–1466, May 2009.
- [C22] Netta Gurari, Katherine J. Kuchenbecker, and Allison M. Okamura. Stiffness discrimination with visual and proprioceptive cues. In *Proc. IEEE World Haptics Conference*, pages 121–126, March 2009.
- [C23] Joseph M. Romano, Steve R. Gray, Nathan T. Jacobs, and Katherine J. Kuchenbecker. Toward tactilely transparent gloves: Collocated slip sensing and vibrotactile actuation. In *Proc. IEEE World Haptics Conference*, pages 279–284, March 2009.
- [C24] Kyle N. Winfree, Jamie Gewirtz, Thomas Mather, Jonathan Fiene, and Katherine J. Kuchenbecker. A high-fidelity ungrounded torque feedback device: The iTorqU 2.0. In *Proc. IEEE World Haptics Conference*, pages 261–266, March 2009.
- [C25] Katherine J. Kuchenbecker, David Ferguson, Michael Kutzer, Matthew Moses, and Allison M. Okamura. The Touch Thimble: Providing fingertip contact feedback during point-force haptic interaction. In *Proc. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems*, pages 239–246, March 2008.
- [C26] Katherine J. Kuchenbecker, Netta Gurari, and Allison M. Okamura. Effects of visual and proprioceptive position feedback on human control of targeted movement. In *Proc. IEEE International Conference on Rehabilitation Robotics*, pages 513–524, June 2007.
- [C27] Jonathan P. Fiene and Katherine J. Kuchenbecker. Shaping event-based haptic transients via an improved understanding of real contact dynamics. In *Proc. IEEE World Haptics Conference*, pages 170–175, March 2007. Best Haptic Technology Paper Award.
- [C28] Katherine J. Kuchenbecker and Günter Niemeyer. Improving telerobotic touch via high-frequency acceleration matching. In *Proc. IEEE International Conference on Robotics and Automation*, pages 3893–3898, May 2006.
- [C29] Jonathan P. Fiene, Katherine J. Kuchenbecker, and Günter Niemeyer. Event-based haptic tapping with grip force compensation. In *Proc. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems*, pages 117–123, March 2006.
- [C30] Katherine J. Kuchenbecker and Günter Niemeyer. Modeling induced master motion in force-reflecting teleoperation. In *Proc. IEEE International Conference on Robotics and Automation*, pages 348–353, April 2005.
- [C31] Katherine J. Kuchenbecker, Jonathan P. Fiene, and Günter Niemeyer. Event-based haptics and acceleration matching: Portraying and assessing the realism of contact. In *Proc. IEEE World Haptics Conference*, pages 381–387, March 2005.
- [C32] Katherine J. Kuchenbecker and Günter Niemeyer. Canceling induced master motion in force-reflecting teleoperation. In *Proc. ASME International Mechanical Engineering Congress and Exposition, Symposium on Advances in Robot Dynamics and Control*, volume 2, paper number 60049, November 2004. Best Student Paper Award.
- [C33] Katherine J. Kuchenbecker, William R. Provancher, Günter Niemeyer, and Mark R. Cutkosky. Haptic display of contact location. In *Proc. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems*, pages 40–47, March 2004.

- [C34] Katherine J. Kuchenbecker, June Gyu Park, and Günter Niemeyer. Characterizing the human wrist for improved haptic interaction. In *Proc. ASME International Mechanical Engineering Congress and Exposition, Symposium on Advances in Robot Dynamics and Control*, volume 2, paper number 42017, November 2003.
- [C35] William R. Provancher, Katherine J. Kuchenbecker, Günter Niemeyer, and Mark R. Cutkosky. Perception of curvature and object motion via contact location feedback. In Paolo Dario and Raja Chatila, editors, *Robotics Research: the Eleventh International Symposium (ISRR 2003)*, volume 15 of *Springer Tracts in Advanced Robotics*, pages 456–465. Springer, 2005.

Education-Oriented Peer-Reviewed Conference Papers

- [E1] Mark Yim, Katherine J. Kuchenbecker, Paulo Arratia, John Bassani, Jonathan P. Fiene, Vijay Kumar, and Jennifer Lukes. A practice-integrated curriculum in mechanical engineering. In *Proc. ASEE Annual Conference and Exposition*, June 2008.
- [E2] Carol B. Muller, Elisa H. Barney Smith, Jennifer Chou-Green, T. Daniels-Race, A. Drummond, and Katherine J. Kuchenbecker. The power of external mentors for women pursuing academic careers in engineering and science: Stories of MentorNet ACE and its proteges and mentors. In *Proc. Women in Engineering Programs and Advocates Network (WEPAN) National Conference*, June 2007.

Short Peer-Reviewed Conference Papers and Abstracts

- [S1] Karlin Bark, Ernest D. Gomez, Charlotte Rivera, William McMahan, Austin Remington, Kenric Murayama, David I. Lee, Kristoffel Dumon, Noel Williams, and Katherine J. Kuchenbecker. Surgical instrument vibrations are a construct-valid measure of technical skill in robotic peg transfer and suturing tasks. Accepted for presentation at the *Hamlyn Symposium on Medical Robotics*, 2012.
- [S2] Ernest D. Gomez, Karlin Bark, Charlotte Rivera, William McMahan, Austin Remington, David I. Lee, Noel Williams, Kenric Murayama, Kristoffel Dumon, and Katherine J. Kuchenbecker. Construct validity of instrument vibrations as a measure of robotic surgical skill. Accepted for presentation at the *American College of Surgeons (ACS) Clinical Congress*, 2012.
- [S3] Margrit P. Maggio, Robert Parajon, and Katherine J. Kuchenbecker. VerroTeach: Visuo-audio-haptic training for dental caries detection. In *Proc. Annual American Dental Educator's Association (ADEA) Conference*, March 2012.
- [S4] Ernest D. Gomez, Karlin Bark, William McMahan, Charlotte Rivera, Austin Remington, David I. Lee, and Katherine J. Kuchenbecker. VerroTouch: Detection of instrument vibrations for haptic feedback and skill assessment in robotic surgery. In *Proc. Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)*, March 2012. Emerging Technology Poster available at <http://thesagesmeeting.org/>.
- [S5] William McMahan, Joseph M. Romano, and Katherine J. Kuchenbecker. Using accelerometers to localize tactile contact events on a robot arm. In *Proc. Workshop on Advances in tactile sensing and touch based human-robot interaction, ACM/IEEE International Conference on Human-Robot Interaction*, March 2012.
- [S6] William McMahan, Karlin Bark, Jamie Gewirtz, Dorsey Standish, Paul D. Martin, Jacquelyn A. Kunkel, Magalie Lilavois, Alexei Wedmid, David I. Lee, and Katherine J. Kuchenbecker. Tool vibration feedback may help expert robotic surgeons apply less force during manipulation tasks. In G. Z. Yang and A. Darzi, editors, *Proc. Hamlyn Symposium on Medical Robotics*, pages 37–38, June 2011.
- [S7] William McMahan, Jamie Gewirtz, Dorsey Standish, Paul Martin, Jacquelyn Kunkel, Magalie Lilavois, Alexei Wedmid, David I. Lee, and Katherine J. Kuchenbecker. VerroTouch: Vibrotactile feedback for robotic minimally invasive surgery. *The Journal of Urology*, 185(4, Supplement):e373, May 2011. Presented at the Annual Meeting of the American Urological Association.

- [S8] Katherine J. Kuchenbecker, Jamie Gewirtz, William McMahan, Dorsey Standish, Jonathan Bohren, Paul Martin, Alexei Wedmid, Pierre J. Mendoza, and David I. Lee. VerroTouch: A vibrotactile feedback system for minimally invasive robotic surgery. In *Proc. 28th World Congress of Endourology*, number PS8-14, September 2010.
- [S9] Joseph M. Romano, Alla Safonova, and Katherine J. Kuchenbecker. Real-time graphic and haptic simulation of deformable tissue puncture. In *Proc. Medicine Meets Virtual Reality*, January 2009.
- [S10] Meng Yang, Jingwan Lu, Zehua Zhou, Alla Safonova, and Katherine J. Kuchenbecker. A GPU-based approach for real-time haptic rendering of 3D fluids. In *Proc. SIGGRAPH Asia Conference*, December 2008.
- [S11] Amy Blank, Allison M. Okamura, and Katherine J. Kuchenbecker. Effects of proprioceptive motion feedback on sighted and unsighted control of a virtual hand prosthesis. In *Proc. IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems*, pages 141–142, March 2008.
- [S12] Katherine J. Kuchenbecker. Haptography: Capturing the feel of real objects to enable authentic haptic rendering (invited paper). In *Proc. Haptic in Ambient Systems (HAS) Workshop, in conjunction with the First International Conference on Ambient Media and Systems*, February 2008.
- [S13] Katherine J. Kuchenbecker, Netta Gurari, and Allison M. Okamura. Quantifying the value of visual and haptic position feedback in force-based motion control. In *Proc. IEEE World Haptics Conference*, pages 561–562, March 2007.
- [S14] Günter Niemeyer, Katherine J. Kuchenbecker, Raymond Bonneau, Probal Mitra, Andrew Reid, Jonathan Fiene, and Grant Weldon. THUMP: An immersive haptic console for surgical simulation and training. In *Proc. Medicine Meets Virtual Reality*, pages 272–274, January 2004. Best Poster Award.

Hands-On Demonstrations

- [D1] Karlin Bark, Elizabeth Cha, Frank Tan, Steven A. Jax, Laurel J. Buxbaum, and Katherine J. Kuchenbecker. StrokeSleeve: Real-time vibrotactile feedback for motion guidance. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012.
- [D2] Pablo Castillo, Joseph M. Romano, and Katherine J. Kuchenbecker. Simon game with data-driven visuo-audio-haptic buttons. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012.
- [D3] Pablo Castillo, Joseph M. Romano, Heather Culbertson, Max Mintz, and Katherine J. Kuchenbecker. Pen tablet drawing program with haptic textures. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012.
- [D4] Simon K. Healey, William McMahan, and Katherine J. Kuchenbecker. Haptic vibration feedback for a teleoperated ground vehicle. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012.
- [D5] Margrit P. Maggio, Robert Parajon, and Katherine J. Kuchenbecker. VerroTeach: Visuo-audio-haptic training for dental caries detection. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012. Best Hands-on Demonstration Award (three-way tie).
- [D6] Andrew A. Stanley, Simon K. Healey, Matthew R. Maltese, and Katherine J. Kuchenbecker. A biofidelic CPR manikin with programmable pneumatic damping. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012. Finalist for Best Hands-on Demonstration Award.
- [D7] Diane Tam, Katherine J. Kuchenbecker, Karon MacLean, and Joanna McGrenere. Exploring presentation timing through haptic reminders. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012.

- [D8] Yunqing Wang, Eza Koch, and Katherine J. Kuchenbecker. HALO: Haptic alerts for low-hanging obstacles in white cane navigation. Hands-on demonstration presented at IEEE Haptics Symposium, March 2012. Finalist for Best Hands-on Demonstration Award.
- [D9] Joseph M. Romano and Katherine J. Kuchenbecker. Please touch the robot. Hands-on demonstration presented at IEEE/RSJ Conference on Intelligent Robots and Systems (IROS), San Francisco, California, September 2011.
- [D10] Andrew A. Stanley and Katherine J. Kuchenbecker. Body-grounded tactile actuators for playback of human physical contact. Hands-on demonstration presented at IEEE World Haptics Conference, Istanbul, Turkey, June 2011.
- [D11] Joseph M. Romano, Nils Landin, William McMahan, and Katherine J. Kuchenbecker. TexturePad: Realistic rendering of haptic textures. Hands-on demonstration presented at EuroHaptics, Amsterdam, the Netherlands, July 2010.
- [D12] Katherine J. Kuchenbecker, Jamie Gewirtz, William McMahan, Dorsey Standish, Paul Martin, Jonathan Bohren, Pierre J. Mendoza, and David I. Lee. VerroTouch: High-frequency acceleration feedback for telerobotic surgery. Hands-on demonstration presented at EuroHaptics, Amsterdam, the Netherlands, July 2010.
- [D13] Zhihao Jiang, Mohit Bhoite, and Katherine J. Kuchenbecker. The haptic board. Hands-on demonstration presented at IEEE Haptics Symposium, Boston, Massachusetts, March 2010.
- [D14] Saurabh Palan, Ruoyao Wang, Nathaniel Naukam, Edward Li, and Katherine J. Kuchenbecker. Tactile gaming vest (TGV). Hands-on demonstration presented at IEEE Haptics Symposium, Boston, Massachusetts, March 2010.
- [D15] Joseph M. Romano and Katherine J. Kuchenbecker. Realistic haptic contacts and textures for tablet computing. Hands-on demonstration presented at IEEE Haptics Symposium, Boston, Massachusetts, Best Teaser Award, March 2010.
- [D16] Dorsey Standish, Jamie Gewirtz, William McMahan, Paul Martin, and Katherine J. Kuchenbecker. High-frequency tactile feedback for the da Vinci surgical system. Hands-on demonstration presented at IEEE Haptics Symposium, Boston, Massachusetts, March 2010.
- [D17] Meng Yang, Jingwan Lu, Alla Safonova, and Katherine J. Kuchenbecker. GPU-based haptic rendering of 3D smoke. Hands-on demonstration presented at IEEE Haptics Symposium, Boston, Massachusetts, March 2010.
- [D18] Joseph M. Romano, Steve R. Gray, Nathan T. Jacobs, and Katherine J. Kuchenbecker. The SlipGlove. Hands-on demonstration presented at IEEE World Haptics Conference, Salt Lake City, Utah, March 2009.
- [D19] William McMahan and Katherine J. Kuchenbecker. Displaying realistic contact accelerations via a dedicated vibration actuator. Hands-on demonstration presented at IEEE World Haptics Conference, Salt Lake City, Utah, Proc. IEEE World Haptics Conference, pp. 613–614, March 2009. Best Hands-On Demonstration Award.
- [D20] Pulkit Kapur, Sunthar Premakumar, Steven A. Jax, Laurel J. Buxbaum, Amanda M. Dawson, and Katherine J. Kuchenbecker. Vibrotactile feedback system for intuitive upper-limb rehabilitation. Hands-on demonstration presented at IEEE World Haptics Conference, Salt Lake City, Utah, Proc. IEEE World Haptics Conference, pp. 621–622, March 2009.
- [D21] Kyle N. Winfree, Jamie Gewirtz, Thomas Mather, Jonathan Fiene, and Katherine J. Kuchenbecker. The iTorqu 1.0 and 2.0. Hands-on demonstration presented at IEEE World Haptics Conference, Salt Lake City, Utah, March 2009.

- [D22] Katherine J. Kuchenbecker, David Ferguson, Michael Kutzer, Matthew Moses, and Allison M. Okamura. The Touch Thimble. Hands-on demonstration presented at IEEE Haptics Symposium, Washington, D.C., March 2008.
- [D23] Katherine J. Kuchenbecker, Netta Gurari, and Allison M. Okamura. Comparing visual and haptic position feedback. Hands-on demonstration at IEEE World Haptics Conference, Tsukuba, Japan, March 2007.
- [D24] Katherine J. Kuchenbecker, Jonathan P. Fiene, and Günter Niemeyer. Event-based haptic feedback. Hands-on demonstration at IEEE World Haptics Conference, Pisa, Italy, March 2005.

PATENTS

1. K. J. Kuchenbecker, J. Romano, W. McMahan, and N. Landin. Systems and methods for capturing and recreating the feel of surfaces. United States patent application #13/193,731, filed July 29, 2011.
2. K. J. Kuchenbecker, D. Standish, W. McMahan, and J. Gewirtz. Systems and methods for providing vibration feedback in robotic systems. United States and international patent applications PCT/US2011/023995, filed February 8, 2011.
3. M. Kochman and K. J. Kuchenbecker. System and method for determining stricture characteristics. Provisional United States patent application #61/410,030, filed November 4, 2010.
4. B. G. MacGregor, J. C. B. Novoa, L. Cheng, E. Cruse, T. B. Eich, J. A. Fourt, D. M. Gresham, A. T. Grishaver, J. L. Hei, M. D. Inouye, K. J. Kuchenbecker, J. N. Ludwig, S. D. Newman, T. A. Pelman, A. Salamini, F. N. Schultz, B. J. V. Tarbell, S. A. Whitman, and D. M. Webster. Partition panel with modular appliance mounting arrangement. United States Patent #6,851,226, issued February 8, 2005. International patents also issued.
5. A. Calder, L. Bayer, K. Kuchenbecker, and E. Froelich. Self-service terminal. European Patent #1,258,842, issued November 20, 2002. United States patent pending under application #10/101,582.

GRANTS AND CONTRACTS

Current

1. NSF CAREER #IIS-0845670: “Haptography: Capturing and Recreating the Rich Feel of Real Surfaces.” Katherine J. Kuchenbecker (PI), University of Pennsylvania. Funded via American Recovery and Reinvestment Act (ARRA). Amount to Penn: \$499,495. July 15, 2009, through June 30, 2014.
2. NSF #IIS-0915560: “HCC: Small: Modular Tactile Feedback for Whole-Body Motion Guidance.” Katherine J. Kuchenbecker (PI), University of Pennsylvania. Amount to Penn: \$500,000. July 1, 2009, through June 30, 2012. Two \$16,000 REU supplements for summer 2010 and summer 2011.
3. ARL RCTA: “Robotics Collaborative Technology Alliance.” General Dynamics Robotic Systems (Lead), with approximately forty PIs from the University of Pennsylvania, Carnegie Mellon University, University of Central Florida, Florida A & M University, California Institute of Technology/Jet Propulsion Laboratory, Foster-Miller, Boston Dynamics, and General Dynamics Robotic Systems. \$129,700,000 total for the first five years. Amount to Penn: \$9,836,112. July 1, 2010 through June 30, 2015.
4. Willow Garage PR2 Beta Program: “PR2GRASP: From Perception to Reasoning to Grasping.” Maxim Likhachev (PI), Kostas Daniilidis (Co-PI), Katherine J. Kuchenbecker (Co-PI), Vijay Kumar (Co-PI), Daniel D. Lee (Co-PI), Jianbo Shi (Co-PI), Camillo Jose Taylor (Co-PI), and Mark Yim (Co-PI), University of Pennsylvania. Amount to Penn: One PR2 two-handed mobile robot (equipment only). July 1, 2010, through June 30, 2012.

5. Coulter Translational Research Award: “Vibrotactile and Auditory Feedback for Robotic Minimally Invasive Surgery.” Katherine J. Kuchenbecker (PI) and David I. Lee (Co-PI), University of Pennsylvania. Amount to Penn: \$180,000. September 1, 2011, through August 30, 2013.
6. Subcontract from DARPA BOLT Activity E: “Perceptual Grounding of Language using Probabilistic Models,” University of California, Berkeley. Trevor Darrell (PI), Pieter Abbeel (Co-PI), Tom Griffiths (Co-PI), Gerald Friedland (Co-PI), Dan Klein (Co-PI), and Katherine J. Kuchenbecker (Co-PI). Total award: approximately \$5,000,000. Amount to Penn: approximately \$750,000. October 1, 2011, through September 30, 2016.
7. NSF REU Site #CNS-1156366: “Perception, Planning, Mobility, and Interaction for Next Generation Robotics.” Max Mintz (PI), Katherine J. Kuchenbecker (Co-PI), C. J. Taylor (Co-PI), Christine Massey (Co-PI), and Vijay Kumar (Co-PI), University of Pennsylvania. Amount to Penn: \$349,200. April 1, 2012, through March 31, 2015.

Completed

1. DARPA ARM-S: “DHARMA: Dexterous Hand-Arm Robotic Manipulation Autonomy.” Wes Huang (PI, iRobot), Vijay Kumar (Manipulation lead, Penn), Rod Grupen (Perception lead, UMass-Amherst), Kostas Daniilidis (Perception lead, Penn), Max Likhachev (Co-PI, Penn), Katherine J. Kuchenbecker (Co-PI, Penn), Dan Lee (Co-PI, Penn), and Chris Geyer (Co-PI, iRobot). Total award: approximately \$1,000,000. July 1, 2010, through September 30, 2011.
2. Pennsylvania Department of Health: Heath Research Formula Funds (Tobacco Funds): “Vibrotactile and Auditory Feedback for Robotic Minimally Invasive Surgery.” Katherine J. Kuchenbecker (PI) and David I. Lee (Co-PI), University of Pennsylvania. Amount to Penn: \$75,000. July 1, 2010, through December 31, 2010.
3. NSF CRI #CNS-0855210: “II-EN: Mobile Manipulation.” Maxim Likhachev (PI), Katherine J. Kuchenbecker (Co-PI), Daniel Lee (Co-PI), Jianbo Shi (Co-PI), and Kostas Daniilidis (Co-PI), University of Pennsylvania. Amount to Penn: \$298,050. September 1, 2009, through August 31, 2010.
4. Subcontract from Pennsylvania Department of Health: Health Research Formula Fund (Tobacco Funds), Moss Rehabilitation Research Institute: “Development of a Low Cost Haptic Virtual Environment for Upper Limb Rehabilitation.” Steven Jax (PI), Laurel Buxbaum (Co-PI), and Katherine J. Kuchenbecker (Co-PI). Amount to Penn: \$10,041 plus equipment. January 1, 2009, through December 31, 2009.
5. Subcontract from NSF #EEC-9731748, ERC: Engineering Research Center for Computer-Integrated Surgical Systems and Technology (CISST), Johns Hopkins University, Russell Taylor (PI): “Haptic Effects of Nonideal Slave Dynamics in Robotic Surgery.” Amount to Penn: \$19,976. September 1, 2007, through June 30, 2008.

TECHNICAL TALKS AND SEMINARS

1. “Tactile Acceleration Cues for Haptic and Robotic Systems.” Invited presentation, Department of Mechanical and Civil Engineering, California Institute of Technology, Pasadena, California. May 24, 2012.
2. “Haptic Systems in Surgical Robotics.” Invited presentation, IDEAS (Innovation, Design, and Emerging Alliances in Surgery) Symposium: Opportunities and Challenges in Surgical Robotics, Beth Israel Deaconess Medical Center, Boston, Massachusetts. April 21, 2012.
3. “Tactile Acceleration Cues for Haptic and Robotic Systems.” Invited presentation, Department of Mechanical and Aerospace Engineering, University of California at Los Angeles, Los Angeles, California. March 16, 2012.

4. "Tactile Acceleration Cues for Biomedical Robotics." Invited presentation, Biomed Seminar Series, Drexel University, Philadelphia, Pennsylvania. February 3, 2012.
5. "Haptics." PopTech Science and Public Leadership Fellow presentation, PopTech Conference, Camden, Maine. October 20, 2011. http://poptech.org/popcasts/katherine_j_kuchenbecker_haptic_interfaces
6. "Touching Reality: Haptic Feedback for Robotic Surgery, Tablet Computers, and More." Invited presentation, TEDxPenn, University of Pennsylvania. October 7, 2011.
7. "Collaborating with Engineers." Invited presentation, Surgical Innovation and Entrepreneurship Conference, University of Pennsylvania. September 24, 2011.
8. "VerroTouch: Tool Contact Acceleration Feedback for Telerobotic Surgery." Invited presentation, Workshop on Haptics in Surgical Robotics, IEEE World Haptics Conference, Istanbul, Turkey. June 21, 2011.
9. "Tool Vibration Feedback May Help Expert Robotic Surgeons Apply Less Force During Manipulation Tasks." Paper presentation, Hamlyn Symposium on Medical Robotics, London, England. June 20, 2011.
10. "Human-Inspired Robotic Grasp Control with Tactile Sensing." Invited presentation, Workshop on Mobile Manipulation, IEEE International Conference on Robotics and Automation, Shanghai, China. May 13, 2011.
11. "Three Good Reasons to Buy an Accelerometer." Invited seminar, Laboratory for Computational Sensing and Robotics, Johns Hopkins University, Baltimore, Maryland. April 27, 2011.
12. "Haptics: Touch Feedback for Robotic Surgery, Tablet Computers, and More." Invited seminar, Women in Human-Computer Interaction Lecture Series, Iowa State University, Ames, Iowa. April 14, 2011. <http://vimeo.com/channels/190937#226>
13. "Haptics: Touch Feedback for Robotic Surgery, Tablet Computers, and More." Distinguished lecture, Drexel IEEE Graduate Forum's Annual Research Symposium, Drexel University, Philadelphia, Pennsylvania. March 3, 2011.
14. "High-Fidelity Haptic Interfaces: Haptography, VerroTouch, StrokeSleeve, and Tactile Grasping." Invited seminar, Center for Injury Research and Prevention at The Children's Hospital of Philadelphia. February 15, 2011.
15. "High-Fidelity Haptic Interfaces: Haptography, VerroTouch, StrokeSleeve, and Tactile Grasping." Invited seminar, Institute for Research on Cognitive Science, University of Pennsylvania. January 21, 2011.
16. "High-Fidelity Haptic Interfaces: Haptography, VerroTouch, StrokeSleeve, and Tactile Grasping." Invited seminar, Center for Robotics and Intelligent Machines, Georgia Institute of Technology, Atlanta, Georgia. November 23, 2010.
17. "Robotics in the 21st Century: From the Lab to the OR and Back." Invited seminar, Anesthesiology Grand Rounds, Main Line Health Anesthesia Departments (Lankenau, Bryn Mawr, and Paoli Hospitals), Philadelphia, Pennsylvania. November 16, 2010.
18. "Creating Realistic Virtual Textures from Contact Acceleration Data." Invited seminar, Mechanical Engineering Department, University of Maine, Orono, Maine. October 1, 2010.
19. "Creating Realistic Virtual Textures from Contact Acceleration Data." Invited seminar, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania. September 23, 2010.
20. "High-Fidelity Haptic Interfaces for Surgical Applications." Invited seminar, Neurosurgery Grand Rounds, Hospital of the University of Pennsylvania. August 12, 2010.

21. “High-Fidelity Haptic Interfaces for Medical Applications.” Invited seminar, Center for Simulation, Advanced Education, and Innovation, Children’s Hospital of Philadelphia. July 21, 2010.
22. “VerroTouch: High-Frequency Acceleration Feedback for Telerobotic Surgery.” Paper presentation, EuroHaptics Conference, Amsterdam, the Netherlands. July 8, 2010.
23. “High-Fidelity Haptic Feedback for Robotic Surgery.” Invited presentation, Medical Robotics Innovation Forum, Stanford Medical Innovation Conference on Medical Robotics, Stanford University, Stanford, California. April 10, 2010.
24. “High-Fidelity Haptic Feedback: Haptography, VerroTouch, and Stroke Sleeve.” Invited seminar, Robotics Lab, Stanford University, Stanford, California. April 9, 2010.
25. “High-Fidelity Haptic Feedback for Robotic Surgery: Haptography and VerroTouch.” Invited seminar, Intuitive Surgical, Inc., Sunnyvale, California. April 9, 2010.
26. “New Trends in Medical Robotics and Haptic Feedback.” Invited seminar, Lankenau Hospital, Philadelphia, Pennsylvania. February 23, 2010.
27. “High-Fidelity Haptic Interfaces for Real, Remote, and Virtual Environments.” Invited seminar, QinetiQ North America/Foster-Miller, Waltham, Massachusetts. November 20, 2009.
28. “GPU Methods for Real-Time Haptic Interaction with 3D Fluids.” Paper presentation, IEEE International Workshop on Haptic Audio-Visual Environments and Games, Lecco, Italy. November 7, 2009.
29. “Haptography: Capturing and Recreating the Rich Feel of Real Interactions.” Invited paper presentation, International Symposium on Robotics Research, Lucerne, Switzerland. August 31, 2009.
30. “Haptography: Creating Authentic Haptic Feedback from Recordings of Real Interactions.” Invited presentation (Early Career Spotlight Talk), Robotics: Science and Systems Conference, Seattle, Washington. July 1, 2009.
31. “High-Fidelity Haptic Feedback for Surgical Teleoperation.” Invited seminar (delivered twice), Electrical Engineering Department, University of Calgary, and Neurosurgery Department, Foothills Hospital, Calgary, Alberta. May 1, 2009.
32. “Overview of Current Research: High-Fidelity Haptic Interfaces for Real, Remote, and Virtual Environments.” Invited seminar, Robotics Program, Engineering and Systems Division, SRI International, Menlo Park, California. February 10, 2009.
33. “Application: Haptics.” Invited presentation, Workshop on Contact Models for Manipulation and Locomotion, IEEE International Conference on Robotics and Automation, Pasadena, California. May 19, 2008.
34. “The Touch Thimble: Providing Fingertip Contact Feedback During Point-Force Haptic Interaction.” Paper presentation, IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems, Reno, Nevada. March 13, 2008.
35. “Rendering Realistic Contact with Virtual Surfaces Via Event-Based Haptic Feedback.” Invited presentation, Workshop on Integration of Haptics in Virtual Environments: from Perception to Rendering. IEEE Virtual Reality Conference, Reno, Nevada. March 8, 2008.
36. “Realistic Haptic Feedback for Virtual Environments and Teleoperation.” Invited seminar, City College of New York, New York, New York. February 7, 2008.
37. “Effects of Visual and Haptic Position Feedback on Human Control of Targeted Movement.” Paper presentation, IEEE International Conference on Rehabilitation Robotics, Noordwijk, Netherlands. June 12, 2007.

38. “High-Frequency Acceleration Matching for Realistic Haptic Interaction.” Invited seminar, Somatosensory Group, Krieger Mind/Brain Institute, Johns Hopkins University, Baltimore, Maryland. November 29, 2006.
39. “Characterizing and Controlling the High-Frequency Dynamics of Haptic Interfaces.” Invited seminar, ERC-CISST Seminar Series, Johns Hopkins University, Baltimore, Maryland. October 11, 2006.
40. “Characterizing and Controlling the High-Frequency Dynamics of Haptic Interfaces.” Doctoral defense, Department of Mechanical Engineering, Stanford University, Stanford, California. May 30, 2006.
41. “Improving Telerobotic Touch Via High-Frequency Acceleration Matching.” Paper presentation, IEEE International Conference on Robotics and Automation, Orlando, Florida. May 18, 2006.
42. “Characterizing and Controlling the High-Frequency Dynamics of Haptic Interfaces.” Invited seminar, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, Pennsylvania. April 13, 2006.
43. “Realistic Haptic Feedback for Virtual Environments and Teleoperation.” Invited seminar, University of British Columbia, Vancouver, Canada, January 30; University of California, Riverside, February 6; University of California, Santa Cruz, February 8; University of Pennsylvania, February 14; Johns Hopkins University, February 16; Northwestern University, February 20; Cal Poly San Luis Obispo, February 27; Tufts University, March 2; University of Maryland, College Park, March 9; University of Michigan, Ann Arbor, March 21; Carnegie Mellon University, March 23; Massachusetts Institute of Technology, April 5; Columbia University, April 12; Duke University, April 17; Georgia Tech, April 18, 2006.
44. “Modeling Induced Master Motion in Force-Reflecting Teleoperation.” Paper presentation, IEEE International Conference on Robotics and Automation, Barcelona, Spain. April 19, 2005.
45. “Event-Based Haptics and Acceleration Matching: Portraying and Assessing Realism of Contact.” Paper presentation, IEEE World Haptics Conference, Pisa, Italy. March 20, 2005.
46. “Canceling Induced Master Motion in Force-Reflecting Teleoperation.” Paper presentation, International Mechanical Engineering Congress and Exposition, Dynamic Systems and Controls Division, Symposium on Advances in Robot Dynamics and Control, Anaheim, California. November 18, 2004.
47. “Haptic Display of Contact Location.” Paper presentation, IEEE Symposium on Haptic Interfaces for Virtual Environment and Teleoperator Systems, Chicago, Illinois. March 27, 2004.
48. “Characterizing the Human Wrist for Improved Haptic Interaction.” Paper presentation, International Mechanical Engineering Congress and Exposition, Dynamic Systems and Controls Division, Symposium on Advances in Robot Dynamics and Control, Washington, D.C. November 19, 2003.

EDUCATIONAL PRESENTATIONS AND WORKSHOPS

1. “Sensors and Sensor Interfaces.” Workshop on Tools and Techniques for Prototyping Haptic Interfaces, IEEE Haptics Symposium. March 4, 2012.
2. “Haptics: Touch Technology.” Technical presentation for alumni and their families, Homecoming Weekend, University of Pennsylvania. November 5, 2011.
3. “Penn Haptics Research.” Guest Lecture, IPD 561: Integrated Product Design Theories and Methods I, University of Pennsylvania. November 1, 2011.
4. “Three Good Reasons to Buy an Accelerometer.” Master lecture for high-school-age participants in the Summer Academy in Applied Science and Technology (SAAST), University of Pennsylvania. July 22, 2011.
5. “Haptics: Touch-Based Interaction.” Workshop and lab tour, IRCS Undergraduate Summer Workshop on Cognitive Science, University of Pennsylvania. June 6, 2011.

6. "Penn Haptics Research: Touch Feedback for Robotic Surgery, Tablet Computers, and More." Guest lecture, MEAM 348: Mechanical Engineering Design Laboratory, University of Pennsylvania. March 21, 2011.
7. "Penn Haptics Research: Touch Feedback for Robotic Surgery, Tablet Computers, and More." Technical presentation and hands-on demonstrations for high-school-age participants in the Robotics Leadership Academy at GRASP, University of Pennsylvania. February 17, 2011.
8. "Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Guest lecture, EMTM 695: Robotics, Executive Masters in Technology and Management program, University of Pennsylvania. February 4, 2011.
9. "Haptics: Touch Feedback for Robotic Surgery, Tablet Computers, and More" Online seminar (webinar) for the Penn Alumni Association. November 9, 2010.
10. "Earning an NSF Graduate Research Fellowship." Panel presentation, School of Engineering and Applied Science, University of Pennsylvania. October 5, 2010.
11. "Mechanical Engineering in Action!" Two hands-on design activities for PennGEMS: Girls in Engineering Math and Science Camp, University of Pennsylvania. August 3 and 4, 2010.
12. "Haptics: Touch-Based Interaction." Workshop and lab tour, IRCS Undergraduate Summer Workshop on Cognitive Science, University of Pennsylvania. June 16, 2010.
13. "Introduction to Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Guest lecture, CIS 563: Physically Based Animation, University of Pennsylvania. March 29, 2010.
14. "Haptics: Touch Feedback for Robotic Surgery and More." Workshop, Society of Women Engineers (SWE) Region E Conference, University of Pennsylvania. March 20, 2010.
15. "Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Guest lecture, EMTM 695: Robotics, Executive Masters in Technology and Management program, University of Pennsylvania. October 30, 2009.
16. "Earning an NSF Graduate Research Fellowship." Panel presentation, School of Engineering and Applied Science, University of Pennsylvania. October 16, 2009.
17. "Mechanical Engineering in Action!" Two hands-on design activities for PennGEMS: Girls in Engineering Math and Science Camp, University of Pennsylvania. August 6 and 7, 2009.
18. "Haptography: Capturing and Recreating the Rich Feel of Real Surfaces." Master lecture for high-school-age participants in the Summer Academy in Applied Science and Technology (SAAST), University of Pennsylvania. July 24, 2009.
19. "Please Touch! Haptic Technology for Games, Surgery, and More." Keynote speech, RobotGames Competition, University of Calgary, Calgary, Alberta. May 2, 2009.
20. "Past, Present, and Future Research." Guest lecture, MEAM 348: Mechanical Engineering Design Laboratory, University of Pennsylvania. March 30, 2009.
21. "Introduction to Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Guest lecture, CIS 563: Physically Based Animation, University of Pennsylvania. March 2, 2009.
22. "Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Lecture for participant parents, Science and Technology Series, Center for Talented Youth Robotics Program, University of Pennsylvania. November 15, 2008.
23. "Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments." Guest lecture, EMTM 695: Robotics, Executive Masters in Technology and Management program, University of Pennsylvania. October 31, 2008.

24. “Earning an NSF Graduate Research Fellowship.” Panel presentation, School of Engineering and Applied Science, University of Pennsylvania. October 10, 2008.
25. “Mechanical Engineering in Action!” Hands-on design activity for PennGEMS: Girls in Engineering Math and Science Camp, University of Pennsylvania. August 7, 2008.
26. “Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments.” Master lecture for high-school-age participants in the Summer Academy in Applied Science and Technology (SAAST), University of Pennsylvania. July 25, 2008.
27. “Haptics: Touch-Based Interaction with Real, Remote, and Virtual Environments.” Guest lecture, EMTM 695: Robotics, Executive Masters in Technology and Management program, University of Pennsylvania. October 26, 2007.

ADVISING

Visiting Faculty

Seungmoon Choi, Ph.D., Associate Professor of Computer Science and Engineering at Pohang University of Science and Technology (POSTECH), Korea.
Visiting Associate Professor in Mechanical Engineering and Applied Mechanics at the University of Pennsylvania, July 2011 through July 2012.

Post-Doctoral Fellows

Karlin Bark, Ph.D., September 2010 through present.
L’Oréal Post-doctoral “For Women in Science” Fellowship (\$60,000 research grant) 2011–2012.
Will start in September 2012 at Honda Research in Mountain View, California.

Doctoral Students

Heather Culbertson, 2010 through present. Anticipated graduation May 2015.
Ph.D. Student in Mechanical Engineering and Applied Mechanics at Penn.
NSF Graduate Research Fellowship 2011–2014.

Rebecca Pierce, 2010 through present. Anticipated graduation May 2015.
Ph.D. Student in Mechanical Engineering and Applied Mechanics at Penn.
NSF Graduate Research Fellowship 2011–2014.

William McMahan, 2008 through present. Anticipated graduation December 2012.
Ph.D. Student in Mechanical Engineering and Applied Mechanics at Penn.
Best Poster in Session (of 17 posters), American Urological Association Annual Meeting 2011.
Best Hands-on Demonstration, IEEE World Haptics Conference 2009.

Joseph M. Romano, 2007 through 2012.
Ph.D. in Mechanical Engineering and Applied Mechanics at Penn, May 2012.
Ashton Fellowship 2007–2012.
Best Teaser Presentation, IEEE Haptics Symposium 2010.
Intern at Willow Garage in Summer 2010.
Now at Heartland Robotics in Boston, Massachusetts.

Masters Thesis Students

Diane Tam, 2011 through present. Anticipated graduation August 2012.
M.S. Student with HCI Sub-Specialization at the University of British Columbia.
Co-advised by Karon MacLean and Joanna McGrenere.

Jennifer Hui, 2011 through present. Anticipated matriculation to doctoral program September 2012.
M.S.E. Student in Robotics at Penn.
NSF Graduate Research Fellowship 2011–2014.

Ernest (Ted) Gomez, 2011 through present. Anticipated graduation December 2012.
M.S. Student in Translational Research at Penn.

Yunqing (David) Wang, graduated December 2011.
M.S.E. in Bioengineering at Penn. Now at the U.S. Patent Office.
“HALO: Haptic Alerts for Low-hanging Obstacles in White Cane Navigation.”

Pulkit Kapur, graduated May 2010.
M.S.E. in Mechanical Engineering and Applied Mechanics at Penn. Now at Geomagic (formerly Sens-
Able Technologies).
“StrokeSleeve: Spatially Distributed Tactile Feedback for Kinesthetic Motion Guidance.”

Kyle N. Winfree, graduated August 2009.
M.S.E. in Robotics at Penn. Now a Ph.D. student at the University of Delaware.
“An Ungrounded Haptic Torque Feedback Device: The iTorqU.”

Many additional graduate students work in my lab without writing a thesis. Research is performed for independent study course credit, for hourly pay, or on a volunteer basis. Many of these projects begin in my graduate-level course on haptics and culminate in publication of a conference paper.

Visiting Graduate Students

Gabjong Han, October 2011 – January 2012.
Ph.D. student in Computer Science and Engineering at Pohang University of Science and Technology (POSTECH), Korea, under Professor Seungmoon Choi.

Rahul Chaudhari, September 2011 – November 2011.
Ph.D. student in Media Technology at Technische Universität München (TUM), Germany, under Professor Eckehard Steinbach.
Supported by a \$2,000 student exchange award from the IEEE Technical Committee on Haptics.

Undergraduate Research Students

Over 30 undergraduate researchers have been recruited and mentored since 2007. The majority have been University of Pennsylvania undergraduate students in Mechanical Engineering and Applied Mechanics or Bioengineering. Research is performed for independent study course credit, for hourly pay, or on a volunteer basis. Many of the undergraduate researchers have been co-authors on papers or abstracts, and several of them have gone on to Ph.D. research with competitive national fellowships.

Senior Design Projects

2011-2012: “DIGIT: Automated, Temperature-Calibrated Measurement of Capillary Refill Time” by Annett Bordoley, Rikki Irwin, Viraj Kalyani, Craig McDonald, and Dorsey Standish. MEAM senior design project sponsored by Dr. Vinay Nadkarni. Tatnall Prize for most outstanding project. Fifth place overall in SEAS senior design competition.

2011-2012: “Weight-Bearing Casting System for Transfemoral Prostheses” by Melissa Cedarholm, Duyun Chen, Gregory Lee, and Zameer Merchant. BE senior design project. Advanced to SEAS senior design competition.

2010-2011: “High-Fidelity Mannequin Chest for CPR Training” by Michael Boyle, Nihar Dharamsey, Simon Healey, Nihar Naik, and Andrew Stanley. MEAM senior design project co-advised by Matt Maltese. Couloucondis prize for best presentation of a senior design project. Tied for fourth place overall in SEAS senior design competition. Gold Award in James F. Lincoln Arc Welding Foundation Division IV Design Competition.

2009-2010: “Robotic Self-Feeder for Children with Cerebral Palsy” by Cynthia Ericksen, Mallory Jensen, Monica Sachs, and Monica Thomas. MEAM senior design project.

2008-2009: “Tactile Vision” by Amal Abdul Rahuman, David Argudo, Sameer Kirtane, and Haresh Tilani. Joint MEAM and BE senior design project.

2008-2009: “Haptic Compass for the Visually Impaired” by Brian Hylton and Sumito Ahuja. MEAM senior design project.

2008-2009: “ROGER: Rapidly Orienting Green-Eyed Robot” by Kate Chovanetz, Matthew MacMillan, and Travis Van Schoyck. MEAM senior design project co-advised by Mark Yim. Couloucondis prize for best presentation of a senior design project. Advanced to SEAS senior design competition.

Thesis and Exam Committees

2012: Ph.D. dissertation committee for Joe Romano. Ph.D. dissertation proposal committee for William McMahan. Departmental qualifying exam for one student.

2011: Ph.D. dissertation committee for Paul White and Chris Thorne. Dissertation proposal committee for Paul White, Chris Thorne, and Joe Romano. Departmental qualifying exams for three students.

2010: Ph.D. dissertation committee for Netta Gurari (Johns Hopkins University). Departmental qualifying exam for one student.

2009: Departmental qualifying exams for two students.

2008: Departmental qualifying exams for three students.

INSTRUCTION AND COURSE DEVELOPMENT

Undergraduate Courses

Engineering Mechanics: Dynamics This sophomore-level lecture course investigates the motion of bodies and the forces involved in their motion, focusing on particle and rigid body models. Students attend lectures and recitation, complete weekly problem sets, do individual dynamic simulation problems using Matlab, and take three examinations. *MEAM 211 at the University of Pennsylvania: 68 students in Spring 2010, 58 students in Spring 2011, and 72 students in Spring 2012.*

Introduction to Mechanics Lab (new course) This freshman-level laboratory class investigates the concepts of classical mechanics through weekly hands-on experiments, many of which use Matlab and a custom camera-based motion-capture system. Each week, students read the lab workbook, take an in-class pre-lab quiz, work through the lab’s activities in teams of three, and complete a follow-on post-lab assignment. *MEAM 147 at the University of Pennsylvania: 38 students in Fall 2007, 71 students in Fall 2008, 70 students in Fall 2009, and 78 students in Fall 2010.*

I have also taught a three-week version of this class in a summer program that helps prepare incoming undergraduate students for college-level engineering classes. *PFP at the University of Pennsylvania: 15 students in Summer 2008, 14 students in Summer 2009, and 13 students in Summer 2010.*

Assorted Other Topics (as a teaching assistant) I worked as a teaching assistant for eight quarters as a graduate student at Stanford University. Five quarters were spent as a TA in the Product Realization Laboratory, teaching mechanical design and manufacturing in affiliation with the ME 203 course. The other courses I helped teach were Computer-Aided Design and Prototyping (ME 213), Control System Design and Simulation (E 206), Statics (E 14), and Dynamics (E 15).

Graduate Courses

Haptic Interfaces (new course) This course provides an introduction to research in the field of haptics, which involves human interaction with real, remote, and virtual objects through the sense of touch. The course includes lectures, written and hands-on homework assignments, research paper discussion and presentation, and semester-long team projects. Many of these student projects lead to further research and conference publications. *MEAM 625 at the University of Pennsylvania: 19 students in Spring 2008, 14 students in Spring 2009, and 28 students in Fall 2010.*

PROFESSIONAL SERVICE

Program Committees, Review Panels, and Conference Organization

- 2012 National Science Foundation proposal reviews.
- 2012 Area Chair, Robotics: Science and Systems (RSS) Conference.
- 2012 Associate Editor, IEEE International Conference on Robotics and Automation (ICRA).
- 2012 Program Committee, IEEE Haptics Symposium.
- 2012 Website Advisor and Organizing Committee Member, IEEE Haptics Symposium.
- 2011 Co-chair (with Marcia O'Malley and Yasu Yokokohji), special sessions on "Haptic Interfaces," IEEE Conference on Intelligent Robots and Systems (IROS).
- 2011 Associate Editor, IEEE World Haptics Conference.
- 2011 Associate Editor, IEEE International Conference on Robotics and Automation (ICRA).
- 2010 One National Science Foundation proposal review panel.
- 2010 Publicity Chair, Robotics: Science and Systems. Helped plan the conference, designed the conference poster and flyer, drafted the call for papers and the call for participation, and distributed these posters, flyers, and calls worldwide.
- 2010 Co-Chair of Posters, Demonstrations and Exhibits, IEEE Haptics Symposium. Wrote and distributed the call for hands-on demonstrations, reviewed demonstration submissions, and coordinated the presentation of posters, demonstrations, and exhibits at the conference venue.
- 2010 Program Committee, IEEE Haptics Symposium. Recruited reviewers, checked reviews, reviewed submitted papers, and made recommendations on paper acceptance.
- 2009 Two National Science Foundation proposal review panels.
- 2009 National Institutes of Health proposal reviews.
- 2008 Program Committee, IEEE Haptics Symposium (held biannually).
- 2008 One National Science Foundation proposal review panel.

Reviews

Journal paper reviews: IEEE Transactions on Haptics, IEEE Transactions on Robotics, International Journal of Robotics Research, IEEE Transactions on Visualization and Computer Graphics, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Instrumentation and Measurement, IEEE Transactions on Neural Systems and Rehabilitation Engineering, IEEE Transactions on Systems, Man, and Cybernetics, Presence: Teleoperators and Virtual Environments, ASME Journal of Computing and Information Science in Engineering, ACM Transactions on Applied Perception, PLoS ONE.

Conference paper reviews: In addition to the conference program committees listed earlier, occasional reviews are provided for numerous annual and biannual conferences, including IEEE World Haptics Conference (WHC), IEEE International Conference on Robotics and Automation (ICRA), IEEE Virtual Reality (VR), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechanics (BioRob), EuroHaptics (EH), ASME Dynamic Systems and Controls Conference (DSC), International Symposium on Robotics Research (ISRR).

Professional Society Memberships

Institute for Electrical and Electronic Engineers (IEEE), Robotics and Automation Society
American Society of Mechanical Engineers (ASME), Dynamic Systems and Controls Division
Association for Women in Science (AWIS)
Society of Women Engineers (SWE)

UNIVERSITY SERVICE

Department of Mechanical Engineering and Applied Mechanics at the University of Pennsylvania

Search Committee, Part-time Lecturer for Senior Design (2012)
Search Committee, Department Chair for Mechanical Engineering and Applied Mechanics (2011)
Search Committee, Associate Director for Integrated Product Design masters program (2010–2011)
Graduate Admissions Committee (2007–2008, 2010, 2012)
Website Redesign Committee (2008–2010)
Senior Design Committee (2008–2010)

School of Engineering and Applied Science at the University of Pennsylvania

Faculty Advisor for the Society of Women Engineers Student Chapter (2009–present)
Faculty Advisory Board, Advancing Women in Engineering (2007–present)
Library Redesign Committee (2008–2009)

University of Pennsylvania

Executive Committee, Institute for Research on Cognitive Science (2011–present)
Faculty Advisor for TCPW, the Trustees' Council on Penn Women (2009–present)
Faculty Liaison, Trustees' Committee on Student Life (2009–2010)
Numerous presentations to alumni, industrial partners, and prospective donors, plus interviews and lab tours for internal and external audiences