

Wesley J. Womack, PE, Ph.D.

Curriculum Vitae

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Education

Ph.D. in Mechanical Engineering, Emphasis in Biomedical Engineering
Colorado State University, Fort Collins, CO
Computational modeling of the lower cervical spine: Facet cartilage distribution and disc replacement
Summer 2009; 4.0 GPA

B.S. in Mechanical Engineering
Montana State University, Bozeman, Montana
May 2001 with Highest Honors; 3.74 GPA

Professional Certifications

Licensed Professional Engineer, Mechanical Engineering, Wyoming, 2011

Certified LabVIEW Developer, 2010

Research/Work Experience

Director of Engineering, Epsilon Technology Corp (2011-Present)

- Lead R&D efforts and guide project teams
- Directed development and launch of nine new product lines
- Developed multiple software systems to increase productivity and product quality
- Developed and deployed integrated quality control and CRM systems

Senior Technology Officer, Square One Systems Design, (2009-2011)

- Developed and implemented controls strategies for mechatronic systems
- Developed software and software libraries for complex electromechanical systems including automated systems, teleoperated robots, positioning mechanisms, and mobile robots
- Assessed promising technologies for potential inclusion in mechatronic systems and developed controls, hardware, and software libraries for new and potential equipment. Evaluated the utility of new proposed techniques and technologies including the design and execution of evaluation metrics and software.

Graduate Research Assistant, Colorado State University, (2005-2009)

- Developed a high-fidelity experimentally validated numerical model of the lower cervical spine.
 - Developed novel high-fidelity experimentally validated geometric and material models
- Developed multiple custom software tools, including:
 - Quantitative optimization of finite element mesh quality
 - Image-based strain measurement of soft organic tissues from video
 - Element-specific definition of material properties based on qCT image density
 - Mesh topology conversion and image/mesh registration
 - Automated development of finite element model sets directly from qCT/MRI imagery
 - Pre-surgical analysis of optimal patient-specific pedicle screw trajectory
- Led novel collaborative research projects
 - Cartilage thickness distribution mapping
 - Diametral compression testing of bone samples

- Cadaveric spine testing
- Post-yield behavior of cortical and haversian bone
- Provided mentoring and design analysis for graduate and undergraduate students
 - Developed experimental hardware and software for several colleagues' research efforts

Mechanical Engineer, Los Alamos National Laboratory, (2001-2005)

- Supported the emergency response community by performing design, analysis, testing, and certification of a variety of technical tools and classified devices
- Provided technical training and manuals for users of unique tools and techniques
- Performed reverse engineering analysis in support of national security interests
- Developed unique tools and equipment using diverse industrial resources
 - Led development of various mechanical disassembly tools
 - Hydraulics, circuit design, thermo/fluids, acoustics, chemical assays, explosive forming, pyrotechnics, cutting tools, machine dynamics, etc.
- Led design projects throughout the life cycle, from concept through final certification
- Interacted with customers to develop appropriate solutions
- Provided field-engineer expertise and analysis for nuclear system disassembly.
- Performed mechanical engineering design and analysis using Pro-E and other utilities

Skills

Professional

- Formal research and development training
 - High Explosives safety, electrical hazard mitigation, hoisting and rigging certification
 - Nuclear/radiological safety and hazard mitigation, X-ray/radiography operations
 - First aid & CPR certifications
- Research and development expertise
 - Tool and mechanism design
 - Biomechanical testing and analysis
 - Design-for-production
 - Experience with mills, lathes, assembly tools, etc.
 - Circuit design and assembly, soldering, etc.

Software Expertise

- Programming:
 - Extensive development in VBA, MathCAD, LabVIEW, QuickBasic & Excel
- Development and analysis:
 - Pro-Engineer, SolidWorks
 - FEA/FEM: TrueGrid, ABAQUS
- Additional experience with AutoCAD, C, Matlab, Maple, Word, WordPerfect, etc.

Selected Awards and Recognition

Woodie Flowers Finalist Award (First Robotics)
 ASTM Emerging Professionals Award
 National Technological University Graduate Fellowship
 Electrical Engineering & Honor Scholarships
 National Merit Scholarship
 MSU Top 75 Sophomores List
 Dean's List for 6 semesters
 Golden Key, Alpha Lambda Delta, Tau Beta Pi & Phi Kappa Phi Honor Societies

Professional Affiliations

American Society of Mechanical Engineers (ASME)
 American Society for Testing and Materials (ASTM)

Peer-Reviewed Publications

1. **Womack WJ**, Santoni BG, CM Puttlitz. "Diametral compression of non-circular diaphyseal bone sections." *Journal of Biomechanics* Jan 41(1):194-9, 2008.
2. **Womack WJ**, Woldtvedt D, Puttlitz CM. "Lower cervical spine facet cartilage thickness mapping", *Osteoarthritis and Cartilage* Sept 16(9):1018-23, 2008.
3. Santoni BG, **Womack WJ**, Wheeler DL, Puttlitz CM. "A mechanical and computational investigation on the effects of conduit orientation in massive bone allografts." *Bone* Nov 41(5):769-74, 2007.
4. Santoni BG, Hynes RA, McGilvray KC, Rodriguez-Canessa G, Lyons AS, Henson MAW, **Womack WJ**, Puttlitz CM. "Cortical bone trajectory for lumbar pedicle screws." *The Spine Journal* May 9(5):366-373, 2009.
5. **Womack WJ**, Puttlitz CM. "Non-linear structural finite element modeling of the human annulus fibrosus" *Wessex Institute of Technology Transactions on Biomedicine and Health*; Eighth International Conference on Modeling in Medicine and Biology, Crete, 2009 [In publication]
6. Olsen S, Clinton JM, Working Z, Lynch JR, Warne WJ, **Womack WJ**, Matsen FA. "Thermal effects of glenoid reaming during shoulder arthroplasty in vivo." *The Journal of Bone and Joint Surgery* August 2010 [In publication]

Abstracts and Conference Proceedings

1. **Womack WJ**, Puttlitz CM. "Application of a modified quasi-linear viscoelastic model to the cervical disc." Orthopaedic Research Society Meeting, San Diego CA, 2007
2. **Womack WJ**, Puttlitz CM. "Diametral compression of hollow non-circular bone sections." 2007 ASME Summer Bioengineering Conference, Keystone CO, June 20-24 2007
3. Santoni BG, **Womack WJ**, Wheeler DL, Puttlitz CM. "A mechanical and computational investigation of the effects of conduit orientation on the strength of massive bone allografts." 2007 ASME Summer Bioengineering Conference, Keystone CO, June 20-24 2007
4. **Womack WJ**, Ames C, Puttlitz CM. "A modified quasi-linear viscoelastic parametric study of the cervical disc", Spine Arthroplasty Society Conference, Berlin Germany, 2007
5. **Womack WJ**, Woldtvedt D, Puttlitz CM. "Diametral compression: computational and experimental investigation of a new bone strength test", Orthopaedic Research Society Meeting, San Francisco CA, 2008
6. **Womack WJ**, Woldtvedt D, Puttlitz CM. "An analytical description of cartilage thickness mapping and shape of the cervical spine facet joints", Orthopaedic Research Society Meeting, San Francisco CA, 2008
7. Santoni BG, Hynes RA, McGilvray KC, Rodriguez-Canessa G, Lyons AS, Henson MAW, **Womack WJ**, Puttlitz CM. "Lumbar pedicle screw design and trajectory affects bone quality available for purchase and fixation mechanics." 54th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2-5, 2008.
8. **Womack WJ**, Puttlitz CM. "Implementation of physiological facet cartilage thickness mapping in a high resolution finite element model of the cervical spine and implant-related facet force transmission predictions" 17th Annual Symposium on Computational Methods in Orthopaedic Biomechanics, Las Vegas, NV, February 2009
9. Tichota R, **Womack WJ**, Puttlitz CM. "A biomechanical study of a limited motion device for lumbar posterior stabilization in an ovine model" Orthopaedic Research Society 55th Annual Meeting, Las Vegas NV, 2009