

CURRICULUM VITAE

Zheng Chen

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EDUCATION:

- * **Ph.D. in Electrical & Computer Engineering**, Michigan State University, East Lansing, Dec. 2008 (expected)
Dissertation topic: *Modeling and Control of Electroactive Polymers with Application to Biomimetic and Micro Manipulation*
Advisor: Dr. Xiaobo Tan
- * **M.S. in Electrical Engineering**, Zhejiang University, Hangzhou, China, March 2002
M.S. Thesis: *Integrated Control System of Power Substation*
- * **B.S. in Electrical Engineering**, Zhejiang University, Hangzhou, China, June 1999
(GPA: 3.81/4.0)
B.S. Thesis: *Integrated Control System of Power Substation*
Honor program: Advanced Class of Engineering and Education in Zhejiang University

AWARDS AND HONORS:

- * **Summer Dissertation Completion Fellowship**, Graduate School of Michigan State University, March 2008
- * **Honorable Mention, Fitch Beach Outstanding Graduate Research Award**, College of Engineering, Michigan State University, 2008
- * **Summer Dissertation Fellowship**, College of Engineering, Graduate School of Michigan State University and Microsoft, May 2006
- * **Klomprens Fellowship**, Graduate School, Michigan State University, February 2006
- * **Excellent Graduate of Zhejiang Province**, (awarded to the top 3% graduates in Zhejiang Province), Education Department of Zhejiang Province, 1999
- * **Undergraduate scholarships**, Zhejiang University: Third class prize (1995), First class prize (1996), Second class prize (1997, 1998), Kuang-Hua (Guanghua) Scholarship (1998), Sai-ba Scholarship (1998)
- * **Second class prize in Hunan Province**, National Olympiad Physics Competition for High School Students, China, 1994

RESEARCH EXPERIENCE:

* **Graduate Research Assistant & Lab Manager**

Smart Microsystems Laboratory, Electrical & Computer Engineering Department, Michigan State University, Jan. 2005 - Present

- Design and micro-fabrication of ionic polymer-metal composite MEMS devices.
- Measurement of micro adhesion force between liver cells and PEM substrate.
- Model-based H_∞ control of ionic polymer-metal composite actuators
- Modeling of ionic polymer-metal composite sensors and actuators
- Modeling of hysteresis and nonlinear dynamics in ionic polymer-metal composites (IPMCs)
- Development of an IPMC/PVDF sensory actuator and its application to fruitfly embryo injection
- Overseeing daily operation of Smart Microsystems Laboratory
- Supervised/supervising three undergraduate students on their research in the lab
- Co-advised a German exchange student, Mr. Alexander Will, on his study thesis
- Co-advised a Germany exchange student, Mr. Ernest Mbemmol, on his master thesis

* **Graduate Research Assistant**

Electrical & Computer Engineering Department, University of Missouri Rolla, Dec. 2003-Dec. 2004

- Design of optimal control methods for engine emission systems with an adaptive neural network architecture
- Study of numerical methods for obtaining sub-optimal control for nonlinear discrete-time systems

* **Graduate Research Assistant**

Electrical Engineering Department, Zhejiang University, P.R.China, July 1999- May 2002

- Study of the real-time fault detection and relay protection for power transmission line, transformer, and high power electrical motor
- Development of an integrated control system for 35KV power substation in Xin Chang County, Zhejiang Province
- Design of the PWM controller for electric-driven bicycle

* **Undergraduate Research Assistant**

Electrical Engineering Department, Zhejiang University, P.R.China, Sep.1997- June 1999

- Participation in Student Research Training Program (STRP) for the project of the embedded controller design for relay protection of 35KV power transmission line in Xin Chang County, Zhejiang Province

INDUSTRIAL EXPERIENCE:

* **Senior IC Designer**, Silan Microelectronics Ltd., Hangzhou, P.R.China, May 2003- Dec. 2003

- Pre-marketing investigation and design of the product “USB Security Key” for personal computer and local network

* **Project Manager and Embedded System Designer**, Hangzhou Blue Mobile, Jan. 2003 – May 2003

- Design, testing and marketing of Business Fixed Wireless Access System

* **System Application Engineer**, Sino Wealth Electronic Ltd, Shanghai, P.R.China, May 2002- Dec. 2002

- Design of ISP (In System Programming)-ICE (In Circuit Emulator) for 8 bits microcontroller

PUBLICATIONS:

* **Journal Papers**

1. **Z. Chen**, and X. Tan, “A Control-oriented, Physics-based Model for Ionic Polymer-Metal Composite Actuators”, *IEEE/ASME Trans on Mechatronics*, to appear, 2008
2. **Z. Chen**, K. Y. Kwon, and X. Tan, “Integrated IPMC/PVDF Sensory Actuator and Its Application to Feedback Control”, *Sensors and Actuators A: Physical*, Vol. 144, No. 2, pp 231-241, 2008
3. **Z. Chen**, X. Tan, A. Will, and C. Ziel, “A Dynamic Model for Ionic Polymer-Metal Composite Sensors”, *Journal of Smart Material and Structures*, Vol. 16, No. 4, pp. 1477-1488, 2007.
4. **Z. Chen**, Y. Shen, N. Xi, X. Tan, “Integrated sensing for ionic polymer–metal composite actuators using PVDF thin films”, (**Invited paper** for special issue on Electroactive Polymer Materials), *Smart Materials and Structures*, Vol. 16, No. 2, pp. S262-S271,2007
5. **Z. Chen**, S. Jagannathan, “Generalized Hamilton-Jacobi-Bellman Formulation based Neural Network Control of Affine Nonlinear Discrete-Time Systems”, *IEEE Trans on Neural Networks*, Vol. 19 No. 1, pp 90-106, 2008
6. **Z. Chen**, E. Mbemmo, and X. Tan, “Modeling of Biomimetic Robotic Fish Propelled by An Ionic Polymer-Metal Composite Actuator”, ready to submit to *IEEE Trans on Robotics*, 2008

* **Conference Papers:**

1. **Z. Chen**, D. Hedgepeth, and X. Tan “Nonlinear Capacitance of Ionic Polymer-Metal Composite”, submitted to 11th SPIE conference on Electroactive Polymer Actuation and Devices (EAPAD), San Diego, CA, 2009
2. **Z. Chen**, S. Shatarra, and X. Tan “Modeling of Robotic Fish Propelled by an Ionic Polymer-Metal Composite Caudal Fin”, submitted to 11th SPIE conference on Electroactive Polymer Actuation and Devices (EAPAD), San Diego, CA, 2009
3. **Z. Chen**, D. R. Hedgepeth, X. Tan, “A Nonlinear Control-Oriented Model for Ionic Polymer-Metal Composite Actuators”, accepted for presentation at the 47th *IEEE Conference on Decision and Control*, 2008
4. E. Mbemmo, **Z. Chen**, S. Shatarra, and X. Tan, "Modeling of Biomimetic Robotic Fish Propelled by An Ionic Polymer-Metal Composite Actuator", *Proc. of the IEEE International Conference on Robotics and Automation*, Pasadena, California, pp. 689-694, 2008
5. **Z. Chen**, K. Yong and X. Tan, “Design of Integrated IPMC/PVDF Sensory Actuator and Its Application to Feedback Control”, (**Invited**), M. Tomizuka, editor, *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, Proc. of the SPIE*, Vol. 6932, pp. 68321O, 2008
6. **Z. Chen**, X. Tan, “A Scalable Dynamic Model for Ionic Polymer-Metal Composite Actuators”, Y. Bar-Cohen,

- editor, *Electroactive Polymer Actuators and Devices (EAPAD) X, Proc. of the SPIE*, Vol. 6927, pp. 692701, 2008
7. **Z. Chen**, and X. Tan, "A Control-oriented, Physics-based Model for Ionic Polymer-Metal Composite Actuators", *Proc. of the 46th IEEE Conference on Decision and Control*, New Orleans, pp. 590-595, 2007
 8. **Z. Chen**, A. Will, C. Ziel, and X. Tan, "A Dynamic Model for Ionic Polymer-Metal Composite Sensors" (Invited), *Proc. of the World Forum on Smart Materials and Smart Structures Technology*, Chongqing & Nanjing, China, 2007
 9. **Z. Chen**, Y. Shen, J. Malinak, N. Xi, X. Tan, "Hybrid IPMC/PVDF Structure for Simultaneous Actuation and Sensing," in Y. Bar-Cohen, editor, *Smart Structures and Materials 2006: Electroactive Polymer Actuators and Devices (EAPAD)*, *Proceedings of SPIE*, San Diego, CA, Vol. 6168, 2006
 10. **Z. Chen**, X. Tan, M. Shahinpoor, "Quasi-static Positioning of Ionic Polymer-Metal Composite (IPMC) Actuators", *Proc. of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Monterey, CA, pp. 60-65, 2005
 11. **Z. Chen**, S. Jagannathan, "A Recursive Method of Obtaining the Optimal Control for Nonlinear Discrete-Time Systems", *Proc. of the 44th IEEE Conference on Decision and Control and European Control Conference*, Seville, Spain, pp. 4123 – 4128, Dec. 2005
 12. P. He, **Z. Chen**, S. Jagannathan, "Reinforcement-Learning Neural Network-based Control of Nonlinear Discrete-Time Systems in Non-Strict Form", *Proc. of the 44th IEEE Conference on Decision and Control and European Control Conference*, Seville, Spain, pp. 2580 – 2585, 2005
 13. J. Chen, **Z. Chen**, "Two-step Method for Gross Error Detection in Process Data", *Proc. of the American Control Conference*, Arlington, VA, pp. 2121-2126, 2001.

PRESENTATIONS:

- * "Modeling of Biomimetic Robotic Fish Propelled by Ionic Polymer Metal Composite", oral presentation at IEEE conference on Robotics and Automation, Pasadena, CA 2008
- * "A Scalable Dynamic Model for Ionic Polymer Metal Composite Actuator", oral presentation at 15th SPIE International Annual Symposium on Smart Material Structure, San Diego, CA, 2008
- * "Design of Integrated IPMC/PVDF Sensory Actuator and Its Application to Feedback Control", oral presentation at 15th SPIE International Annual Symposium on Smart Material Structure, San Diego, CA, 2008
- * "Electroactive polymers as Artificial Muscles and Sensors: A Systems Perspective", oral presentation for Fitch Beach Outstanding Graduate Research Award at Noontime Research Seminar, Michigan State University, 2008
- * "A Control-oriented, Physics-based Model for Ionic Polymer Metal Composite Actuators", oral presentation at 46th IEEE conference on Control and Decision, New Orleans, LA 2007
- * "A Dynamic Model for Ionic Polymer-Metal Composite Sensors", poster at Red Raider Mini Symposium, Lubbock, TX, 2006
- * "Hybrid IPMC/PVDF Structure for Simultaneous Actuation and Sensing", oral presentation at the SPIE 13th Annual International Symposium on Smart Structures and Materials, San Diego CA, 2006

FULL HOUR INVITED TALK

- * "Electroactive Polymers as Artificial Muscles and Sensors: A Control Systems Perspective", Department of Electrical & Computer Engineering, National University of Singapore, July, 2008

PATENTS:

- * X. Tan, **Z. Chen**, Y. Shen, and N. Xi, "Integrated Actuator-Sensor Structure", US patent pending, 2006

PROFESSIONAL MEMBERSHIP AND SERVICE

- * Student member of IEEE and SPIE
- * Technical reviewer of IEEE Transactions on Neural Networks, Journal of Smart Materials and Structures, IEEE/ASME Trans on Mechatronics, Journal of Scripta Materialia.
- * Technical reviewer of the IEEE International Symposium on Intelligent Control, 17th IFAC World Congress, annual conference of IEEE Industrial Electronics Society, International Symposium on Neural Networks, European Control Conference 2007, IEEE Conference on Decision and Control 2008

RESEARCH INTERESTS:

- * Modeling, sensing and control of electroactive polymers (EAP)
- * Micro fabrication of EAP in Micro-Electrical-Mechanic System (MEMS)
- * Application of electroactive polymers to biomimetic robots, social robots, biological and biomedical devices
- * Biomedical MEMS device
- * Micromanipulation
- * Control of dynamical systems with hysteresis and other nonlinearities
- * Embedded control system with neural networks
- * Numerical methods for optimal control of nonlinear discrete systems