

Xinyan Deng

Bio-Robotics Laboratory
Department of Mechanical Engineering
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Research Interests

- **Principles of aerial and aquatic locomotion in animals**
 1. Experimental fluid mechanics
 2. Dynamics
 3. Control
- **Bio-inspired robotics**
 1. Biologically inspired micro aerial vehicles and underwater robots
 2. Bio-sensing and sensor fusion algorithms

Employment

- **Assistant Professor**, Department of Mechanical Engineering, University of Delaware, 2004-
- **Graduate Student Researcher**, Department of Electrical Engineering and Computer Sciences, University of California at Berkeley 1998-2004

Education

- **Ph.D.** Department of Mechanical Engineering, University of California at Berkeley, 2004.
Major: Control Systems. Minors: Mathematics, Signal Processing. Advisor: Shankar Sastry.
Dissertation Title: *Flapping Flight for Robotic Insects: Modeling and Flight Control in Hover.*
- **B.S.** Department of Electrical Engineering and Automation, Tianjin University, China, 1995.
Major: Automatic Control.

Awards and Honors

- **NSF CAREER Award**, 2006-2011
- **Excellence in Teaching Award Nomination**, University of Delaware, 2005.
- **Best Student Paper Award Finalist**, IEEE International Conference on Robotics and Automation (ICRA), 2003.
- **Tianjin University - North American Alumni Association Fund Scholarship**(awarded to 4 out of the total of 12,000 undergraduates annually), 1995
- **Excellent Student Award**, Tianjin University, 1993, 1994

Awards and Honors Obtained by Students

- **Nowinski Award**, (awarded to the best undergraduate researcher annually, highest honor for undergraduate student at the Department of Mechanical Engineering, University of Delaware), by Aaron Winn, 2007.
- **NASA Excellence in Undergraduate Research**, NASA Delaware Space Grant College Consortium, by Aliza Greenblatt and Raymond McCauley, 2007.
- **Science and Engineering Scholars Award** for undergraduate research, by Anne Martin, Aliza Greenblatt, Raymond McCauley, 2006.

Courses Taught

- ME301 *Vibration and Control*, junior class; average enrollment: 75.
- ME311 *Machine Design*, junior class; average enrollment: 75.
- ME467/667 *Bio-robotics*, graduate course and senior elective; average enrollment: 20.
- ME468 *NASA Senior Design*, senior elective; average enrollment: 12.
- ME624 *Advanced Control Systems*, graduate course; average enrollment: 8.

Research Grants

- **NSF CAREER Award** *Theory and practice of flapping flight: from natural to robotic insects*, PI, NSF IIS -545931, \$455K, 2006-2011.
- **NASA Space Grant College Consortium** *Bio-inspired robotics laboratory research*, \$35K, 2006-2007.
- **University of Delaware Research Foundation, Inc.** *Bio-inspired Ostraciiform underwater robotic fish*, \$25K, 2005-2006.

University, College and Department Services

- Associate Director, NASA Delaware Space Grant College Consortium, 2005-present.
- Department Representative, College Election Committee, 2007-present.
- Faculty Search Committee, 2005-2007.
- Chair, Department Seminars, 2006-2007.
- Undergraduate Laboratory Committee, 2005-2006, 2008-2009.
- Graduate Committee, 2005-2006.

Professional Activities

Technical Committees

- Co-Chair, *Technical Committee for Biorobotics*, IEEE Robotics and Automation Society, Nominated, 2009.
- Co-Chair, *Technical Committee for Prototyping and Automation*, IEEE Robotics and Automation Society, 2007-2008.

Conference Program Committees

- Co-Chair, *Workshop on Biologically-inspired Robots*, IEEE/JRS International Conference on Intelligent Robots and Systems (IROS'09), St. Louis, MO, 2009.
- Co-Chair, *Workshop on Critical Impediments and Challenges for Multi-Modal Robotic Locomotion*, IEEE/JRS International Conference on Intelligent Robots and Systems (IROS'09), St. Louis, MO, 2009.
- Co-Chair, *Session on "Biologically inspired Robots"*, IEEE International Conference on Robotics and Automation (ICRA'09), Kobe, Japan, 2009.
- Co-Chair, *Session on "Bio-inspired Underwater Robots"*, IEEE International Conference on Robotics and Automation (ICRA'07), Rome, Italy, 2007.
- Program Committee, IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM'08), Xi'an, China, 2008.
- International Program Committee, IEEE International Conference on Robotics, Automation and Mechatronics (RAM'06), Bangkok, Thailand, 2006.

Invited Workshops

- Participant by Invitation, Workshop on Biologically inspired robots, IEEE/JRS International Conference on Intelligent Robots and Systems (IROS'09), St. Louis, MO, 2009.
- Participant by Invitation, Workshop on Critical Impediments and Challenges for Multi-Modal Robotic Locomotion, IEEE/JRS International Conference on Intelligent Robots and Systems (IROS'09), St. Louis, MO, 2009.
- Participant by Invitation, NSF Workshop on Bio-sensing and Bio-actuation, College Park, MD, November 2007.
- Participant by Invitation, NSF US-Korea Workshop on Bio-sensing and Bio-actuation, Seoul, Korea, May 2008.
- Participant by Invitation, NSF US-China Workshop on Bio-inspired Smart Systems, Dalian, China, July 2009.

Proposal Reviewer

- Panel Review, NSF CMMI Sensor, 2006, 2007, 2009.
- Panel Review, NSF CISE IIS, 2007, 2008.
- Panel Review, European Science Foundation, 2008.

Book Reviewer

- *Robotics: Kinematics, Dynamics and Control*, Springer, 2006.

Journal Reviewer

- IEEE Transaction on Robotics
- Journal of Experimental Biology
- Journal of Bio-inspiration and Bio-mimetics
- Aerospace Science and Technology
- Mechanisms and Machine Theory
- Robotica
- Advanced Robotics
- Composites Science and Technology

Conference Paper Reviewer

- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/JRS International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Conference on Advanced Intelligent Mechatronics (AIM)
- IEEE International Conferences on Robotics, Automation and Mechatronics (RAM)
- AIAA Fluid Dynamics Conference
- ASME Congress

Professional Affiliations

- Member, Institute for Electrical and Electronic Engineers (IEEE), 2002-present.
- Member, American Society of Mechanical Engineers (ASME), 2004-present.
- Member, American Institute of Aeronautics and Astronautics (AIAA), 2004-present.
- Member, Society for Integrative and Comparative Biology (SICB), 2005-present.

Group Members

Current

- Bo Cheng, Ph.D. Student, 2006-present.
- Liang Zhao, Ph.D. Student, 2006-present.
- Zheng Hu, Ph.D. Student, 2006-present.
- Qingfeng Huang, Ph.D. Student, 2006-present.

Past

- Lijuan Pi, M.S. Student, 2006-2009.
- Chris DiLeo, M.S. Student, 2004-2007.
- Parasar Kodati, M.S. Student, 2004-2006.

Publications

(*=**corresponding author**; all manuscripts are available upon request)

Book Chapters

1. Z. Hu and **X. Deng***, “A Flight Strategy for Intelligent Aerial Vehicles Learned from Dragonflies”, in *Aerial Vehicles*, ISBN 978-953-7619-41-1, Pages 189-204, January 2009.
2. P. Kodati and **X. Deng***, “Bio-inspired Robotic Fish with Multiple Fins”, in *Underwater Vehicles*, ISBN 978-953-7619-49-7, Pages 96-110, January 2009.

Journal Articles

1. T. Hedrick*, B. Cheng and **X. Deng***, “Wingbeat Time and Scaling of Passive, Rotational Damping in Flapping Flight”, to appear in *Science*, March 2009.
2. C. DiLeo and **X. Deng***, “Design and Experiments of a Dragonfly-inspired Robot”, to appear in *Journal of Advanced Robotics*, May 2009.
3. D. Campolo*, L. Schenato, **X. Deng** and E. Guglielmelli, “Attitude Stabilization of Biologically Inspired Micromechanical Flying Insects: Attitude Estimation via Multimodal Sensor Fusion”, to appear in *Journal of Advance Robotics*, May 2009.
4. P. Kodati, A. Winn, J. Hinkle and **X. Deng***, “Micro Autonomous Robotic Ostraciiform: Stability, Hydrodynamics and Prototype Development”, in *IEEE Transaction on Robotics*, Volume 24, issue 1, Page 105-117, 2008.
5. **X. Deng***, L. Schenato, W. Wu and S. Sastry, “Flapping Flight for Biomimetic Robotic Insects, I: System Modeling”, in *IEEE Transactions on Robotics*, Volume 22, No. 4, Pages 776-788, 2006.

6. **X. Deng***, L. Schenato and S. Sastry, "Flapping Flight for Biomimetic Robotic Insects, II: Flight Control", in *IEEE Transactions on Robotics*, Volume 22, No.4, Pages 789-803, 2006.
7. L. Zhao, Q. Huang, S. Sane and **X. Deng***, "Aerodynamic Effects of Wing Flexibility in Flapping Flight", revision submitted to *Journal of Royal Society Interface*, 26 pages, 2009.
8. B. Cheng, Q. Huang, S. Fry, M. Dickinson and **X. Deng***, "Dynamics and Control of Turning in Fruit Fly *Drosophila*", to be submitted to *Journal of Experimental Biology*, 42 pages, 2009.
9. B. Cheng and **X. Deng***, "Neural adaptive control for an insect robot", submitted to *Journal of Intelligent Systems and Robots*, 21 pages, 2009.
10. L. Zhao and **X. Deng***, "Power Efficiency in the Flight of Hawkmoth *Manduca Sexta*", submitted to *Journal of Bioinspiration and Biomimetics*, 18 pages, 2009.
11. C. DiLeo, P. Kodati, Z. Hu and **X. Deng***, "Experimental Fluid Mechanics Testbed for Aerial and Aquatic Locomotion", submitted to *Review of Scientific Instrumentation*, 21 pages, 2008.
12. P. Kodati, G. Barbera and **X. Deng***, "Stability of a Robotic Boxfish with a self correcting vortex", submitted to *Journal of Advanced Robotics*, 15 pages, 2008.
13. D. Campolo*, L. Schenato, L. Pi, **X. Deng** and E. Guglielmelli, "Attitude Stabilization of Biologically Inspired Micromechanical Flying Insects: Robust Dynamic Attitude Control", submitted to *Journal of Advance Robotics*, 17 pages, 2008.
14. L. Schenato and **X. Deng***, "Reachability Analysis of Uncertain Piecewise-Affine Dynamic System by Ellipsoidal Approximation", submitted to *International Journal of Automation and Computing*, 10 pages, 2008.
15. Z. Hu and **X. Deng***, "Aerodynamics of Dragonflies in Hovering", submitted to *Journal of Experimental Biology*, 32 pages, 2008.

Journal Articles In Preparation

1. L. Zhao, S. Sane and **X. Deng***, "The Effect of Leading Edge Vortex on the Aerodynamic Force Production of Flapping Wings", to be submitted in May 2009.
2. Z. Hu and **X. Deng***, "Aerodynamics of Dragonfly in Forward Flight", to be submitted in April 2009.
3. B. Cheng and **X. Deng***, "Rotational Dynamics of Flapping Flight", to be submitted in April 2009.
4. Q. Huang, S. Sane and **X. Deng***, "Aerodynamic Effect of Flexible Wings During Stroke Reversal", to be submitted in April 2009.
5. B. Cheng, S. Sane and **X. Deng***, "Control Prospective on Reafference Principle", to be submitted in May 2009.
6. G. Barbera, L. Pi and **X. Deng***, "Attitude Control of a Bio-inspired Fish Robot with Sensory Feedback", to be submitted in June 2009.

Peer-reviewed Conference Papers (40% acceptance conferences)

1. H. Zheng, S. Schaeffer, R. McCauley and **X. Deng***, "Aerodynamics of Dragonfly Flight and Robotic Design", to appear in the *Proceedings of IEEE International Conference on Robotics and Automation (ICRA '09)*, Kobe, Japan, July 2009.
2. B. Cheng, S. Fry, Q. Huang, W. Dickson, M. Dickinson and **X. Deng***, "Turning Dynamics and Passive Stability in Flapping Flight", to appear in the *IEEE International Conference on Robotics and Automation (ICRA '09)*, Kobe, Japan, July 2009.
3. L. Zhao, Q. Huang, S. Sane, and **X. Deng***, "Aerodynamic Effects of Wing Flexibility in Flapping Flight", to appear in the *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA '09)*, Kobe, Japan, July 2009.
4. D. Campolo*, L. Schenato and **X. Deng**, "Bio-inspired Sensor Suite and Sensor Fusion Algorithms for a Micromechanical Flying Insect", in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'08)*, Nice, France, September 2008.
5. C. DiLeo and **X. Deng***, "Experiments and Prototype Development of a Dragonfly-Inspired Robot", in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'07)*, San Diego, CA, Pages 1594-9, October 2007.
6. P. Kodati and **X. Deng***, "Micro Autonomous Robotic Ostraciiform: Design and Fabrication", in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA '07)*, Pages 960-965, Rome, Italy, 2007.
7. P. Kodati and **X. Deng***, "Towards Body Shape Design of a Hydrodynamically Stable Robotic Boxfish", in *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'06)*, Pages 5412-17, Beijing, China 2006.
8. P. Kodati and **X. Deng***, "Experimental Studies on the Hydrodynamics of a Ostraciiform Caudal Fin", in *Proceedings of the IEEE International Conference on Intelligent Robots and Systems (IROS'06)*, Pages 5418-23, Beijing, China 2006.
9. **X. Deng*** and S. Avadhanula, "Biomimetic Underwater Microrobotic Boxfish with Oscillating Fin Propulsion: System Design and Force Measurements", in *Proceedings of IEEE International Conference on Robotics and Automation (ICRA '05)*, Barcelona, Spain, Pages 3312-3317, August 2005.
10. **X. Deng**, L. Schenato, and S. Sastry*, "Model Identification and Attitude Control for a Micromechanical Flying Insect Including Thorax and Sensor Models", in *Proceedings of IEEE International Conference on Robotics and Automation (ICRA '03)*, Taipei, Taiwan, Pages 1152-1157, September 2003. (**Best Student Paper Award Finalist**).
11. **X. Deng**, L. Schenato and S. Sastry*, "System Identification and Control for a Micromechanical Flying Insect in Hover", in *Proceedings of the IEEE International Conference on Control, Automation, Robotics, and Vision (ICARCV' 02)*, Singapore, Pages 1007-1012, December 2002.
12. L. Schenato, **X. Deng** and S. Sastry*, "Hovering Flight for a Micromechanical Flying Insect: Modeling and Robust Control Synthesis", in *Proceedings of the 15th IFAC World Congress on Automatic Control (IFAC'02)*, Bancelona, Spain, July, 2002.

13. **X. Deng**, L. Schenato and S. Sastry*, “Hovering Flight Control of a Micromechanical Flying Insect, in *Proceedings of the 40th IEEE Conference on Decision and Control (CDC’01)*, Orlando, Florida, Pages 235-241, December 2001.
14. L. Schenato, **X. Deng** and S. Sastry*, “Flight Control System for a Micromechanical Flying Insect: Architecture and Implementation”, in *Proceedings of IEEE International Conference on Robotics and Automation (ICRA’01)*, Seoul, South Korea, May 2001.
15. L. Schenato, **X. Deng**, W. Wu and S. Sastry*, “Virtual Insect Flight Simulator: A Software Testbed for Insect Flight”, in *Proceedings of IEEE International Conference on Robotics and Automation (ICRA’01)*, Seoul, South Korea, May 2001.

Invited Seminars

- Invited Seminar, Institute for Neuroinformatics, ETH-Zurich, in schedule for Spring 2009.
- Department Seminar, Theoretical and Applied Mechanics, Cornell University, 02/04/09.
- Department Seminar, Mechanical Engineering, Carnegie Mellon University, 10/30/08.
- Department Seminar, Mechanical Engineering, George Washington University, 10/22/08.
- Minta Martin Distinguished Aerospace Seminar, Aerospace Engineering, University of Maryland at College Park, 10/17/08.
- Department Seminar, Mechanical Engineering, Vanderbilt University, 10/06/08.
- Department Seminar, Mechanical Engineering, City University of New York, 09/11/08.
- Invited Seminar, Institute for Genome Research, Chinese Academy of Science, 11/20/06.

References

1. **Shankar Sastry**: Dean, College of Engineering; Professor, Department of Electrical Engineering and Computer Sciences; Professor, Department of Bioengineering; University of California at Berkeley, Berkeley, CA 94720, (510)642-5771, sastry@coe.berkeley.edu
2. **Ron Fearing**: Professor, Department of Electrical Engineering and Computer Sciences; University of California at Berkeley, Berkeley, CA 94720, (510)642-9193, ronf@eecs.berkeley.edu
3. **Michael Dickinson**, Professor, Department of Bioengineering, California Institute of Technology, Pasadena, CA 91125, (626)395-5775, flyman@caltech.edu
4. **Metin Sitti**, Associate Professor, Robotics Institute, Department of Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA 15213, (412)268-3632, sitti@cmu.edu
5. **Sean Humbert**, Assistant Professor, Department of Aerospace Engineering, University of Maryland, College Park, MD 20742, (301)405-0328, humbert@umd.edu
6. **Sanjay Sane**, Assistant Professor, National Center for Biological Sciences, Tata Institute of Fundamental Research, Bangalore, 560 065 India, +91-80-23666020, sane@ncbs.res.in