

## Katherine Yanhang Zhang

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### Education

2003	Ph. D., Mechanical Engineering, University of Colorado at Boulder
2000	M. S., Mechanical Engineering, University of Colorado at Boulder
1998	B. Eng., Engineering Mechanics, Tsinghua University, China
1998	B. Eco., Economics and Management, Tsinghua University, China

### Professional Experience

2008-present	Clare Boothe Luce Assistant Professor, Division of Materials Science & Engineering, Boston University
2007-present	Clare Boothe Luce Assistant Professor, Department of Biomedical Engineering, Boston University
2006-present	Clare Boothe Luce Assistant Professor, Department of Mechanical Engineering, Boston University
2004-2005	Research Associate, Department of Mechanical Engineering, University of Colorado at Boulder
1999-2003	Research Assistant, Department of Mechanical Engineering, University of Colorado at Boulder
1998, 2002	Teaching Assistant, Department of Mechanical Engineering, University of Colorado at Boulder

### Honors

2010	NSF CAREER Award
2007	Young Faculty Award, DARPA/MTO
2006	Clare Boothe Luce Assistant Professorship
2003	Outstanding Mechanical Engineering Ph.D., University of Colorado at Boulder
2002	First place, Best Student Paper Award, SPIE's 9th International Symposium on Smart Structures and Materials, San Diego, CA, March 2002.
2002	Outstanding Teaching Assistant Award, Department of Mechanical Engineering, University of Colorado at Boulder
2002	Graduate Fellowship Award for Research Excellence, University of Colorado at Boulder
1996-97	Outstanding Student Fellowship, Tsinghua University, China
1995	Takada-Tsinghua Fellowship, Tsinghua University, China
1994	Cai Minxue Fellowship, Tsinghua University, China

### Profession Service

Faculty advisor, Society of Women Engineers at BU, 2008-present  
 Reviewer and Judge, Southern New England Regional Junior Science and Humanities Symposium, 2006-2008  
 Reviewer and Judge, ASME Summer Bioengineering Conference, 2007-present  
 Panelist for NSF 2006-present  
 Ad hoc reviewer for NIH 2009-present

Technical committee, MEMS/MOEMS Technologies and Applications conference, Photonics Asia Symposium, Beijing, China, Nov 11-15, 2007  
 Topic Chair, Nanobiomechanics, ASME 2011 International Mechanical Engineering Congress & Exposition

Journal reviewer

Acta Mechanica Solida Sinica  
 Biomechanics and Modeling in Mechanobiology  
 Biomacromolecules  
 Cardiovascular Engineering and Technology  
 Journal of Applied Physiology  
 Journal of Biomechanical Engineering  
 Journal of Biomechanics  
 Journal of Computer Methods in Biomechanics and Biomedical Engineering  
 Journal of Electronic Packaging  
 Journal of Microelectromechanical System  
 Journal of Nanomaterials  
 Journal of Physics D: Applied Physics  
 Measurement Science and Technology  
 Medical Engineering & Physics

## Research Interests

Cardiovascular mechanics  
 Multi-scale mechanics of extracellular matrix  
 Mechanobiological constitutive modeling of biological tissue  
 Micro- and Nano-mechanics of thin film and thin film coatings

## Teaching Interests

Heat transfer  
 Engineering mechanics  
 Finite element analysis  
 Soft tissue biomechanics  
 Constitutive modeling of biological materials

## Publications

### *Journal Articles in Preparation*

- J-24. Chow, M-J, and Zhang, Y., 2011, Mechanical and structural changes in elastin and collagen digested arterial tissue as a model of aortic aneurysm, in preparation.
- J-23. Zou, Y. and Zhang, Y., 2011, Structure and function of arterial elastin in solutes, in preparation.
- J-22. Xu, B. and Zhang, Y., 2011, Elastic and Viscoelastic behavior of collagen matrix, in preparation.

### *Journal Articles under Review*

- J-21. Xu, B., Chow, M-J, and Zhang, Y., 2010, Experimental and modeling study of collagen scaffolds with the effects of crosslinking and fiber alignment, *International Journal of Biomaterials*, under review.
- J-20. Chow, M-J, Zou, Y., He, H., McGowan F.X. Jr., and Zhang, Y., 2010, Obstruction-induced pulmonary vascular remodeling, *American Journal of Physiology – Heart and Circulatory Physiology*, revision submitted.

### *Peer Reviewed Journal Articles*

- J-19. Zou, Y. and Zhang, Y., 2010, Mechanical evaluation of decellularized porcine thoracic aorta, *Journal of Surgical Research*, accepted.
- J-18. Lin, I-K, Zhang X., and Zhang Y., 2010, Inelastic deformation of bilayer microcantilevers with

- nanoscale coating, *Sensors & Actuators: A. Physical*, accepted.
- J-17. Zou, Y. and Zhang, Y., 2010, The orthotropic viscoelastic behavior of aortic elastin, *Biomechanics and modeling in mechanobiology*, Epub ahead of print.
- J-16. Chow, M-J and Zhang, Y., 2010, The change in mechanical and biochemical properties of aortic tissue due to cold storage, *Journal of surgical research*, doi:10.1016/j.jss.2010.04.007, in press.
- J-15. Wei, D. and Zhang, Y., 2009, Friction between  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> (0 0 1) surfaces and the effects of surface hydroxylation, *Surface Science*, doi:10.1016/j.susc.2009.06.022
- J-14. Lin, I-K, Zhang X., and Zhang Y., 2009, Thermomechanical behavior and microstructural evolution of SiN<sub>x</sub>/Al biomaterial microcantilevers, *Journal of Micromechanics and Microengineering*, Vol. 19, 085010.
- J-13. Zou, Y. and Zhang, Y., 2009, An experimental and theoretical study on the anisotropy of elastin network. *Annals of Biomedical Engineering*, Vol. 37, pp. 1572-1583.
- J-12. Zhang, Y. and Dunn, M. L., 2009, Deformation of Patterned Bilayer Plate Microstructures Subjected to Thermal Loading, *International Journal of Solids and Structures*, Vol. 46, pp. 125-134.
- J-11. Lin, I-K, Zhang, Y., and Zhang, X., 2008, The deformation of microcantilever-based infrared detectors during thermal cycling, *Journal of Micromechanics and Microengineering*, Vol. 18, 075012.
- J-10. Zhang, Y., Dunn, M. L., Hunter, S. K., Lee, P. F., Lanning, C., Dunbar, D., and Shandas R., 2007, Application of a microstructural constitutive model of pulmonary artery to patient-specific studies: validation and effect of orthotropy. *Journal of Biomechanical Engineering*, Vol. 129, pp. 193-201.
- J-9. Hunter, K. S., Lanning, C.J., Zhang, Y., Garg, R., Ivy, D. D., Shandas, R., 2006, Simulations of congenital defect closure and reactivity tests in patient-specific models of the pediatric pulmonary vasculature: a 3-D numerical study with fluid-structure interaction, *Journal of Biomechanical Engineering*, Vol. 128, pp. 564-572.
- J-8. Pajot, J., Maute, K., Zhang, Y., and Dunn, M. L., 2006, Design of patterned multilayer films with eigenstrains by topology optimization, *International Journal of Solids and Structures*, Vol. 43, pp. 1832-1853.
- J-7. Zhang, Y., Dunn, M. L., Drexler E. S., McCowan, C. N., Slifka, A. J., Ivy, D. D., and Shandas, R., 2005, Implementation and application of a microstructural orthotropic hyperelastic model of pulmonary artery mechanics under normotensive and hypertensive conditions. *Annals of Biomedical Engineering*, Vol. 33, pp. 1042-1052.
- J-6. Zhang, Y. and Dunn, M. L., 2004, Linear and nonlinear deformation of multilayer thin-film microstructures during thermal loading, *Journal of the Mechanics and Physics of Solids*, Vol. 52, pp. 2101-2126.
- J-5. Zhang, Y. and Dunn, M. L., Elam, J. W., and George, M., 2004, Suppression of inelastic deformation in multilayer thin film microstructures by the use of nanocoatings, *Journal of Applied Physics*, Vol. 95, pp. 8216-8224.
- J-4. Gall, K., Dunn, M. L., Zhang, Y., and Corff, B., 2004, Thermal cycling response of layered gold/silicon MEMS structures, *Mechanics of Materials*, Vol. 36, pp. 45-55.
- J-3. Zhang, Y. and Dunn, M. L., 2003, Deformation of blanked and patterned bilayer thin-film microstructures during post-release and cyclic thermal loading, *Journal of Microelectromechanical Systems*, Vol. 12, pp. 788-796.
- J-2. Dunn, M. L., Zhang, Y., and Bright, V. M., 2002, Deformation and structural stability of layered plate microstructures subjected to thermal loading, *Journal of Microelectromechanical Systems*, Vol. 11, pp. 372-384.
- J-1. Dunn, M. L., Zhang, Y., and Bright, V. M., 2000, Deformation and stability of gold/polysilicon layered MEMS plate structures subjected to thermal loading, *ASTM Special Technical Publication*, n 1413, *Mechanical Properties of Structural Films*, pp. 306-317.

### Book Chapters

- BC-1. Dunn, M.L., Gall, K., Zhang, Y., and Corff, B., 2002, Aspects of Lifecycle Engineering for Reliable

Microelectromechanical Systems Containing Multilayer Materials Systems. *Modeling and Simulation-Based life cycle engineering*. Taylor & Francis, pp. 106-119.

### Thesis

Zhang, Y. Thermomechanical Behavior of Multilayer Thin Film Microstructures (Advisor: Martin L. Dunn). University of Colorado, Boulder, 2003

### Peer-Reviewed Conference Proceedings

- C-13. Zou Y. and Zhang, Y., 2011, Mechanical behavior of arterial elastin with glycation effect, *Engineering Mechanics Conference (EMI 2011)*, June 2-4, Boston, MA.
- C-12. Chow M-J and Zhang, Y., 2011, Quantifying the structural and mechanical changes in elastase degraded arteries as an in vitro model of aortic aneurysm, *Proceedings of the ASME 2011 Summer Bioengineering Conference*, June 22-25, Farmington, PA.
- C-11. Xu B. and Zhang, Y., 2011, Hydration and crosslinking effects on the elastic and viscoelastic properties of collagen scaffolds, *Proceedings of the ASME 2011 Summer Bioengineering Conference*, June 22-25, Farmington, PA.
- C-10. Lin, I-K, Zhang, X., and Zhang, Y., 2010, Inelastic deformation in multilayer microcantilevers with nanocoatings," *Proceedings of the USNCTAM, 16<sup>th</sup> US National Congress of Theoretical and Applied Mechanics*, June 27-July 2, 2010, State College, PA.
- C-9. Zou, Y. and Zhang, Y., 2009, Time-dependent mechanics of elastin network, *Proceedings of the ASME 2009 Summer Bioengineering Conference*, June 17-21, Lake Tahoe, CA.
- C-8. Zou, Y. and Zhang, Y., 2008, Experimental and theoretical study of bovine aorta and its elastin, *Proceedings of the ASME 2008 Summer Bioengineering Conference*, Marco Island, Florida.
- C-7. Hunter, K., Zhang, Y., Lanning, C., Ivy, and Shandas, R., 2006, Clinical and numerical studies supporting pulmonary vascular input impedance as a determinant of global vascular stiffness in pediatric pulmonary hypertension, *Proceedings of the ASME 2006 Summer Bioengineering Conference*, June 21-25, Amelia Island, FL.
- C-6. Zhang, Y., Dunn, M. L., Hunter, K., Lee, P., Lanning, C., Ivy, D. D., and Shandas, R., 2005, Modeling of pulmonary artery mechanics in children with pulmonary hypertension, *Proceedings of the ASME 2005 Summer Bioengineering Conference*, Vail, CO.
- C-5. Zhang, Y. and Dunn, M. L., 2002, A vertical electrostatic actuator with extended digital range via tailored topology, *SPIE's 9th Annual International Symposium on Smart Structures and Materials, Proceedings of SPIE*, Vol. 4700, pp. 147-156.
- C-4. Zhang, Y. and Dunn, M. L., 2001, Stress relaxation of gold/polysilicon layered MEMS microstructures subjected to thermal loading, *Proceedings of the MEMS Symposium, ASME International Mechanical Engineering Congress and Exposition*, Vol. 3, pp. 149-156.
- C-3. Dunn, M. L., Zhang, Y., and Bright, V. M., 2000, Linear and geometrically nonlinear behavior of metal/polysilicon plate microstructures subjected to temperature changes, *Proceedings of the MEMS Symposium, ASME International Mechanical Engineering Congress and Exposition*, Vol. 2, pp. 207-213.
- C-2. Harsh, K. F., Kladitis, P. E., Zhang, Y., Dunn, M. L., Bright, V. M., and Lee, Y. C., 2000, Tolerance and precision study for solder self-assembled MEMS, *Micro-Opto-Electro-Mechanical Systems Conference, Proceedings of SPIE*, Glasgow, United Kindom. Vol. 4075, pp. 173; doi:10.1117/12.397933.
- C-1. Dunn, M. L., Zhang, Y., Roy, J. M., Labossiere, P. E. W., and Bright, V. M., 1999, Nonlinear deformation of multilayer MEMS structures," *Proceedings of the MEMS Symposium, ASME International Mechanical Engineering Congress and Exposition*, Vol. 1, pp. 75-80.

### Abstracts

- A-21. Chow M-J, and Zhang, Y., 2011, Quantifying the structural and mechanical changes in elastase degraded arteries, *ASME International Mechanical Engineering Congress and Exposition*, November 11-17, Denver, CO.

- A-20. Zou, Y., and Zhang, Y., 2011, Changes in the Mechanical Behavior of Arterial Elastin due to Glycation, *ASME International Mechanical Engineering Congress and Exposition*, November 11-17, Denver, CO.
- A-19. Zou, Y., and Zhang, Y., 2010, Viscoelastic properties of elastin network with solvent effects, *MRS Fall meeting*, Boston, MA.
- A-18. Chow, M-J, and Zhang, Y., 2010, Remodeling in arteries as a result of a pulmonary vascular obstruction, *MRS Fall meeting*, Boston, MA.
- A-17. Xu, B., Chow, M-J, and Zhang, Y., 2010, Elastic and viscoelastic properties of collagen scaffolds, *MRS Fall meeting*, Boston, MA.
- A-16. Lin, I-K, Du, P., Zhang, Y., and Zhang, X., 2010, Mechanical and material characterization of bilayer Microcantilever-based IR detectors, *MRS Fall meeting*, Boston, MA.
- A-15. Zou, Y. and Zhang, Y., 2010, The elastic and viscoelastic behaviors of aortic elastin network, *BMES Annual Meeting*, Austin, TX.
- A-14. Lin, I-K, Zhang, X., and Zhang, Y., 2009, Suppression of inelastic deformation in multilayer microcantilevers with nanoscale coating, *Materials Research Society Symposia Proceedings, MRS Fall meeting*, Boston, MA.
- A-13. Xu, B. and Zhang, Y., 2009, Biaxial mechanical properties of collagen scaffolds with the effects of crosslinking and fiber alignment, *BMES Annual Meeting*, Pittsburgh, PA.
- A-12. Chow, M-J, Zou, Y., He, H., McGowan, F., McElhinney, D., and Zhang, Y., 2008, Effect of pulmonary artery banding on the mechanical behavior of arteries, *ASME International Mechanical Engineering Congress and Exposition*, Boston, MA.
- A-11. Wei, D. and Zhang, Y., 2008, Molecular dynamics simulations of friction and the effect of surface coating, *ASME International Mechanical Engineering Congress and Exposition*, Boston, MA.
- A-10. Lin, I-K, Z, Fan, K., Huang, S., Gonzalez, A., Zhang, Y., and Zhang, X., 2008, Characterization of gradient residual stress in bimaterial microcantilever structures for MEMS applications," *ASME International Mechanical Engineering Congress and Exposition*, Boston, MA.
- A-9. Zou, Y. and Zhang, Y., 2008, Experimental and theoretical study of bovine aorta and its elastin, *ASME International Mechanical Engineering Congress and Exposition*, Boston, MA.
- A-8. Zhang, Y., Wong, J., and Zhang, X., 2008, A multi-scale approach to understanding the mechanical and biochemical behavior of tissue engineered blood vessels, *NSF Design, Service and Manufacturing Grantees and Research Conference*, Knoxville, TN, January 7-10.
- A-7. Lin, I-K, Zhang, Y., and Zhang, X., 2007, Curvature control of microcantilever based infrared detectors using thermal loading method, *MRS Fall Meeting*, Boston, MA.
- A-6. Zhang, Y., Hunter, K., Lanning, C., Ivy, D. D., and Shandas, R., 2006, A study of the passive and active responses of the pulmonary arterial wall, *MRS Fall Meeting*, Boston, MA.
- A-5. Zhang, Y., Hunter, K., Lanning, C., Ivy, D. D., and Shandas, R., 2006, A microstructural model relates clinical pressure-diameter responses to structural remodeling in PAH, *BMES Annual Meeting*, Chicago, IL.
- A-4. Zhang, Y., Hunter, K., Lanning, C., Ivy, D. D., Claussen, L., and Shandas, R., 2006, A microstructural finite element model applied to three-dimensional patient-specific images of the pulmonary vasculature: a novel tool to predict structural remodeling in pulmonary arterial hypertension, *ATS (American Thoracic Society)*, May 19-24, San Diego, CA.
- A-3. Hunter, K., Zhang, Y., Lanning, C., Ivy, D. D., and Shandas, R., 2005, Patient-specific simulations of reactivity in models of the pulmonary vasculature: a 3-D numerical study with fluid-structure interaction, *APS (American Physical Society)*, November 20–22, Chicago, IL.
- A-2. Zhang, Y., Dunn, M. L., Drexler, E., McCowan, C., Slifka, A., Ivy, D. D., and Shandas, R., 2004, Non-linear, hyperelastic, finite element modeling of normal and hypertensive rat pulmonary arteries, *BMES Annual Meeting*, Philadelphia, Pennsylvania.
- A-1. Zhang, Y. and Dunn, M. L., 2002, Suppression of stress relaxation in MEMS multilayer film microstructures by use of ALD nanocoatings, *MEMS and Nanotechnology Symposium, ASME International Mechanical Engineering Congress and Exposition*, pp. 179-187.

## Invited talks

School of Engineering, Solid Mechanics Seminar, Brown University, May 2011  
 Department of Mechanical Engineering, University of Washington, April 2011  
 Department of Mechanical and Industrial Engineering, Northeastern University, March 2011  
 Department of Mechanical Engineering, University of Illinois – Urbana Champaign, March 2011  
 Department of Mechanical Engineering, University of Arizona, March 2011  
 Department of Mechanical Engineering, University of Texas – Austin, October 2010  
 Department of Engineering Mechanics, Tsinghua University, Beijing, China, June 2010  
 Department of Medicine, Boston University, November 2008  
 Department of Biomedical Engineering, Boston University, April 2007  
 Department of Mechanical Engineering, University of Washington, May 2005  
 Department of Mechanical Engineering, Stanford University, April 2005  
 Department of Mechanical Engineering, Florida International University, April 2005  
 Department of Mechanical Engineering, University of New Mexico, April 2005  
 Department of Mechanical Engineering, University of Central Florida, April 2005  
 Department of Aerospace and Mechanical Engineering, Boston University, March 2005

## Patents

P-2. Zhang Y., Digital Vertical Electrostatic Actuator, CUtech-100P, provisional patent filed November 2, 2001.  
 P-1. Harsh, K. F., Kladitis, P. E., Lee, Y. C., Bright, V., M., Zhang, W., Dunn, M. L., and Zhang, Y., Multi-Dimensional Micro-Electromechanical Assemblies and Method of Making Same, United States Patent Application 20020170290.

## Professional Affiliations

American Society of Mechanical Engineers (ASME)  
 Biomedical Engineering Society (BMES)  
 Materials Research Society (MRS)

## Students Advised

Postdoctoral research associate-  
 Dongshan Wei (2007- 2008)

### PhD-

Ming-Jay Chow (2008-present)  
 Bin Xu (2007-present)  
 Yu Zou (2006-2010, now at EMD Millipore, Merck KGaA)  
 I-Kuan Lin (co-advise with Prof. Xin Zhang, 2006-2010, now at Goddard Space Flight Center & Global Science and Technology, Inc)

### MS-

Ming-Jay Chow (2006-2008)  
 Holly Brideau (2007-2008)

## Committee

### Ph.D. thesis Committee Chair-

Haibiao Luo, Three-Dimensional Model of Elastic Wave Propagating in Kidney Stones with Application to Shock Wave Lithotripsy (Graduated in Summer 2010)  
 Yaopeng Zhou, Adaptive Optics Two-Photon Scanning Laser Fluorescence Microscopy (Graduated in

Summer 2008)

Gozde Ozaydin – Ince, Surface Morphology Evolution During Low Energy Ion Bombardment of Si and GaSb (Graduated in Spring 2007)

Tianming Wu, Bubble-Mediated Focused Ultrasound: Nucleation, Cavitation Dynamics, and Lesion Prediction. (Graduated in Spring 2006)

Ph.D. thesis committee-

Ping Du, Mechanical and Material Characterization of Polymer Transducers (2011- ), 4<sup>th</sup> reader.

James Truslow, Design and Analysis of Engineered Microvasculature via Computational Methods (Graduated in Spring 2011), 4<sup>th</sup> reader.

Carlos Rivas, An Optimization Formulation of Elastic Inverse Problems (2007-2009), 3<sup>rd</sup> reader.

Shusen Huang, Uncooled Double Cantilever Micrometer Focal Plan Arrays with mK NETD (Graduated in Spring 2007), 5<sup>th</sup> reader.

Hui Yu, Flexible Fabrication of Three-Dimensional Multi-Layered Microstructures Using a Scanning Laser System (Graduated in Spring 2006), 5<sup>th</sup> reader.

Zhiqiang Cao, Mechanical Behavior of PECVD Dielectric Films for MEMS Applications (Graduated in Spring 2006), 5<sup>th</sup> reader.

M.S. thesis committee-

Mark Slater, Elastic Modulus Reconstructions via Sparse Data Sampling, (Graduated in Spring 2011), 3<sup>rd</sup> reader.

Else Frohlich, Biomimetic Platform to Study Effects of Surface Topography and Flow-Induced Shear Stress on Renal Epithelial Cells (Graduated in Spring 2011), 2<sup>nd</sup> reader.

John Alfred Gallagher, Intervertebral Variation of Orthotropic Elastic Properties (Graduated in Summer 2010), 2<sup>nd</sup> reader.

Nabi Onur Azak, Nanomechanical Resonators in a Fluidic Channel: Fabrication and Detection Techniques (Graduated in Fall 2007), 3<sup>rd</sup> reader.

Department committees-

Graduate committee (2006-present)

Thermal/Fluids (2007-present)

Seminar Committee (2007-2008)

Structures/Dynamics (2007)

Faculty search committee (2007)

## Extramural Research Funding

Active

CMMI 1038208 (02/01/2010-01/31/2015)

NSF Faculty Early Career Development (CAREER) Award

*Integrating Multi-Scale Mechanics and Biomaterials to Study the Translation of Mechanical Forces from Tissue to Cell (\$400,000)*

Role: PI

CMMI 1038208

NSF (02/01/2010-01/31/2015)

*Research Experience for Undergraduates (REU) supplement: Integrating Multi-Scale Mechanics and Biomaterials to Study the Translation of Mechanical Forces from Tissue to Cell (\$12,000)*

Role: PI

R01 HL098028

(12/15/2010-11/30/2014)

NIH

*An integrative Multi-Scale Model of Extracellular Matrix Mechanics in Vascular Remodeling (\$1,144,325)*

Role: PI

CMME 1100791

(05/01/2011-04/20/2014)

NSF

*Effects of Immediate Biochemical Environments on the Structure and Function of Aortic Elastin*  
(\$370,000)

Role: PI (Co-PI: Larry Ziegler)

Completed

Young Faculty Award

(04/25/2007-04/24/2009)

Defense Advanced Research Projects Agency/The Microsystems Technology Office (DARPA/MTO)

*Micro- and Nano- Mechanics of Thin Film and Thin Film Coatings* (\$150,000)

Role: PI

CMMI 0700507

(06/01/2007-05/31/2009)

NSF

*A multi-scale approach to understanding the mechanical and biochemical behavior of tissue engineered blood vessels* (\$75,000)

Role: PI (Co-PIs: Joyce Wong, Xin Zhang)

NSF

(06/01/2007-05/31/2009)

*REU supplement: A multi-scale approach to understanding the mechanical and biochemical behavior of tissue engineered blood vessels* (\$6,750)

Role: PI