

# MATTHEW B. PARKINSON

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## Research Interests

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Rigorous methods for the design of artifacts for use by people. This includes areas like: mechanical design, biomechanics, biomedical design, ergonomics, rehabilitation engineering, motion modeling and prediction, optimization, and product platforms. This is a new *D-f-X* capability: Designing for Human Variability.

## Education

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**Ph.D., University of Michigan, *Biomedical Engineering*  
December, 2004.**

Dissertation: *Balance maintenance in normal seated reach.*  
Co-Chairs: Panos Y. Papalambros and Don B. Chaffin.

**M.S., University of Michigan, *Industrial and Operations Engineering*  
April, 2003.**

Emphasis in biomechanics, ergonomics, human factors, and task analysis.  
Advisor: Don B. Chaffin.

**M.S., Brigham Young University, *Mechanical Engineering*  
December, 1998.**

Thesis: *A process model and framework for the active control of product development processes.*  
Chair: Jordan J. Cox.

**B.S., Brigham Young University, *Mechanical Engineering with University Honors*  
December, 1996.**

Honors Thesis: *Compliant mechanisms: An optimization-based approach to their design.* Minors in Mathematics and English.

## Experience

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*Assistant Professor*, Summer 2005 - Present, The Pennsylvania State University  
Joint appointment in Engineering Design and Mechanical Engineering. Teaching design courses and continuing research into Designing for Human Variability.

*Adjunct Lecturer*, Fall 2004, Mechanical Engineering Department, University of Michigan  
Senior-level design class in Mechanical Engineering. Projects include: exoskeleton, vehicle pack-

aging, automobile seating, wheelchair modification, hydraulics-assisted bicycles, and medical devices.

*Research Fellow*, Fall 2004 - Summer 2005, University of Michigan

Post-doctoral research in multi-disciplinary project within Mechanical, Biomedical, and Industrial & Operations Engineering Departments. Research is sponsored by the Automotive Research Center in response to my proposal to develop methodologies for the incorporation of models of human behavior and preference into rigorous design methods such as robust optimization and uncertainty analysis.

*Instructor*, Fall 2003, University of Michigan

Primary instructor for Junior-level design class in Mechanical Engineering. Developed curriculum, presented lectures, wrote homeworks and exams. Our class staged a wildly successful project display which was visited by hundreds of people and covered by the *Ann Arbor News*. Excellent comments and evaluations from students are available upon request.

*Independent Consultant*, 2002-Present

Applications of research results to *DfHV* problems.

*Research Assistant*, 1998-2004, Optimal Design Laboratory, University of Michigan

Conduct research in product development and optimization. Emphasis on product platforms, design processes, and integrating an understanding of biomechanics into design.

*Research Assistant*, 2001-2004, Human Motion Simulation Laboratory, University of Michigan

Design and conduct experiments involving human participants. These focus on the biomechanics of reach and balance, muscle recruitment, and movement strategies. Additional work with people with disabilities, including spinal cord injury, and their movement and compensation strategies as well as their susceptibility to further injury.

*Portal Designer*, 2000-2001, Automotive Research Center, University of Michigan

Architected and deployed portal technologies for *iARC* and the Design Portal (in the Mechanical Engineering Department). These aggregate research projects and the models, publications and presentations associated with them into web-based portals.

*Teaching Assistant*, Fall 2000, University of Michigan

Senior design course in Mechanical Engineering. Supervised team projects. Received excellent evaluations, available upon request.

*Intern and Contractor*, 1997-1999, Workgroup Technology Corporation

Interned in Summer of 1997. Continued as consultant to Vice President of Product Strategy, focussing on product development processes.

*Instructor*, Fall 1997-Spring 1998, Brigham Young University

Primary instructor for Sophomore-level course in numerical methods and computer programming. Received excellent evaluations, which are available upon request.

*Honor's Department Writing Fellow*, Fall 1995-Fall 1998, Brigham Young University

Mentored students in English, Mathematics, and Engineering courses with their writing. This was a great experience to work with students and improve my own writing.

## Publications

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### Journal Publications

Parkinson, M.B. and Reed, M.P. (2007). Optimizing truck cab layout for driver accommodation. *ASME Journal of Mechanical Design*, Vol. 129:1110-1117.

Parkinson, M.B., Chaffin, D.B., and Reed, M.P. (2006). Center of pressure excursion capability in performance of seated lateral-reaching tasks. *Clinical Biomechanics*, Vol. 21:26-32.

Parkinson, M.B. and Reed, M.P. (2006). Optimizing vehicle occupant packaging. Technical Paper 2006-01-0961. *SAE Transactions: Journal of Passenger Cars—Mechanical Systems*.

Parkinson, M.B. and Reed, M.P. (2006). Considering driver balance capability in truck shifter design. Technical Paper 2006-01-2360. *SAE Transactions: Journal of Commercial Vehicles*.

Sasena, M., Parkinson, M.B., Reed, M.P., Papalambros, P.Y., and Goovaerts, P. (2005). Improving an Ergonomics Testing Procedure via Approximation-Based Adaptive Experimental Design. *ASME Journal of Mechanical Design*, Vol. 127:1006-1013.

Parkinson, M.B., Reed, M.P. and Chaffin, D.B. (2004). Balance maintenance during seated reaches of people with spinal cord injury. Technical Paper 2004-01-2138. *SAE Transactions: Journal of Aerospace*, Vol. 113.

Reed, M.P., Parkinson, M.B., and Wagner, D. (2004). Torso kinematics in seated reaches. Technical Paper 2004-01-2176. *SAE Transactions: Journal of Aerospace*, Vol. 113.

Chaffin, D.B., Woolley, C., Dickerson, C., and Parkinson, M.B. (2004). Modeling of object movement capability in the spinal cord injured population. *International Journal of Industrial Ergonomics*, Vol. 33(3):229-236.

Reed, M.P., Parkinson, M.B., and Klinkenberger, A.L. (2003). Assessing the validity of kinematically generated reach envelopes for simulations of vehicle operators. Technical Paper 2003-01-2216. *SAE Transactions: Journal of Passenger Cars—Electronic and Electrical Systems*, Vol. 112. Received the *Arch T. Colwell Merit Award* for best paper, 2003.

Reed, M.P., Parkinson, M.B., and Chaffin, D.B. (2003). A new approach to modeling driver reach. Technical Paper 2003-01-0587. *SAE Transactions: Journal of Passenger Cars—Mechanical Systems*, Vol. 112.

Nelson, S. A., Parkinson, M. B., and Papalambros, P. Y. (2001). Multicriteria optimization in product platform design. *ASME Journal of Mechanical Design*, Vol 123, 199-204.

### Peer-Reviewed Conference Proceedings

Garneau, C.J. and Parkinson, M.B. (2007). Including preference in anthropometry-driven models for design. Technical Paper DETC2007-35479. *ASME International Design Engineering Technical Conferences*. Las Vegas, NV. Received the *Ford Motor Company Best Paper Award*.

Parkinson, M.B. and Reed, M.P. (2007). Standing reach envelopes incorporating anthropometric variance and postural cost. Technical Paper 2007-01-2482. *SAE Digital Human Modeling Conference*. Seattle, WA.

Parkinson, M.B. and Reed, M.P. (2006). Improving head restraint design for safety and compliance. Technical Paper DETC2006-99429. *ASME International Design Engineering Technical Conferences*. Philadelphia, Pennsylvania.

Parkinson, M.B., Reed, M.P., Kokkolaras, M., and Papalambros, P.Y. (2005). Robust truck cabin layout optimization using advanced driver variance models. *Proceedings of the ASME Design Engineering Technical Conferences*. Long Beach, CA.

Sasena, M., Parkinson, M.B., Goovaerts, P., Papalambros, P.Y., and Reed, M.P. (2002). Adaptive experimental design applied to an ergonomics testing procedure. *Proceedings of the ASME Design Engineering Technical Conferences*. Montreal, Canada.

Parkinson, M.B., Jensen, B.D., and Kurabayashi, K. (2001). Design of compliant force and displacement amplification micromechanisms. *Proceedings of the ASME Design Engineering Technical Conferences*. Pittsburgh, PA.

Parkinson, M.B., Jensen, B.D., and Roach, G.M. (2000). Optimization-based design of a fully-compliant bistable micromechanism. *Proceedings of the ASME Design Engineering Technical Conferences*. Baltimore, MD.

Nelson, S.A., Parkinson, M.B., and Papalambros, P.Y. (1999). Multicriteria optimization in product platform design. *Proceedings of the ASME Design Engineering Technical Conferences*. Las Vegas, NV.

Parkinson, M.B., Howell, L.L., and Cox, J.J., (1997). A parametric approach to the optimization-based design of compliant mechanisms. *Proceedings of the ASME Design Engineering Technical Conferences*. Sacramento, CA.

### **Panel or Committee-Reviewed Conference Proceedings**

Reed, M.P., Parkinson, M.B., and Chaffin, D.B. (2003). A new approach to modeling driver reach. Technical Paper 2003-01-0587. *Presented at SAE World Congress and Exposition*. Detroit, MI.

Parkinson, M. B., Chaffin, D. B., and Reed, M. P. (2002). Maintaining balance in seated reaches. *Proceedings of International Conference of Rehabilitation Engineering and Assistive Technology Society of North America*. Minneapolis, MN.

Parkinson, M. B., and Huggins, J. E. (2001). A method for the rapid prototyping of custom contoured cushions. *ASME Advances in Bioengineering*, Vol 51. ASME International Mechanical Engineering Congress and Exposition. New York, NY.

Parkinson, M. B., Roach, G. M., and Howell, L. L. (2000). Predicting the large-deflection path of tapered cantilever beams. *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*. Orlando, FL.

## Abstract-Reviewed Conference Proceedings

Jensen, B. D., Parkinson, M. B., Kurabayashi, K., Howell, L. L., and Baker, M. S. (2001). Design optimization of a fully-compliant bistable micro-mechanism. *Proceedings of the ASME International Mechanical Engineering Congress and Exposition*. IMECE2001/MEMS-23852. New York, NY.

## Invited Presentations

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*Designing for Human Variability*, Carnegie Mellon Mechanical Engineering Seminar. February, 2007.

*A Primer on Designing for Human Variability*, Penn State University Mechanical Engineering Design Seminar. December, 2006.

## Honors and Awards

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Lloyd L. Withrow Distinguished Speaker award, SAE International. 2008.

Ford Motor Company Best Paper award, ASME International Design Automation Committee. Awarded at ASME International Design Engineering Technical Conferences, Las Vegas, NV. 2007.

Excellence in Oral Presentation award, SAE Digital Human Modeling for Design and Engineering Conference and Exhibition. Seattle, WA. 2007.

Arch T. Colwell Merit Award for outstanding paper in mobility engineering for 2003. Selected from 2,492 papers. Awarded by Society of Automotive Engineers (SAE) June, 2005.

Excellence in Oral Presentation award, SAE Digital Human Modeling for Design and Engineering Symposium. Rochester, Michigan. 2004.

American Society of Engineering Education Outstanding Student Instructor Award. 2004.

Excellence in Oral Presentation award, SAE Digital Human Modeling for Design and Engineering Symposium. Montreal, Canada. 2003.

Second Place, ASME International Student Mechanism Design Competition, Graduate Division. Montreal, Canada. 2002.

James A. and Hazel L. Hughes Fellowship. 1998-1999.

National Science Foundation Honorable Mention. 1998.

Brigham Young University Honors Department Writing Fellow. 1995-1998.

National Merit Scholarship. 1992-1997.

Brigham Young University Office of Research and Creative Activities Scholarship. 1996.

Brigham Young University Trustee's Scholarship. 1992-1997.

National Society Professional Engineers / Tau Beta Pi Scholarship. 1992.

## Patents

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*Bistable compliant micromechanism*, Howell, L.L., Parkinson, M.B., Jensen, B.D., and Roach, G.M., U.S. Patent # 7,075,209

*Suspended pixelated seating structure*, Brill, R.S., VanDeRiet, D.M., Aldrich, J.F., Hill, C.C., Kur-rasch, A.J., Slagh, J.D., Parkinson, M.B., Reed, M.P., and Weber, J.A., U.S. Patent Application# 20070262634

## Memberships

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American Society of Mechanical Engineerings

Society of Automotive Engineers

American Society for Engineering Education

## Service

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Session organizer for ASME International Designing Engineering Technical Conferences. Special session: Designing for Human Variability. 2006-2008.

Session organizer for ASME International Designing Engineering Technical Conferences. Special session: Designing for Human Variability. 2006-2008.

Member of SAE International's Digital Human Modeling Committee. Also session organizer / paper review chair for the 2006, 2007, and 2008 Digital Human Modeling for Design and Engineering Conferences.

Research mentor in Marian Sarah Parker Scholars Program, which uses "research internships" to encourage women in engineering to pursue graduate degrees. 2002-2003.

Volunteer service mission to Houston, Texas for two years, from 1992 - 1994. Developed fluency in Spanish language.