JAMES EDWARD COLGATE

Department of Mechanical Engineering
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Citizenship: U.S.A.
Birthdate: 9-30-62

Research Interests

- Human-Machine Systems. Especially haptic interface and cobotics.
- Physical Systems Modeling, Analysis, and Control.

Academic History

Northwestern University, Department of Mechanical Engineering

Allen and Johnnie Breed University Professor of Design, September 2010 – present
Director, Master of Science in Engineering Design & Innovation, 2007 – present
Director, Segal Design Institute, July 2010 – September 2011
Co-Director, Segal Design Institute, March 2007-June 2010
Pentair-Nugent Professor, September 2006 – August 2009
Alumnae of Northwestern Professor of Teaching Excellence, September 2003 – August 2006
Professor and Director, Institute for Design Engineering and Applications, September 2002 – March 2007
Associate Professor, September 1994 - 2002
Assistant Professor, September 1988 - September 1994

Gwangju Institute of Science and Technology

Adjunct Professor, 2007-2010

Massachusetts Institute of Technology, Department of Mechanical Engineering

PhD, Mechanical Engineering, September 1988
Advisor: Neville Hogan
Thesis: "The Control of Dynamically Interacting Systems"

S.M., Mechanical Engineering, January 1986
Advisor: Neville Hogan
Thesis: "The Design of a Dynamics Measuring Device"

Massachusetts Institute of Technology, Department of Physics

S.B., Physics, June 1983
Advisor: Neville Hogan
Thesis: "Design of a Gripper Capable of Repositioning Objects within its Grasp"

Honors

- Best Paper Award, CHI 2011 for "Enhancing Physicality in Touch Interaction with Programmable Friction" by Vincent Lévesque, Louise Oram, Karon MacLean, Andy Cockburn, Nicolas D. Marchuk, Dan Johnson, J. Edward Colgate and Michael A. Peshkin. Proc. ACM Conference on Human Factors in Computing Systems (CHI '11), Vancouver, Canada, May 2011, pp. 2481-2490.
- Visiting Professor, University of Siena, Siena, Italy, July 2008. Taught a one-week PhD course on "The Passivity Approach to Haptic Display" sponsored by the University of Siena and the IEEE Robotics and Automation Society, Italian chapter.
- Best Demonstration Award, 2007 World Haptics Conference, Tsukuba, Japan. For TPaD: Tactile Pattern Display, by Laura Winfield, J. Edward Colgate and Michael Peshkin.
- Emerald Literati Network Awards for Excellence 2007, "Highly Commended" citation for "Lessons Learned from a Novel Teleoperation Testbed" by B.P. Dejong, E.L. Faulring, J.E. Colgate, M.A. Peshkin, H. Kang, Y.S. Park, T.F. Ewing, Industrial Robot, 33(3): 187-193, 2006
- Pentair-Nugent Professorship, September 2006-August 2009
- Visiting Professor, Institut d'Organització i Control de Sistemes Industrials, Universitat Politéchnica de Catalunya, April 2006
- Leonardo Da Vinci Award for Contributing Significantly to Design Engineering, 2003. Presented by Design Engineering Division of the American Society of Mechanical Engineers.
- Alumnae of Northwestern University Teaching Professorship, 9/03 – 8/06.
- Freshman Programs Division (FPD) 2002 Best Paper Award for paper "Enriching Freshman Design Through Collaboration With Professional Designers" by P. Hirsch, J. Anderson, J.E. Colgate, J. Lake, B. Shwom, and C. Yarnoff.
- Northwestern University Alumni Association Excellence in Teaching Award, 2000
- 1998 ASME Material Handling Engineering Division Best Paper Award for paper "Cobots: A Novel Material Handling Technology" by Wannasuphoprasit, W., Akella, P., Peshkin, M., Colgate, J.E.
- Finalist, Discover Magazine Awards for Technological Innovation, 1997 (with M.A. Peshkin)
- Best Paper Award, 1996 IEEE International Conference on Robotics and Automation for paper "Nonholonomic Haptic Display" by J.Edward Colgate, M.A. Peshkin and W. Wannasuphoprasit
- Guest Researcher, Mechanical Engineering Laboratory, Ministry of International Trade and Industry, Tsukuba Science City, Japan, 2/96
- Henry Hess Award for outstanding paper by a young author in an ASME journal, 1995 for paper entitled "Coordinate Transforms and Logical Operations for Minimizing Conservativeness in Coupled Stability Criteria"
- Ralph R. Teetor Educational Award of the SAE, 1995
- Associated Student Government Faculty Honor Roll, 1994-1995
- National Science Foundation Fellow, 1983-1986
- Luis de Florez Award for best student engineering design, MIT, 1983
- National Merit Scholarship recipient, 1979

Graduate and Postgraduate Students

Postdoctoral Associates

Wiertlewski, Michael (current)
Kim, Keehoon (Research Scientist, Korean Institute for Science and Technology)
Gillespie, Brent (Associate Professor, University of Michigan)
Burdet, Etienne (Lecturer, Imperial College London)
Kotoku, Tetsuo (Robotics Department, Mechanical Engineering Laboratory, AIST, MITI)

PhD Students

Aguirre-Ollinger, Gabriel	Active Impedance Control of a Lower-Limb Assistive Exoskeleton, 9/09 (University of Technology, Sydney)
Weir, David	Assessing and Increasing Z-Width of Haptic Displays with Active Electrical Damping, 6/08 (Intuitive Surgical)
Dejong, Brian	On Cyclic Robots for the Lower Limb, 12/07 (Central Michigan University)
Epstein, Michael	Generating Thrust with a Biologically Inspired, Robotic Ribbon Fin, 9/06
Faulring, Eric	The Cobotic Hand Controller: Design, Control and Analysis of a Novel Haptic Display, 12/05 (HDT Robotics)
Salada, Mark	Fingertip Haptics: Preliminary Experiments on the Perception of Slip in Hapti Feedback, 6/04 (Intuitive Surgical)
Miller, Brian	Stability of Haptic Systems Exhibiting Non-Passive Behavior, 9/00 (Intuitive Surgical, Inc.)
Reger, Bernard	A Neuro-Robotic Interface for the Study of Synaptic Plasticity in Sensorimotor Adaptation, 6/99 (US Army)
Wannasuphoprasit, Witaya	Cobots: Collaborative Robots, 6/99 (Associate Professor, Chulalongkorn University, Bangkok Thailand)
Brown, J. Michael	Passive Implementation of Multibody Simulations for Haptic Display, 6/98 (Intuitive Surgical)
Stanley, Michael	High Fidelity Haptic Display of Complex Environments, 6/97
Tsai, Jui-Chang	Toward Guaranteed Stability in the Haptic Display of Virtual Environments, 6/96
Millman, Paul	Haptic Perception of Localized Features, 12/95 (Intuitive Surgical, Inc.)
Grace, Ken	Kinematic Design of an Ophthalmic Surgery Robot and Feature Extracting Bil Manipulation, 6/95
Matsumoto, Hirofumi	Mechanisms and Characteristics of Micro Electrostatic Linear Actuators, 6/92 (Nippon Mektron, Ltd.)

Master's and DAAD Exchange Students

Approximately 80 students since 1988

Teaching

Dynamic Systems and Control

- ME 495 Haptic Interface
- ME 390 Introduction to Dynamic Systems
- ME 391 Fundamental of Control Systems
- ME D91 State Space Control Theory
- ME 492 Robust Control Theory
- ME D95 Computational Mechanics

Design

- DSGN 401-1,2 Human Centered Design Studio
- IDEA 306 Technology Assessment and Innovation
- IDEA 298/398 Multidisciplinary Design Projects
- ME C98 Capstone Design
- Engineering Design and Communication (EDC)

I was a founding co-Director of the Segal Design Institute (www.segal.northwestern.edu) which focuses on teaching and researching design methodology in multiple contexts, including business, engineering, and communications. Segal offers a variety of programs, including MMM, a joint degree of the engineering and business schools; MS-EDI, a one-year master's program in human-centered design for the recent engineering graduate; MaDE, a bachelor's degree in manufacturing and design engineering; the Certificate in Engineering Design that any undergraduate can earn; a freshman program called "Design Thinking and Communication" (DTC) which is a standard part of the engineering curriculum at Northwestern and is taken by nearly 400 students annually. I was instrumental in starting MS-EDI, the Certificate in Engineering Design, and EDC.

Professional Activities

Professional Associations

- ASME
- IEEE
- ASEE

Editorial Responsibilities

- IEEE Transactions on Haptics, Founding Editor-in-Chief, 2007-present
- IEEE Transactions on Robotics and Automation, Associate Editor, 1998-2003
- Journal of Dynamic Systems, Measurement and Control, Associate Editor, 1995-1998
- Robotics and Computer Integrated Manufacturing, U.S. Editor, 1995-1999

Commercialization

- Founder (with M.A. Peshkin) of Tangible Haptics, LLC. Tangible is a start-up company developing haptics technology for touch screens and touch pads.
- Founder (with M.A. Peshkin and D. Brown) of Kinea Design, LLC (www.kineadesign.com). Kinea Design applies robotics to enhance the physical activity of people.
- Founder (with M.A. Peshkin) of Cobotics, Inc (www.cobotics.com). Cobotics is the leading provider of human assist technology for the industrial marketplace. From June 1999 until September 2000, I took a sabbatical leave from Northwestern University to serve as the Company's President. In 2002 the company was sold to The Stanley Works.

Selected Other Activities

- Member, External Adivsory Board, University of Delaware Department of Mechanical Engineering, 2008-2009
- Member, Board of Directors, Methode Electronics Corporation (NASDAQ – METH), 2004-present. Methode is a global manufacturer of component and subsystem devices with manufacturing, design, and testing facilities in the United States, Mexico, Malta, United Kingdom, Germany, Czech Republic, Singapore, and China.
- Founding Chair (with B.D. Adelstein) of the "Symposium on Haptic Interfaces to Virtual Environments and Teleoperators," which is today the leading conference of the haptic interface research community. Dr. Adelstein and I organized this conference from 1992 until 1995.
- Organizing Committee, "Strategic Development of Products and Environments for People with Stroke: Designing for a Unique Market." Rehabilitation Institute of Chicago Academy, October 6, 2006.
- Host for the Haptics Community Web Page (haptic.mech.northwestern.edu) that was developed by my graduate students J. Michael Brown and Bernard Reger.
- Reviewer for numerous publications, NSF programs, and multiple other funding agencies
- ASME Dynamic Systems and Control Division, Robotics Panel, Chair 1993-1995

Service to Northwestern University

Committees, University

- Evanston Space Planning Advisory Committee, 2005-2008
- Parking Committee, 2003-2006
- Information Technology Committee, 1997-2003
- UFRTDAP, 1995-2000

Committees, McCormick School of Engineering and Applied Science

- Promotion & Tenure Committee, 2005, 2008-2010
- Ford Engineering Design Center Building Committee, 2000-2005
- Co-op Committee, 1998-1999
- Undergraduate Curriculum Revision Committee, 1995-1996
- Computer Committee, 1989-1994

- Academic Standing Committee, 1992-1995
- McCormick Committee on Excellence (Subcommittee on Comparing Academic Cultures), 1993
- Dean's committee for assessment of Lower Division requirements in science and mathematics, 1989-1991.

Committees, Department of Mechanical Engineering

- Awards Committee, 2006-present
- Shop Committee, 2000-2005
- Executive Committee, 1998-2000
- Graduate Studies Committee, 1994
- Graduate Curriculum in Mechanics, Control and Manufacturing, 1993
- Benchmarking Committee, 1993
- Undergraduate Curriculum in Mechanics, Control and Manufacturing, 1988-1989

Sponsored Research

NSF, *Surface Haptics via Tractive Forces*, 7/1/10-6/30/14, with Profs. Michael Peshkin and Roberta Klatzky

DARPA (Subcontract with Johns Hopkins University Applied Physics Laboratory), *Revolutionizing Prosthetics 2009 Phase II*, 4/00-4/10, $420,000, with Prof. Michael Peshkin

Lemelson Foundation, The NUberwalker: Low Cost Body Weight Supported Treadmill Training System, 9/1/05-12/31/06, $20,000

Ford Motor Company, *Enhancing the Continuous Awareness of Automobile Drivers for Increased Safety*, 10/06-9/07, $72,000, with Profs. Michael Peshkin and Donald A. Norman

DARPA (Subcontract with Johns Hopkins University Applied Physics Laboratory), *Revolutionizing Prosthetics 2009 Phase I*, 12/05-11/07, $433,305, with Prof. Michael Peshkin

DARPA (Subcontract with DEKA Corporation), *Prosthetics 2007*, 12/05-11/07. $244,168, with Prof. Michael Peshkin

Honda Research Institute, *Coupled-Stable Human Interface to an Assistive Exoskeleton*, 12/1/04-3/31/06, $100k, with Prof. Michael Peshkin

NSF, *Variable Compliance Haptic Field Displays*, 9/1/04-8/31/07, $517k, with Profs. Michael Peshkin and Kornell Ehmann

Rehabilitation Institute of Chicago*, IDEA Training*, 10/03-9/08, $287k

NIST (ATP) and Rehabilitation Institute of Chicago, *Kine-assists for Physical Therapists*, 6/03-11/04, $1,814,626, with M.A. Peshkin and D.A. Brown

NSF, *Institute for Design Engineering and Applications: Fostering Creative Synthesis Across the Curriculum*, 9/02-8/03, $100k, with W. Hopp, A. McKenna, S. Mehrotra, D.Norman, G. Olson

NSF, *Fingertip Haptics: a Novel Direction in Force Feedback Systems*, 9/01-8/04, $327k

DOE, *Remote manipulation for D&D exhibiting tele-autonomy and tele-collaboration*, 10/01-9/04, $400k, with Professor Michael Peshkin

NSF Grant Opportunities for Academic Liason with Industry, 2000-2002, *GOALI - Haptic Cobots*, $450K (with M.A. Peshkin, Pietro Buttolo, Paul Stewart)

Ford Motor Company, 2000-2002, *University Research Program - Haptic Cobot*, $150K (with M.A. Peshkin)

Ford Motor Company, *Human Factors*, 8/99, $50,000, with Professor Michael Peshkin

ONR, *The Wildcat: A High Performance Haptic Display*, 9/97-2/98, $104,800

Murphy Society, *Engineering Design and Communication: An Infrastructure Proposal*, 9/97-9/98, $85,278

Proctor and Gamble, *Engineering First: Engineering Design and Communication* , 6/97-6/00, $150,000

NSF, *Vehicle Assembly Assistive Devices Using Programmable Constraint Machines*, 9/96-8/99, $326,847, with Professor Michael Peshkin

NSF, *Robust Haptic Display of Dynamical Virtual Environments (for R. Brent Gillespie)*, 3/96-3/98, $46,191

The Margaret W. and Herbert Hoover Jr. Foundation, *GRIN Endoscope Imaging of the Retina: Applications to Microsurgery*, 7/95-6/96, $39,914, with Professor M.R. Glucksberg

General Motors Corporation, *Operator Assistive Devices for Vehicle Assembly*, 5/1/95-4/30/00, $500,000, with Professors A. Haddad, L. Massone, M. Mavrovouniotis, M. Peshkin, and M. Van Oyen

ONR, *The Organization of Motor Behavior by the Combination of Vector Fields in Biological and Artificial Systems*, 3/1/95-2/28/98, $357,445, with Professor F.A. Mussa-Ivaldi

NASA, Graduate Student Researchers Program (for J. Michael Brown), 7/1/94-6/31/95, $22,000

NASA, *A Preliminary Investigation of Haptic Display for EVA Training,* 6/94-2/95, $47,995

NSF, *Real-Time Haptic Display of Rigid Body Dynamic Systems,* 6/94-5/97, $150,803

The Margaret W. and Herbert Hoover Jr. Foundation, *A Microinjection System for Treatment of Retinal Vascular Occlusion: Transition to Clinical Practice*, 1/94-12/94, $34,208, with Professor M.R. Glucksberg

NSF, *Average Power as a Measure of Dexterity in Generalized Hand Tool Use,* 1/93-12/95, $203,000

NSF, Research Experiences for Undergraduates Supplement, *Dexterity Enhancement Via Macro-Micro Bilateral Manipulation,* 7/92-6/93, $8,875

The Margaret W. and Herbert Hoover Jr. Foundation, *A Microinjection System for Treatment of Retinal Vascular Occlusion,* 1/92-12/93, $91,324, with Professor M.R. Glucksberg

Chrysler Corporation, *Performance Investigation of Hydroelastic Mounts,* 9/91-8/93, $170,900, with Professors L.M. Keer and W.K. Liu

NSF, *Dexterity Enhancement Via Macro-Micro Bilateral Manipulation*, 6/91-6/94, $200,000

Whitaker Foundation, *Linear Electrostatic Microactuator Development: Potential Building Blocks for Artificial Muscles*, 4/91-3/94, $179,937

Nippon Mektron, Ltd., *Linear Electrostatic Actuator Development,* $18,000 in kind support, 1/91-8/93

Engineering Foundation, *Dexterity Enchancement Via Macro-Micro Bilateral Manipulation,* 9/90-8/91, $20,000

Invited Presentations

Surface Haptics: Virtual Touch on Physical Surfaces
Robotics Institute Lecture Series, Carnegie Mellon University, November 2012

Haptics: What is it Good For?
Inaugural presentation in the Bayer Materials Science Webinar series, October 2012

A Haptics Symposium Retrospective: 20 Years
(with Bernard Dov Adelstein)
Haptics Symposium 2012, Vancouver, March 2012 **(keynote)**

Surface Haptics: Virtual Touch on Physical Surfaces
Distinguished Lecture Series, University of Utah, January 2012

Surface Haptics: Virtual Touch on Physical Surfaces
University of Pierre and Marie Curie, Paris, October 2011

Surface Haptics: Virtual Touch on Physical Surfaces
ETH Zurich, Distinguished Seminar in Robotics, Systems and Control, October 2011

Surface Haptics: Virtual Touch on Physical Surfaces
Plenary Talk, IEEE World Haptics Conference, Istanbul, Turkey, June 2011

Surface Haptics: Virtual Touch on Physical Surfaces
Plenary Talk, IROS, San Francisco, September 2011

Surface Haptics: Virtual Touch on Physical Surfaces
Microsoft Research, Seattle, October 2011

Human Centered Design
Northwestern University Medical School, 10/10

Surface Haptics
Yale University, 2/10

Surface Haptics
EECS Meet the Faculty Series, Northwestern University, 10/09

Edison's Quadrant: Putting Design-Thinking into Engineering Education
2009 ASME Asia-Pacific Engineering Education Congress, Taipei, Taiwan (**keynote**)

Lecture Series on Haptics and Prosthetics
Gwangju Institute of Science and Technology, Gwangju, Korea, 4/09

Three Lives of the Cobot: Material Handling, Haptics and Prosthetics
2009 International Symposium on Robotics, Barcelona, Spain (**plenary**)

Variable Friction Haptic Interfaces
Tactile Research Group, Psychonomics Society
Chicago, IL 11/08

Edison's Quadrant: Putting Design-Thinking into Engineering Education
Harvard University, 4/08

Haptic Prostheses for Upper-Extremity Amputees
University of Pennsylvania, 4/08

A Sense of Touch that is Virtually Real: Haptic Prostheses for Upper-Extremity Amputees
ACM Virtual Reality Science and Technology, 11/07 (**keynote**)

Cobotics
Southeast University, Nanjing, China, 8/07

Lecture Series on Haptics and Cobotics
Gwangju Institute of Science and Technology, Gwangju, Korea, 8/07

Haptic Augmentation
RO-MAN Conference, Jeju Island, Korea, 8/07

The Passivity Approach to Haptic Diplay
IEEE/TRA Haptics Summer School, Paris, France, 9/06

Cobot Kinematics and Control
University of Illinois Urbana-Champaign, 4/06

Haptic Interface for Advanced Prosthetics
DARPA, 1/05

Cobotics
University of British Columbia, 7/04

Engineering First and Design Throughout the Curriculum
University of British Columbia, 7/04

Cobotics
Rice University, 4/04

Cobotics
Georgia Tech, 1/04

Industrial Applications of Intelligent Assist Devices
IROS 2003, Las Vegas

EDC: Northwestern University's Foundational Course in Engineering Design
University of Toronto, 3/02

Cobot Control
Johns Hopkins University, 11/01

Cobot Control
University of Michigan, 11/01

Considerations for Robust Haptic Interaction with Virtual Dynamic Systems
Institute for Math and its Applications Workshop: Haptics, Virtual Reality and Human Computer Interaction, Minneapolis, MN, 6/01

Cobot Control
Vanderbilt University, 3/01

Haptic Interface: the State of the Art
DARPA Soldier Enhancement Workshop, 9/99

Cobots: Robots for Collaboration with Human Operators
Louisiana State University, 10/99

Cobots: Robots for Collaboration with Human Operators
University of Colorado, 2/97

Cobots: Computer Guided Ergonomic Assist Devices

1997 Robotics Industry Forum, Orlando, FL

Haptics Grand Challenges: Stable Display of Complex Environments
1997 Symposium on Haptic Interfaces to Virtual Environments and Teleoperators, Dallas, TX

Cobots: Robots for Collaboration with Human Operators
Marquette University, 11/96

Engineering First: A New Lower Division Curriculum at Northwestern University
Society of American Military Engineers, Chicago, 9/96

Programmable Constraint Machines
Agency of Industrial Science and Technology, Tsukuba, Japan, 2/96

Stability and Performance in the Haptic Display of Complex Environments
Agency of Industrial Science and Technology, Tsukuba, Japan, 2/96

The Psychophysics of Hand Tool Use: Applications in Ophthalmic Surgery
University of Minnesota, 2/95

Design and Control of a Haptic Display
University of Minnesota, 2/95

Haptic Display of Virtual Environments: A Physics-Based Approach
University of Michigan, 11/94

Performance and Stability of Robots in Rehabilitation Applications
Fourth International Conference on Rehabilitation Robotics, 6/94

Performance Investigation of Hydroelastic Engine Mounts
Chrysler Corporation, 10/93

Design and Control of High Performance Haptic Interfaces
IEEE Virtual Reality Annual International Symposium, 9/93

Performance Investigation of Hydroelastic Engine Mounts
Delco Products Corporation, 6/93

Micromachines: Recent Developments and Future Prospects
Argonne National Laboratory, 7/91

Robot Force Control
Robotics International/SME, Roundtable on Force Feedback, 11/90

Toward Artificial Muscle: High Impedance Linear Electrostatic Micromotors
Harvard University, 4/90

Toward Artificial Muscle: High Impedance Linear Electrostatic Micromotors
ASME Spring Design Show, 2/90

Force Feedback Compliance Control
Case Western Reserve University, 11/89

Publications

Edited Volume

Advances in Robotics, Mechatronics, and Haptic Interfaces 1993
Edited by H. Kazerooni, J.E. Colgate, and B.D. Adelstein
Dynamic Systems and Control Division of the ASME

Book Chapters

Safety for Physical Human-Robot Interaction.
Antonio Bicchi, Michael A. Peshkin, and J. Edward Colgate
In Springer Handbook of Robotics, Bruno Siciliano and Oussama Khatib, editors
Springer, 2008.

Instability in Haptic Devices
David Weir and J. Edward Colgate
In Haptic Rendering: Foundations, Algorithms and Applications Edited by Ming Lin and Miguel Otaduy
A.K. Peters, May 2008, pp. 123-156, ISBN: 978-1568813325

Variable Friction Haptic Displays
Laura E. Winfield and J. Edward Colgate
In Haptic Rendering: Foundations, Algorithms and Applications Edited by Ming Lin and Miguel Otaduy
A.K. Peters, May 2008, pp. 123-156, ISBN: 978-1568813325

Cobots in Material Handling
Michael Peshkin, J. Edward Colgate, Prasad Akella, Witaya Wannasuphoprasit
In Human and Machine Haptics, M. Cutkosky, R. Howe, K. Salisbury, and M. Srinivasan, editors
MIT Press, 2000

Stability Problems in Contact Tasks
Neville Hogan and Ed Colgate
In Robotics Review, Craig, J.J., Khatib, O., and Lozano-Perez, T., editors
MIT Press, Cambridge, MA, 1989

The Interaction of Robots with Passive Environments: Application to Force Feedback Control
Ed Colgate and Neville Hogan
In Advanced Robotics 1989, Kenneth J. Waldron, ed.
Springer-Verlag, Berlin, 1989

Refereed Journals

44. Haptic Feedback Enhances Grip Force Control of EMG-Controlled Prosthetic Hands in Targeted Reinnervation Amputees
Keehoon Kim and J. Edward Colgate
IEEE Transactions on Neural Systems and Rehabilitation Engineering, accepted June 2012

43. Inertia Compensation Control of a One-Degree-of-Freedom Exoskeleton for Lower-Limb Assistance: Initial Experiments
G Aguirre-Ollinger, JE Colgate, MA Peshkin, A Goswami
IEEE Transactions on Neural Systems and Rehabilitation Engineering, 20(1):68-77, 2012

42. A Cyclic Robot for Lower Limb Exercise
DeJong, Brian P., J. Edward Colgate, and Michael A. Peshkin.
ASME Journal of Medical Devices 5(3): 2011

41. Robotic touch shifts perception of embodiment to a prosthesis in Targeted Reinnervation amputees
Paul D. Marasco, Keehoon Kim, J. Edward Colgate, Michael A. Peshkin and Todd A. Kuiken
Brain 2011; doi: 10.1093/brain/awq361

40. Design of an Active 1-DOF Lower-Limb Exoskeleton with Inertia Compensation
Gabriel Aguirre-Ollinger, J. Edward Colgate, Michael A. Peshkin and Ambarish Goswami
International Journal of Robotics Research 30(4):486-499 , 2011.

39. A 1-DOF Assistive Exoskeleton with Inertia Compensation: Effects on the Agility of Leg Swing Motion
Gabriel Aguirre-Ollinger, J. Edward Colgate, Michael A. Peshkin and Ambarish Goswami
Proceedings of the Institution of Mechanical Engineers, Part H, Journal of Engineering in Medicine 225(H3):228-245, 2011.

38. ShiverPaD: A Glass Haptic Surface that Produces Shear Forces on a Bare Finger
Erik C. Chubb, J. Edward Colgate and Michael A. Peshkin
18 Mar. 2010. IEEE computer Society Digital Library. IEEE Computer Society, <http://doi.ieeecomputersociety.org/10.1109/TOH.2010.7>

37. A Framework for the Simulation and Haptic Display of Dynamic Systems Subject to Holonomic Constraints
Adolfo Rodriguez, Luis Basanez, J. Edward Colgate, and Eric L. Faulring
International Journal of Robotics Research, 29(4):336-352, 2010.

36. Using Kinesthetic and Tactile Cues to Maintain Exercise Intensity
Aaron Ferber, Michael A. Peshkin and J. Edward Colgate
IEEE Transactions on Haptics, 2(4):224-235, 2009

35. On the Design of Miniature Haptic Devices for Upper Extremity Prosthetics
Keehoon Kim, J. Edward Colgate, Julio J. Santos-Munne, Alex Makhlin, and Michael A. Peshkin
IEEE-ASME Transactions on Mechatronics
Digital Object Identifier: 10.1109/TMECH.2009.2013944

34. KineAssist: Design and Development of a Robotic Overground Gait and Balance Therapy Device
James Patton, David A. Brown, Michael Peshkin, Julio J. Santos-Munne, Alex Makhlin, Ela Lewis, J. Edward Colgate, and Doug Schwandt
Topics in Stroke Rehabilitation, 15(2):59-67, 2008.

33. Causes of Microslip in a Continuously Variable Transmission
Songho Kim, Carl Moore, Michael Peshkin and J. Edward Colgate
Journal of Mechanical Design, 130(1), 2008.

32. Investigation of Motion Guidance with Scooter Cobot and Collaborative Learning

Boy, E.S., Burdet, E., Teo, C.L. and Colgate, J.E.
IEEE Transactions on Robotics, 23(2):245-255, April 2007.

31. Power Efficiency of the Rotational-to-Linear Infinitely Variable Cobotic Transmission
Eric L. Faulring, J. Edward Colgate, and Michael A. Peshkin
ASME Journal of Mechanical Design, 129(12):1295-1293, December 2007.

30. Haptic display of constrained dynamic systems via admittance displays
Faulring, E.L., Lynch, K.M., Colgate, J.E., Peshkin, M.A..
IEEE Transactions on Robotics, 23(1):101-111, February 2007

29. The cobotic hand controller: design, control and performance of a novel haptic display
Faulring, E.L., Colgate, J.E., Peshkin, M.A.
International Journal of Robotics Research, 25(11): 1099-1119, November 2006.

28. Creating the Foundation for an Engineering Design Education
Ann McKenna, J. Edward Colgate, Steven Carr and Gregory Olson
International Journal of Engineering Education, 22(3), 2006

27. Lessons Learned from a Novel Teleoperation Testbed
Brian P. Dejong, Eric L. Faulring, J. Edward Colgate, Michael A. Peshkin, Hyosig Kang, Young S. Park, Thomas F. Ewing
Industrial Robot, 33(3): 187-193, 2006

26. Controlling the Apparent Inertia of Passive Human-Interactive Robots
Tom Worsnopp, Michael Peshkin, Kevin Lynch and J. Edward Colgate
Journal of Dynamics Systems, Measurement and Control, 128(1): 44-52, March 2006

25. Static Single-Arm Force Generation With Kinematic Constraints
Peng Pan, Michael A. Peshkin, J. Edward Colgate, and Kevin M. Lynch
J Neurophysiol, May 2005; 93: 2752 - 2765.

24. Mechanics and Control of Swimming: A Review
J. Edward Colgate and Kevin M. Lynch
IEEE Journal of Oceanic Engineering, 29(3), pp. 660-673, 2004

23. IDEA: Implementing Design Throughout the Curriculum
J. Edward Colgate, Ann McKenna and Bruce Ankenman
International Journal of Engineering Education, 20(3), pp. 405-411, 2004

22. On the Role of Dissipation in Haptic Systems
Brian E. Miller, J. Edward Colgate, Randy A. Freeman
IEEE Transactions on Robotics and Automation, 20(4), pp. 768-771, August 2004

21. Cobot Implementation of Virtual Paths and 3-D Virtual Surfaces
Carl. A. Moore, Jr., M.A. Peshkin and J.E. Colgate
IEEE Transactions on Robotics and Automation, 19(2), pp. 347-350, April 2003

20. Collaborating with Design Professionals and Industry to Build a Design Course for Freshmen
Penny Hirsch, Barbara Shwom, John Anderson, J. Edward Colgate, Dave Kelso, Steve Jacobson, Charly Yarnoff and John Lake
International Journal of Engineering Education, 19(1), January 2003.

19. Kinematic creep in continuously variable transmissions: traction drive mechanics for cobots
Brent Gillespie, Carl Moore, Michael Peshkin, J. Edward Colgate
J. Mechanical Design, 124(4):713-722, December 2002

18. Motion Guides for Assisted Manipulation

Kevin M. Lynch, Caizhen Liu, Allan Sørensen, Songho Kim, Michael Peshkin, Ed Colgate, Tanya Tickel, David Hannon and Kerry Shiels
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