

Steven H. Collins

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Education

Postdoctoral Fellow **Delft University of Technology** (April 2008 - present)
Biomechanical Engineering

Ph.D. **University of Michigan** (September 2002 - April 2008)
Mechanical Engineering

Dynamic Walking Principles Applied to Human Gait

Integrative studies utilizing models, experiments, and biomechatronic devices to improve basic understanding of the dynamics and energetics of walking and to develop technologies that improve mobility for persons with disabilities.

Committee: Arthur Kuo (chair), Richard Gillespie, Karl Grosh, and Riann Palmieri

Examination fields: Dynamics, Controls, Design

B.S. **Cornell University** (September 1997 - May 2002)
Mechanical Engineering
Research advisor: Andy Ruina

Publications

Collins, S. H., Wisse, M., Ruina, A. (2001) A 3-D passive-dynamic walking robot with two legs and knees. *International J. Robotics Research*, **20**, 607-615.

Collins, S., Ruina, A., Tedrake, R., Wisse, M. (2005) Efficient bipedal robots based on passive-dynamic walkers. *Science*, **307**, 1082-1085.

Adamczyk, P. G., Collins, S. H., Kuo, A. D. (2006) The advantages of a rolling foot in human walking. *Journal of Experimental Biology*, **209**, 3953-3963. (18)

Vanderpool, M. T., Collins, S. H., Kuo, A. D. (2008) Ankle fixation need not increase the energetic cost of human walking. *Gait & Posture*, **28**, 427-433.

Collins, S. H., Adamczyk, P. G., Ferris, D. P., Kuo A. D. (2009) A simple method for calibrating force plates and force treadmills using an instrumented pole. *Gait & Posture*, **29**, 59-64.

Collins, S. H., Adamczyk, P. G., Kuo, A. D. (2009) Dynamic arm swinging in human walking. *Proceedings of the Royal Society of London B.*, **276**, 3679-3688.

In Preparation

Collins, S. H., Kuo, A. D., Recycling energy to restore impaired ankle function during human walking. Submitted to *PLoS ONE* August 2009.

Van der Krogt, M. M., Bregmann, D. J. J., Doorenbosch, C. A. M., Harlaar, J., Wisse, M. , Collins, S. H. How crouch gait can dynamically cause stiff-knee gait. Submitted to *Annals of Biomedical Engineering*, September 2009.

Van Zijl, L. H. F., Collins, S. H. Changing walking speed in a simple model with dynamic one-step transitions. In preparation for *International Journal of Humanoid Robotics*, to be submitted November 2009.

Presentations

Invited

Invited: When mechanics matter: utilizing passive dynamics to gain energetic benefits in human locomotion. Society for Experimental Biology, Annual Main Meeting 2009, Glasgow, UK.

Keynote: What can dynamic walking teach us about robots and humans? Dynamic Walking 2006, Ann Arbor MI, USA.

Podium

A comparison of CESR and conventional prosthetic feet: mechanics and metabolics. Dynamic Walking 2008, Delft, The Netherlands.

Energetics of arm swinging. Dynamic Walking 2007, Åland, Finland.

Controlled energy storage and return prosthesis reduces metabolic cost of walking. International Society of Biomechanics, Annual Meeting 2005, Cleveland OH, USA.

A bipedal walking robot with efficient and human-like gait. International Conference on Robotics and Automation (ICRA) 2005, Barcelona, Spain.

Control of balance during walking in young and elderly adults. American Society of Biomechanics, Annual Meeting 2003, Toledo OH, USA.

Proceedings

Collins, S. H., Ruina, A. (2005) A bipedal walking robot with efficient and human-like gait. In *Proc. IEEE International Conference on Robotics & Automation*, Barcelona, Spain, 1983-1988.

Pratt, J. E., Krupp, B. T., Morse, C. J., Collins, S. H. (2004) The RoboKnee: an exoskeleton for enhancing strength and endurance during walking. In *Proc. IEEE International Conference on Robotics and Automation*, New Orleans, LA, 2430-2435.

Professional

Grants

Principal investigator: National Institutes of Health (NIH) Phase II Small Business Technology Transfer Research Grant (STTR), 2007-2010. Development of prosthetic foot with controlled energy storage and release. \$750,000.

Principal investigator: National Institutes of Health (NIH) Phase I Small Business Technology Transfer Research Grant (STTR), 2006-2007. Field-based gait monitoring system for the elderly. \$100,000.

Principal investigator: National Science Foundation (NSF) Phase I Small Business Technology Transfer Research Grant (STTR), 2006-2007. Development of an actively-controlled prosthetic foot. \$100,000.

Principal investigator: National Science Foundation (NSF) Phase I Small Business Technology Transfer Research Grant (STTR), 2003-2004. Controlled energy storage and release in an intelligent prosthetic foot. \$100,000.

Patents

Collins, S. H., Kuo, A. D., Foot prosthesis and method of use. US Provisional Patent no. 60/705,019, filed 2006.

Collins, S. H., Vranceanu, A., Mullins, C., Donelan, J. M., Apparatus for Biomechanical Energy Harvesting. US Provisional Patent no. 61:175,726, filed 2009.

Collins, S. H., Adamczyk, P. G., Kuo, A. D., Reconfigurable prosthetic foot and method of use. In preparation.

Private Sector

President and founder, Intelligent Prosthetic Systems L.L.C., Ann Arbor, MI, USA, 2003-present.

Design engineer, Yobotics Inc., Boston MA, USA, 2000.
Supervisor: Jerry Pratt, Ph.D.

Awards

Fellowship: National Aeronautics and Space Administration (NASA) Graduate Student Researchers Program (GSRP), 2004-2005. Control of balance during walking: assessment and countermeasures for rehabilitation and postflight recovery.

Fellowship: Department of Mechanical Engineering, University of Michigan, Ann Arbor MI, USA, 2002-2003.

McManus Award: Cornell University, Ithaca NY, USA, 2002.

Awarded to one graduate or undergraduate student in Mechanical Engineering, for presentation of the most outstanding solution to a design problem.

\$1,000 prize.

Teaching & Advising

Master's Thesis advisor: Lowie van Zijl, BioMechanical Engineering, Delft University of Technology, Delft, The Netherlands, September 2008-present.

Dissertation committee: Karl Zelik, Mechanical Engineering, University of Michigan, Ann Arbor MI, USA, June 2007-present.

Doctoral student mentoring: Marjolein van der Krogt and Daan Bregman, Vrije Universiteit Amsterdam; Tomas de Boer, Erik Schuitema and Daniël Karssen, Delft University of Technology; Karl Zelik, Shawn O'Connor, Peter Adamczyk and John Rebula, University of Michigan.

Master's and undergraduate mentoring: Lowie van Zijl and Karin Griffioen, Delft University of Technology; Matthew Vanderpool, Micah Druckman and Andrew Chang, University of Michigan; Chaim Garfinkel, Jerry Chien and Monika Danos, Cornell University;

Guest lecturer: Introduction to IronCAD. MAE 225: Mechanical Synthesis, Cornell University, Ithaca NY, USA October 2001 and October 2002.

Teaching assistant: Physics 101. Cornell University, Ithaca NY, USA Fall 1999, Spring 2000, Fall 2000 and Spring 2001.

Academic Service

Conference Co-Chair: Dynamic Walking 2009, Vancouver, Canada.

Referee: *Journal of Biomechanics, Journal of Biomechanical Engineering, International Journal of Robotics Research, IEEE Transactions on Neural Systems & Rehabilitation Engineering, Journal of Experimental Biology, Journal of Theoretical Biology, Robotics and Autonomous Systems, Intelligent Autonomous Systems, Autonomous Robots, Human Movement Science, Humanoids, IEEE Robotics & Automation Magazine, IEEE Transactions on Robotics, International Conference on Robotics and Automation, International Conference on Robotics and Biomimetics.*

Booth: American Association for the Advancement of Science (AAAS) Family Science Days, Washington DC, USA, 2005.

Collaborators

Max Donelan, Asst. Professor of Kinesiology, Simon Fraser University
Martijn Wisse, Professor of Biomechanical Engineering, T. U. Delft
Art Kuo, Professor of Mechanical Engineering, University of Michigan
Andy Ruina, Professor of Theoretical and Applied Mechanics, Cornell University

Peter Adamczyk Ph.D., CSO, Intelligent Prosthetic Systems, Ann Arbor, MI
Glenn Klute, Assoc. Professor of Bioengineering, University of Washington
Greg Sawicki, Asst. Professor of Biomedical Engineering, UNC Chapel Hill
Marjolein van der Krogt, Postdoctoral Fellow, Stanford University
Jaap Harlaar, Professor of Rehabilitation Medicine, Vrije Universiteit Amsterdam
Jesse Dean, Asst. Professor of Physical Therapy, Medical University of S.Carolina

Popular Press

AP (February 2005), AFP (February 2005; August 2009), BBC (February 2005),
Der Spiegel (February 2005), Discover Magazine (January 2006), Discovery
Channel Canada (February 2005), Discovery Channel Magazine (January 2010),
The Guardian (February 2005; August 2009), The Independent (February 2005;
August 2009), Machine Design (March 2005), Nature News (February 2005),
The New Scientist (February 2005), NPR's Day to Day (February 2005), New
York Times (February 2005), Popular Mechanics (June 2005), Reuters (February
2005; August 2009), Science News (August 2005), Science Channel (February
2005), Scientific American (February 2005; August 2009), The Telegraph
(February 2005; August 2009), The Times (London, February 2005), The World
(BBC/PRI, February 2005).