

Xiaopeng Zhao

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University Address

Department of Biomedical Engineering
Duke University, Box 90281
Durham, NC 27708-0821

EDUCATION

Ph.D., Engineering Science and Mechanics

August 2004

Virginia Tech, Blacksburg, VA

- Dissertation: Modeling and Simulation of MEMS Devices
- Advisor: Ali H. Nayfeh

M.S., Engineering Mechanics

June 1999

Tsinghua University, Beijing, China

- Dissertation: The Stochastic Seismic Response Analysis for a Whole Hydroelectric Machine System
- Advisor: Baorong Cheng

B.S., Engineering Mechanics

June 1996

Tsinghua University, Beijing, China

EXPERIENCE

Research Associate

6/2005 – present

Duke University, Durham, NC

- Study the modeling and control of cardiac instabilities
- Conducted theoretical and experimental bifurcation analysis for cardiac alternans

Research Associate

8/2004 – 5/2005

Virginia Tech, Blacksburg, VA

- Conducted stability analysis of cantilever dynamics in atomic force microscopy
- Designed feedback control algorithms for precise positioning of impact microactuators

Research Assistant

9/1999 – 8/2004

Virginia Tech, Blacksburg, VA

- Developed modeling and simulation methodologies for impact microactuators
- Developed reduced order modeling for micropumps and microsensors

RESEARCH INTERESTS

Micro/Nano Technology, Cardiovascular Biomechanics, Applied Mechanics, Nonlinear Dynamics and Control

TEACHING INTERESTS

MEMS, Biomechanics, Computational Mechanics, Engineering Mechanics, Dynamics and Control

PUBLICATIONS

Edited Special Issues:

1. A. Shukla and **X. Zhao**, Discontinuous Dynamical Systems: Modeling, Analysis, and Control, a special issue in Nonlinear Dynamics (complete with 22 articles)

Referred Publications:

1. **X. Zhao**, D.G. Schaeffer, "Alternate pacing of border-collision period-doubling bifurcations", Nonlinear Dynamics, accepted
2. **X. Zhao**, D.G. Schaeffer, C.M. Berger, and D.J. Gauthier, "Small signal amplification of period-doubling bifurcations in smooth iterated maps", Nonlinear Dynamics, accepted
3. P. Thota, **X. Zhao**, and H. Dankowicz, "Co-dimension-two grazing bifurcations in single-degree-of-freedom impact oscillators", ASME Journal of Computational and Nonlinear Dynamics, accepted
4. **X. Zhao** and H. Dankowicz, "Unfolding degenerate grazing dynamics in impact actuators", Nonlinearity, Vol. 19, pp. 399-418, 2006
5. **X. Zhao** and H. Dankowicz, "Characterization of Intermittent Contacts in Tapping Mode Atomic Force Microscopy", ASME Journal of Computational and Nonlinear Dynamics, Vol. 2, 2006
6. **X. Zhao** and H. Dankowicz, "Control of Impact Microactuators for Precise Positioning", ASME Journal of Computational and Nonlinear Dynamics, Vol. 1, pp. 65-70, 2006
7. H. Dankowicz and **X. Zhao**, "Local Analysis of Co-dimension-one and Co-dimension-two grazing bifurcations in Impact Microactuators", Physica D, Vol. 202, pp. 238-257, 2005
8. **X. Zhao**, C.K. Reddy, and A.H. Nayfeh, "Nonlinear Dynamics of an Electrically Driven Impact Microactuator", Nonlinear Dynamics, Vol. 40, pp. 227-239, 2005
9. **X. Zhao** and H. Dankowicz, "Characterization of Intermittent Contacts in Tapping Mode Atomic Force Microscopy", ASME 2005 Design Engineering Technical Conferences, Long Beach, CA, September 24-28, 2005
10. **X. Zhao** and H. Dankowicz, "Near-Grazing Dynamics in Tapping Mode Atomic Force Microscopy", Fifth EUROMECH Nonlinear Dynamics Conference, Eindhoven, Netherlands, August 7-12, 2005
11. P. Thota, **X. Zhao**, and H. Dankowicz, "Continuous and Discontinuous Grazing Bifurcations in Impact Oscillators", Fifth EUROMECH Nonlinear Dynamics Conference, Eindhoven, Netherlands, August 7-12, 2005
12. **X. Zhao**, H. Dankowicz, C.K. Reddy, and A.H. Nayfeh, "Modeling and Simulation Methodology for Impact Microactuators", Journal of Micromechanics and Microengineering, Vol. 14, pp. 775-784, 2004
13. **X. Zhao**, E.M. Abdel-Rahman, and A.H. Nayfeh, "A Reduced-Order Model for Electrically Actuated Microplates", Journal of Micromechanics and Microengineering, Vol. 14, pp. 900-906, 2004
14. **X. Zhao**, H. Dankowicz, and A.H. Nayfeh, "Modeling the Nonlinear Dynamics of Electrically Driven Impact Microactuators", 2004 International Conference on MEMS, NANO and Smart Systems, Banff, Alberta, Canada, August 25-27, 2004
15. **X. Zhao** and A.H. Nayfeh, "A Reduced-Order Model for Electrically Actuated Microplates," in Proceedings of the 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, April 19-22, 2004
16. **X. Zhao**, H. Dankowicz, C.K. Reddy and A.H. Nayfeh, "Dynamic Simulation of an Electrostatically Actuated Impact Microactuator," in Proceedings of NanoTech2004, Boston, MA, March 7-11, 2004
17. **X. Zhao**, E.M. Abdel-Rahman, and A.H. Nayfeh, "Mechanical Behavior of Electrically Actuated Microplates," ASME 2003 Design Engineering Technical Conferences - 19th Biennial Conference on Mechanical Vibration and Noise, Chicago, IL, September 2-6, 2003
18. **X. Zhao**, C.K. Reddy, and A.H. Nayfeh, "Bifurcations and Chaotic Dynamics in an Electrostatically Actuated Microactuator: A Numerical Exploration," ASME 2003 Design Engineering Technical Conferences - 19th Biennial Conference on Mechanical Vibration and Noise, Chicago, IL, September 2-6, 2003

Manuscripts Submitted and in Preparation:

1. C.M. Berger, **X. Zhao**, D.G. Schaeffer, W. Krassowska, H.M. Dobrowolny, and D.J. Gauthier, "Evidence for an unfolded border-collision in paced cardiac tissue", *Physical Review Letter*, submitted
2. D.G. Schaeffer, W. Ying, and **X. Zhao**, "Asymptotic approximation of an ionic model for cardiac restitution", *Nonlinear Dynamics*, submitted
3. H. Dankowicz, **X. Zhao**, S. Misra, "Near-Grazing Dynamics in Tapping-Mode Atomic Force Microscopy", *International Journal of Non-linear Mechanics*, submitted
4. **X. Zhao** and D.G. Schaeffer, "Ionic basis for unfolded border-collision bifurcations in paced cardiac tissue", in preparation
5. **X. Zhao** and D.J. Gauthier, "Chaos control in impact microactuators using extended time delay autosynchronization", in preparation

Conference Presentations:

1. **X. Zhao**, D.G. Schaeffer, C.M. Berger, D.J. Gauthier and W. Krassowska, "Evidence of an unfolded border-collision bifurcation in paced cardiac tissue", KITP Miniprogram on Cardiac Dynamics, Kavli Institute for Theoretical Physics, Santa Barbara, CA, July 13, 2006
2. **X. Zhao**, D.G. Schaeffer, C.M. Berger, D.J. Gauthier, W. Krassowska, "Border-Collision Bifurcations in a Model of Cardiac Tissue", the Eleventh Conference on Nonlinear Vibrations, Stability, and Dynamics of Structures, Blacksburg, VA, August 13-18, 2006
3. **X. Zhao**, D.G. Schaeffer, C.M. Berger, D.J. Gauthier, W. Krassowska, "Differentiation between Smooth and Nonsmooth Period-Doubling Bifurcations in Cardiac Tissue", the 6th Symposium of Understanding Complex Systems, Urbana, Illinois, May 15-18, 2006
4. **X. Zhao**, D.G. Schaeffer, C.M. Berger, D.J. Gauthier, W. Krassowska, "Theoretical Analysis of Smooth and Nonsmooth Period-Doubling Bifurcations in Cardiac Tissue", Dynamics Days, Bethesda, MD, January 4-7, 2006
5. C.M. Berger, H. Dobrowolny, **X. Zhao**, D.G. Schaeffer, W. Krassowska, and D.J. Gauthier, "Investigating a Period-Doubling Bifurcation in Cardiac Tissue Using Alternate Pacing", Dynamics Days, Bethesda, MD, January 4-7, 2006
6. **X. Zhao** and H. Dankowicz, "Characterization of Intermittent Contacts in Tapping Mode Atomic Force Microscopy", Dynamics Days, Bethesda, MD, January 4-7, 2006
7. C.M. Berger, H. Dobrowolny, **X. Zhao**, D.G. Schaeffer, W. Krassowska, and D.J. Gauthier, "Evidence for a border-collision bifurcation in paced cardiac tissue", Southeastern Section of the APS, Gainesville, FL, November 10-12, 2005
8. H. Dankowicz and **X. Zhao**, "Discontinuity-driven Design and Control of an Impact Microactuator", Piecewise Smooth Dynamical Systems Workshop: Analysis, Numerics and Applications, University of Bristol, September 13-16, 2004
9. **X. Zhao** and H. Dankowicz, "Analysis of Grazing Bifurcations in Impact Microactuators", 21st International Congress of Theoretical and Applied Mechanics, Warsaw, Poland, August 15-21, 2004
10. **X. Zhao**, H. Dankowicz, C.K. Reddy and A.H. Nayfeh, "Modeling and Simulation of Impact Microactuator," 10th Conference on Nonlinear Vibrations, Stability and Dynamics of Structures, Blacksburg, VA, July 25-28, 2004
11. **X. Zhao** and H. Dankowicz, "A Normal-Form Analysis of Co-dimension Two Grazing Bifurcation in Impact Oscillators," 23rd Annual International Conference on Nonlinear Dynamics and Complex Systems, Chapel Hill, NC, January 2-5, 2004

Invited Seminars:

1. "Modeling of Alternans in Paced Cardiac Tissue", Department of Manufacturing and Mechanical Engineering, Miami University, Oxford, OH, April 2006
2. "Bifurcation Analysis of Cardiac Dynamics", Department of Mechanical Engineering, University of Maryland, College Park, MD, January 2006

PROFESSIONAL ACTIVITIES

Editing and Organizing:

- Symposium Organizer: ASME 2007 International Design Engineering Technical Conferences, Las Vegas, NV, September 2007
- Guest Co-Editor: special Issue on Discontinuous Dynamical Systems for the journal Nonlinear Dynamics, 2006
- Session Co-Chair: The Eleventh Conference on Nonlinear Vibrations, Stability, and Dynamics of Structures, Blacksburg, VA, August 2006
- Session Chair: MSNDC 16 in The 2005 ASME International Design Engineering Technical Conferences, Long Beach, CA, September 2005

Review Work:

- Panel Reviewer: NSF Graduate Fellowship Program, Bioengineering
- AIAA Journal
- ASME, Design and Technical Conferences
- ASME International Mechanical Engineering Congress and Exposition
- ASME Journal of Computational and Nonlinear Dynamics
- ASME Journal of Vibration and Acoustics
- International Journal of Nonlinear Mechanics
- Journal of Engineering Mathematics
- Nonlinear Dynamics
- Rheologica Acta

Honorary and Professional Societies:

- Member of ASME, AIAA, SIAM
- Membership Committee Chair, The Duke University Chapter of Sigma Xi, 2006
- Mentor of ASME e-Mentoring Program, 2004-present

HONORS AND AWARDS

- Outstanding Postdoc Award, Duke University, 2006
- Sigma Xi Postdoctoral Travel Grant, Duke University, 2006
- Member of Sigma Xi, 2005
- Member of Phi Kappa Phi, 2003
- Outstanding Graduate, Tsinghua University, 1996
- Academic Excellence Scholarship, Tsinghua University, 1993, 1994, 1995