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Waco, Texas 76710

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EDUCATION

Ph.D. Mechanical Engineering (1998)

The University of Texas, Austin

Dissertation: A Musculoskeletal Model of the Upper Limb Based on the Medical Image Dataset of the Visible Human Male. Marcus G. Pandy, Advisor.

M.S. Mechanical Engineering (1992)

The University of Texas, Austin

Thesis: A Dynamic Musculoskeletal Computer Model for Rising from a Squatting or Sitting Position: A Study of Performance Criteria for Optimal Control of Non-Ballistic Human Movements. Marcus G. Pandy, Advisor.

B.S. Mechanical Engineering (1989)

The University of Texas, Austin

Upper Division Technical Block: Mechanical Systems

ACADEMIC EXPERIENCE

Baylor University, Dept. Engineering

Waco, Texas

Aug 2002 – Present

Assistant Professor

- Teaching: Statics, Machine Design, Microprocessor Systems, Engineering Design I, Biomechanics, Computer Modeling in Biomechanics.
- Research: Biomechanical design of women's exercise machines; Experimental study of human shoulder strength; Computer modeling of human lifting biomechanics; Computer simulation of neuromuscular control of target tracking tasks; Computer modeling of human arm musculoskeletal biomechanics.

The University of Texas, Dept. Mechanical Engineering

Austin, Texas

Aug 2001 – May 2002

Faculty Lecturer

- Teaching: Senior-level Machine Elements; Freshman-level Engineering Design Graphics.

The University of Texas, Dept. Mechanical Engineering

Austin, Texas

Sep 1992 – Dec 1998

Doctoral Student

Jan 1990 – Aug 1992

Masters Student

- Constructed biomechanical model of human upper extremity to simulate dynamics of bones, joints, ligaments, and muscles.
- Developed algorithms to model elastic morphology of muscles as they wrap around underlying anatomical structures during limb motion.
- Created multi-processing software to edit, visualize, and simulate musculoskeletal systems on four-processor Silicon Graphics Onyx Workstation.
- Designed and coded software to process 2D medical images and reconstruct 3D surface models of bones and upper-extremity muscles using the National Library of Medicine's Visible Human Project.
- Applied musculoskeletal model of human torso and legs to simulate biomechanics of rising from a chair.
- Investigated various optimization and control algorithms for application to simulation of ballistic and non-ballistic movements.
- Designed and executed experimental protocols to capture kinematic, electromyographic, and ground reaction force data using MotionAnalysis motion capture system.

Austin Community College, Dept. Mathematics

Austin, Texas

Sep 1994 – Aug 1995

Lecturer

- Teaching: Senior-level Kinematics and Dynamics; Freshman-level Pre-Calculus.

RESEARCH INTERESTS

Computer Modeling in Biomechanics

- To develop, validate, and scale musculoskeletal models
- To represent geometry of muscle paths
- To estimate musculotendon parameters

Computer Simulation and Visualization

- To derive computationally-efficient dynamical equations
- To simulate dynamics of system motion and performance
- To apply computer graphics for scientific visualization

3D reconstruction of surface models from medical images

- To identify boundary contours of anatomical structures
- To mesh, smooth, and reduce surface triangulations
- To extract geometrical data from surface models

Coordinated control of multi-segment, rigid-body systems

- To investigate strategies for coordinating movement
- To optimize coordination of goal-directed tasks
- To automate control of movement coordination

BIBLIOGRAPHY

Refereed Journal Articles:

- Garner, B.A. and Shim, J. (in press). Isometric Shoulder Girdle Strength of Healthy Young Adults. *Clinical Biomechanics*.
- Garner, B.A., Shim, J., and Wilson, S.R. (in press). An Apparatus and Protocol for Measuring Shoulder Girdle Strength. *Journal of Medical Devices*.
- Garner, B.A. (2007). Designing Strength-Proportional Hydraulic Resistance for an Elbow Flexion-Extension Exercise Machine. *Journal of Medical Devices* 1: 3-13.
- Garner, B.A. and Pandy, M.G. (2003). Estimation of Musculotendon Properties in the Human Upper Limb. *Annals of Biomedical Engineering* 31: 207-220.
- Garner, B.A. and Pandy, M.G. (2001). A Musculoskeletal Model of the Upper Limb Based on the Visible Human Male Dataset. *Computer Methods in Biomechanics and Biomedical Engineering* 4(2): 93-126.
- Garner, B.A. and Pandy, M.G. (2000). The Obstacle-Set Method for Representing Muscle Paths in Musculoskeletal Models. *Computer Methods in Biomechanics and Biomedical Engineering* 3(1): 1-30.
- Garner, B.A. and Pandy, M.G. (1999). A Kinematic Model of the Upper Limb Based on the Visible Human Project (VHP) Image Dataset. *Computer Methods in Biomechanics and Biomedical Engineering* 2(2): 107-124.
- Levine, D.A., Garner, B.A., and Barr, R.E. (1997). A Dynamic Skeletal Muscle Morphology Model. *FASEB Journal* 11(3): 3587-3587.
- Pandy, M.G., Garner, B.A., and Anderson, F.C. (1995). Optimal Control of Non-ballistic Muscular Movements: A Constraint-Based Performance Criterion for Rising from a Chair. *Journal of Biomechanical Engineering* 117(1): 15-26.

Contributions to Books:

- Garner, B.G. and Pandy, M.G. (1998). Geometric Model of the Human Upper-Extremity Based on Reconstructed Medical Images. In Middleton, J., Jones, M.L., and Pande, G.N. (eds.): *Computer Methods in Biomechanics and Biomedical Engineering 2*, Gordon and Breach Science Publishers, Amsterdam, pp. 35-42.

International and National Conferences:

- Garner, B.A., and Xu, Bo (2007). A Proposed New Obstacle-set Algorithm for Modeling the Wrapping Path of Deltoid. Annual Meeting of the American Society of Biomechanics (ASB), Stanford University, California.
- Shim J., Garner, B., and Wilson, S. (2007). An apparatus for measuring shoulder girdle strength. International Society of Biomechanics, Taipei, Taiwan.
- Garner, B.A. (2007). Dynamic Modeling of Shoulder Girdle Range of Motion Limits. American Society of Mechanical Engineers (ASME) Summer Bioengineering Conferenc, Keystone, Colorado.
- Alford, K., Garner, B.A., Lanning, B. (2006). A Vision for Scientific Research in Equine Therapy. Annual Conference of the North American Riding for the Handicapped Association (NARHA), Indianapolis, Indiana.
- Newman, P.S., and Garner, B.A. (Oct. 2005). The Influence of Load on the Kinematics of Computer-Simulated Sagittal-Plane Lifting. Annual Meeting of the Biomedical Engineering Society, Baltimore, Maryland.
- Garner, B.A. (Jul. 2005). Influence of Musculotendon Parameter Values on Simulated Elbow Joint Moments. Proceedings, International Symposium on Computer Simulation in Biomechanics, 10th Biannual Conference of the International Society of Biomechanics Technical Group on Computer Simulation, Cleveland, Ohio.
- Fincher, L., Medlock, M. and Garner, B. (Oct. 2004). Redesigning A Hydraulic-Resistance Exercise Machine to Complement Elbow Flexion and Extension Strength in Females. Annual Meeting of the Biomedical Engineering Society, Philadelphia, Pennsylvania.
- Garner, B.A. and Pandy, M.G. (Oct. 2003). Computational Algorithm for Estimating Muscle Properties. Annual Meeting of the American Society of Biomechanics, Toledo, Ohio.
- Garner, B.G. and Pandy, M.G. (May 1997). Geometric Parameters for Dynamic Modeling of the Human Upper-Extremity. 3rd International Symposium on Computer Methods in Biomechanics and Biomedical Engineering, Barcelona, Spain.
- Garner, B.A. (Oct. 1994). Musculoskeletal Modeling of Ballistic and Non-Ballistic Human Movement. Annual Fall Meeting of the Biomedical Engineering Society, Phoenix, Arizona.
- Garner, B.A., Daigle, K.E., Pandy, M.G., and Anderson, F.C. (1993). An Optimal Control Model for Rising from a Chair. XIVth International Society of Biomechanics Congress, Paris, France.

Regional Conferences:

- Garner, B.A., Shim, J., and Wilson, S. (2007). Measuring Isometric Shoulder Girdle Strength in Young Adults. 24th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Cragen, A., Bland, D., Brown, M., Campbell, D., and Garner, B.A. (2007). Developing an Ankle Prosthetic Accessible and Reproducible to Those in Third-World Countries. 24th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Shirazi, Y., Anderholm, R., Morgan, S., Narvaez, G., and Garner, B.A. (2007). Measuring Impact Forces of Shotokan Karate Strikes. 24th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Newman, P.S., and Garner, B.A. (Feb. 2006). A Computer-Modeling Study of Load Lifting Strategies. 23rd Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Garner, B.A. (Feb. 2005). Model Estimates of Isometric Muscle Forces During Maximal-Effort Elbow Flexion and Extension Exercises. 22nd Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Garner, B.A. and Pandy, M.G. (Feb. 2004). Calculating Minimum and Maximum Musculotendon Lengths over the Range of Joint Motion in the Human Upper Limb. 21st Annual Houston Conference

on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.

- Garner, B.A. and Pandy, M.G. (Feb. 2003). Estimation of Musculotendon Properties in the Human Upper Limb. 20th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Eng. and Medicine in Biology (HSEMB), Houston, Texas.
- Garner, B.A. (Feb. 1999). Musculoskeletal Model of the Upper Limb Based on the Visible Human Male Dataset. Proceedings, 17th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Levine, D.A., Garner, B.A., and Barr, R.E. (1997). A Realistic, Dynamic, Computer-Based Graphical Muscle Model. 16th Southern Biomedical Engineering Conference, Biloxi, MS.

AWARDS

Curves, International

January 2004 – May 2004

\$150,000

June 2004 – August 2005

\$392,000

Sep 2005 – December 2006

\$350,000

- Contract: Develop Next-generation Exercise Machines for Women's Fitness Program: Walter Bradley, Ian Gravagne, and Brian Garner, P.I.'s

National Aeronautics and Space Administration (NASA)

\$65,710

September 1993 - August 1996

Graduate Student Researchers Program

- Training Grant: Effects of Altered Gravity on Coordination and Performance in the Human Upper Extremity: Optimal Control Modeling and Experimental Verification. Marcus G. Pandy, P.I.

PATENTS

October 2004 (granted 2007): A Variable Resistance Flexion and Extension Exercise Machine.

February 2006 (pending): A Multi-Link Exercise Machine.

October 2006 (pending): Abdominal Exercise Machine.

PROFESSIONAL ACTIVITIES AND SERVICE

- Societies: BMES, ASB, ASEE, ASME, HSEMB.
- Technical Reviewer: Journal of Biomechanics, IEEE Transactions on Biomedical Engineering, Journal of Biomechanical Engineering, Annals of Biomedical Engineering, Journal of Applied Bionics and Biomechanics, International Journal of Robotics and Automation, National Science Foundation (NSF).
- Simbios Advisory Board Member (2006) for Stanford's National Center for Biomedical Computation.
- Co-chair Computational Biomechanics Session at 2007 ASB Conference, Stanford University, CA.
- Regular Conference Session Chair at the Annual HSEMB Conference, Houston, TX.
- Baylor University School of Engineering and Computer Science: EGR Graduate Studies Committee, ME and BME Curriculum Committees, EGR Tenure and Promotion Drafting Committee, ECS Software Engineering Committee

OTHER PROFESSIONAL EXPERIENCE

RunDoc, Inc.

Austin, Texas

Aug 1999 – Jul 2001

Co-Founder, CTO

- Co-developed business plan and strategy to produce online health-management services for runners.
- Addressed legal issues pertaining to medical liability and intellectual property protection.

- Led development team in creation of prototype website.
- Created interactive online injury assessment tool and online customer survey using Java Servlets.
- Wrote software to edit and reconstruct 2D medical images (CT, MRI) into 3D surface models.
- Wrote software to process 3D surface models for smoothing and decimation.

Subsurface Computer Modeling, Inc.
Jun 1997 – Jul 1999; Feb – Apr 2001

Austin, Texas
Software Engineer

- Co-led design-to-delivery development effort of UNIX/Motif- and Java- based commercial software application for viewing, editing, and manipulating 3D geological data.
- Mediated across multiple disciplines to coordinate software GUI, functionality, and implementation.
- Created hierarchical data model for storing, manipulating, and analyzing geological data.
- Designed and coded computationally efficient algorithms for 1) identifying concave boundaries of a pointset, 2) tessellating a pointset into a triangular mesh, 3) identifying and eroding interior holes from within a triangular mesh, 4) decimating a triangular mesh, 5) smoothing a triangular mesh in 3D, 6) performing geometric and Boolean operations on triangular meshes.

Wesson International, Inc.
Sep 1996 – Dec 1996

Austin, Texas
Software Engineer

- Developed multi-processing C++ software to visualize 360 degree view of real-time airport environment for large-scale commercial air traffic control simulation system.
- Designed and coded algorithms for smoothing motion of simulated aircraft, and for processing airport layout images to identify runways and taxiways.
- Created graphical special effects for real-time simulated lightning, flocks of birds, wind-driven windsock, airplane explosions, and condensation trails.

LEADERSHIP AND COMMUNITY SERVICE

Alliance Bible Church
Sep 2004 – present

Waco, Texas
Elder, Children’s Church Director

Grace Covenant Church
Jan 2001 – July 2002

Austin, Texas
Elder Board

Grace Covenant Christian School
Sep 2000 – July 2002

Austin, Texas
School Board

Grace Covenant Church
Sep 1996 – Dec 2000

Austin, Texas
Deacon