Brian Alan Garner, Ph.D.

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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 – Jul 2008 — **Assistant Professor**
Aug 2008 – Present — **Associate Professor**

- Teaching: Statics, Machine Design, Microprocessor Systems, Engineering Design I, Biomechanics, Computer Modeling in Biomechanics, Advanced Dynamics, Engineering Design II.
- Research: Computer algorithms and simulation tools to model human musculoskeletal biomechanics, with a partucular focus on muscle wrapping paths, and forces and motions in the bones, joints, and muscles of the human shoulder; Computer algorithms to automate analysis of medical images, such as CT images, to detect risk of otherwise non-presenting injuries based on mis-alignment and mis-orientation of anatomical features, with a particular focus on the occipoto-cervical complex; Study of electromagnetic (EM) wave propogation on and around the moving human body, particularly as it relates to the design of small, unobtrusive, power-efficient antennas suitable for continuous, remote health monitoring systems; Mechanical devices that facilitate exercise and therapy, with a particular focus on a mechanical horse device that simulates the experience of riding by accurately recreating the complex, three-dimensional motion pattern produced by a horse and experienced by a rider.

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**

- Computer modeling of human upper extremity to simulate dynamics of bones, joints, and muscles.
- Algorithms to model muscles wrapping around underlying anatomical structures during limb motion.
- Developing multi-processing software to edit, visualize, and simulate musculoskeletal systems.
- Developing algorithms and software to reconstruct 3D surface models from 2D medical images.
- Applying human musculoskeletal modeling to simulate biomechanics of rising from a chair.
- Investigating optimization and control algorithms for simulation of ballistic and non-ballistic movements.
- Experimental collection of human kinematic, electromyographic, and ground reaction force data.

Austin Community College, Dept. Mathematics — **Austin, Texas**
Sep 1994 – Aug 1995 — **Lecturer**

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

BIBLIOGRAPHY

Refereed Journal Articles:

- Goodworth, A, Barrett, C, Rylander, J, and Garner, B (2018). Specificity and variability of trunk kinematics on a mechanical horse. *Human Movement Science* 63: 82-95.
- Lee, G, Garner, B, and Li, Y. (2017). Simulation and measurement of electromagnetic wave propagation on dynamic human bodies. *IET Microwaves, Antennas & Propagation* 11(10): 1347-53.
- Li, Y., Xue, D., Forrister, E., Lee, G., Garner, B., and Kim, Y. (2016). Human activity classification based on dynamic time warping of an on-body creeping wave signal. *IEEE Transactions on Antenna and Propagations* 64: 4901-4905.
- Xue, D., Garner, B., and Li, Y. *(*2016*)*. Investigation of short-range, broadband, on-body electromagnetic wave propagations. *IET Microwaves Antennas Propagat* 10(11): 1182-1188.
- Xue, D., Garner, B., Li, Y. (2015). Extraction of on-body creeping wave mechanisms using the ESPRIT algorithm. *Microwave and Optical Technology Letters* 57(4): 868-871.
- Garner, B., and Rigby, R. (2015). Human pelvis motions when walking and when riding a therapeutic horse. *Human Movement Science* 39: 121-137.
- Shim, J. and Garner, B.A. (2012). Residual Force Enhancement of Knee Extensors and Knee Flexors at Short and Long Muscle Lengths. *Journal of Biomechanics* 45(6): 913-918.
- Garner, B.A. and Shim, J. (2008). Isometric Shoulder Girdle Strength of Healthy Young Adults. *Clinical Biomechanics* 23: 30-37.
- Garner, B.A., Shim, J., and Wilson, S.R. (2007). An Apparatus and Protocol to Measure Shoulder Girdle Strength. *Journal of Medical Devices* 1: 246-253.
- 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:

- Lee, G, Garner, N, and Li, Y (July 2018). Simulation and measurement of dynamic on-body electromagnetic wave propagations with motion capture techniques. *IEEE Antennas and Propagation Society International Symposium*, Boston, MA.
- Lee, G, Garner, N, and Li, Y (July 2018). Simulation of dynamic electromagnetic wave propagation on humans: lower body analysis. *IEEE MTT 2018 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.
- C Barrett, N Finlay, L Wu, Y Peng, J Rylander, D Lemke, B Garner (Mar 2017). Human core muscular activation response to imparted organic motion patterns. *Sixth International Conference of the American Hippotherapy Association,* Ft. Collins, CO.
- D. Xue, B. Garner and Y. Li (Mar 2017). On-body radiation of 3D-printed folded cylindrical helix (FCH) wearable antenna, *IEEE MTT 2017 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, Texas.
- G. Lee, B. Garner, and Y. Li (Jan 2017). Simulation of dynamic lower-body electromagnetic wave propagation with experimental verification, *USNC-URSI National Radio Science Meeting*, Boulder, CO
- E. Forrister, G. Lee, D. Xue, B. Garner and Y. Li (Apr 2016). Characterization of narrowband on-body wireless channels using motion capture experimentation, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, Texas.
- D. Xue, B. Garner and Y. Li (Apr 2016). Electrically-small folded cylindrical helix antenna for Wireless Body Area Networks, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, Texas.
- G. Lee, B. Garner and Y. Li (Apr 2016). Simulating electromagnetic wave propagation on moving humans: Comparison with experimental results, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, Texas.
- E. Forrister, G. Lee, D. Xue, B. Garner, and Y. Li (Jan 2016). Effects of body position and motion on on-body wireless channels, *USNC-URSI National Radio Science Meeting*, Boulder, CO.
- G. Lee, B. Garner, and Y. Li (Jan 2016). Simulation of dynamic on-body wave propagations with experimental verifications, *USNC-URSI National Radio Science Meeting*, Boulder, CO.
- D. Xue, B. Garner and Y. Li (Jul 2015). Investigation of broadband on-body electromagnetic wave propagations, *IEEE Antennas and Propagation Society International Symposium*, Vancouver, Canada.
- Y. Li, B. Garner and G. Benton (May 2015). Simulation and measurement of dynamic on-body creeping wave propagations. *URSI Atlantic Radio Science Conference*, Gran Canaria, Canary Islands.
- Xue, D., Liller, T., Garner, B., and Li, Y. (2014). Extraction of the on-body creeping wave mechanism using the ESPRIT algorithm. XXXIth General Assembly and Scientific Symposium of URSI GASS, Beijing, China.
- Xue, D., Liller, T., Garner, B., and Li, Y. (2014). Simulation and measurement of on-body wave propagation. IEEE MTT 2014 Texas Symposium on Microwave and Wireless Circuits and Systems. Waco, Texas.
- Gerardo, M., Chaput, C., Garner, B., and Hoffman, J. (Dec 2014). Automated Detection of Occipitocervical Complex Injuries. 42nd Annual Meeting of the Cervical Spine Research Society. Orlando, Florida.
- Rayess, N., Garner, B., Kleinke, D., Blust, R., Jordan, B., Dougherty, E. (Jun 2014). Intercollegiate Student Design Projects: Lessons Learned by Four Universities. Proceedings of the 121st American Society for Engineering Education Annual Conference & Exposition. Indianapolis, Indiana.
- Garner, B., and White, J. (Sep. 2013). Optimizing Physiological Parameters For Modeled Upper Shoulder Muscles. Annual Meeting of the American Society of Biomechanics, Omaha, Nebraska.
- Rigby, R., Garner, B., and Skurla, C., (2011) Comparing the pelvis kinematics of able-bodied children during normal gait and when riding a therapeutic horse. North American Society for the Psychology of Sport and Physical Activity. Burlington, Vermont.

- Rigby, R., Skurla, C., and Garner, B.A. (2010). Comparing the Pelvis Kinematics of Able-Bodied Children During Normal Gait and When Riding a Therapeutic Horse. American Society of Mechanical Engineers (ASME) Summer Bioengineering Conference, Naples, Florida.
- Benoit, H., Kelley, J., White, J., and Garner, B.A. (2010). Design of a Therapeutic Mechanical Horse. American Society of Mechanical Engineers (ASME) Summer Bioengineering Conference, Naples, Florida.
- Kelley, J., Benoit, H., White, J., Abbot-Kirk, J., Garner, B.A., and Skurla, C. (2010). Comparison of Two Piano Playing Methods Using Motion Capture. American Society of Mechanical Engineers (ASME) Summer Bioengineering Conference, Naples, Florida.
- Garner, B.A., and Rigby, R. (2009). Analysis of Human Pelvis Motions When Riding on a Horse and When Walking. North American Riding for the Handicapped Association (NARHA) National Conference, Ft Worth, TX.
- Alford, K., Lanning, B., and Garner, B.A. (2007). Quantifying Body Motions of Human and Equine Gait. North American Riding for the Handicapped Association (NARHA) National Conference, Anaheim, CA.
- 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 Conference, 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:

- D. Xue, B. Garner, and Y. Li (Apr 2016). Electrically-Small Folded Cylindrical Helix Antenna for Wireless Body Area Networks, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.

- G. Lee, B. Garner, and Y. Li (Apr 2016). Simulating Electromagnetic Wave Propagation on Moving Humans: Comparison with Experimental Results, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.
- E. Forrister, G. Lee, D. Xue, B. Garner, and Y. Li (Apr 2016). Characterization of Narrowband On-Body Wireless Channels Using Motion Capture Experimentation, *IEEE MTT 2016 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.
- A. Hoeckel, G. Lee, E. Forrister, D. Xue, B. Garner, G. Benton and Y. Li (Apr 2015). Simulation and measurement of dynamic on-body wave propagations, *IEEE MTT 2015 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.
- D. Xue, B. Garner and Y. Li (Apr 2015). Investigation of 433 MHz and 915 MHz on-body wave propagations, *IEEE MTT 2015 Texas Symposium on Microwave and Wireless Circuits and Systems*, Waco, TX.
- Garner, B.A. and McNeill, M. (2010). Rider Motions in the Arena and on an Equine Treadmill. Annual Conference of the Lone Star Therapeutic Equestrian Network (LSTEN), Texarkana, Texas.
- Rigby, B.R. and Garner, B.A. (2009). Comparing the Trunk Kinematics of Able-Bodied Humans During Normal Gait and When Riding a Therapeutic Horse. 26th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Garner, B. (2009). How Realistic Are The Motion Patterns of Horse Simulator Exercise Devices? Annual Conference of the Lone Star Therapeutic Equestrian Network (LSTEN) Houston, TX.
- Garner, B.A. (2009). Human Pelvis Motions When Riding and Walking. Annual Conference of the Lone Star Therapeutic Equestrian Network (LSTEN), Houston, Texas.
- Garner, B.A. and Xu, Bo (2008). A Proposed New Obstacle-set Algorithm for Modeling the Wrapping Path of Deltoid. 25th Annual Houston Conference on Biomedical Engineering Research, Houston Society for Engineering and Medicine in Biology (HSEMB), Houston, Texas.
- Garner, B.A. (2008). Quantifying Body Motions of Human and Equine Gait. Annual Conference of the Lone Star Therapeutic Equestrian Network (LSTEN), Waco, Texas.
- 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

National Science Foundation (NSF) **$360,000**
August 2016 – July 2019

- Research Grant: 3-D Printed, Reconfigurable Wearable Antenna Designs for Dynamic On-Body Wireless Communications: Yang Li, Co-PI; Brian Garner, Co-P.I.

Pro Equine Group, Inc. **$8,041**
June 2018 – June 2019

- Contract: Motion Capture Analysis of Team Calf-Roping and Trainers: Brian Garner, P.I., Jonathan Rylander, Co-PI.

Baylor Undergraduate Research and Scholarly Achievement (URSA) **$4,500**
June 2016 – May 2017

- Research Grant: Experimentation and Simulation of On-Body Electromagnetic Wave Propagation for Wireless Health Monitoring: Brian Garner, Co-P.I.; Yang Li, Co-PI;

Baylor Collaborative Faculty Research Investment Program (CFRIP) **$45,000**
June 2014 – May 2015

- Research Grant: Electrically-small, power-efficient wireless wearable antenna for falling prevention: Yang Li, Co-PI; Brian Garner, Co-P.I.; Garrison Benton, Co-PI.

Bernard and Audre Rapoport Foundation **$8,000**
October 2012 – September 2013 **Mechanical Horse Simulator Project**

- Research Grant: A Mechanical Horse Simulator for Therapy if Individuals with Disabilities. Brian Garner, P.I.

National Institutes of Health (NIH) Biocomputation Center, Stanford University **$20,000**
February 2008 – July 2008 **Simbios OpenSim Project**

- Research Grant: Improved Muscle-Path Modeling Tools Applied to the Male Upper Extremity. Brian Garner, P.I.

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

July 2015 (US Patent 9,078,621): Method and System of Measuring Anatomical Features in Subcutaneous Images to Assess Risk of Injury.

October 2014 (US Patent 8,852,010): Six-Degree-of-Freedom Cam-Controlled Support Platform.

April 2013 (US Patent 8,425,384): A Multi-Link Exercise Machine.

May 2009 (US Patent 7,530,934): A Variable Resistance Flexion and Extension Exercise Machine.

January 2009 (US Patent 7,481,752): Abdominal Exercise Machine.

PROFESSIONAL ACTIVITIES AND SERVICE

- Societies: BMES, ASB, ASEE, ASME, HSEMB. (past memberships)
- 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**

Subsurface Computer Modeling, Inc. — **Austin, Texas**
Jun 1997 – Jul 1999; Feb – Apr 2001 — **Software Developer**

Wesson International, Inc. — **Austin, Texas**
Sep 1996 – Dec 1996 — **Software Developer**

LEADERSHIP AND COMMUNITY SERVICE

Alliance Bible Church — **Waco, Texas**
Sep 2004 – present — **Elder, Children's Church Director**

Grace Covenant Church — **Austin, Texas**
Jan 2001 – July 2002 — **Elder Board**

Grace Covenant Christian School — **Austin, Texas**
Sep 2000 – July 2002 — **School Board**

Grace Covenant Church — **Austin, Texas**
Sep 1996 – Dec 2000 — **Deacon**