

DR. ANITA M. FLYNN

486 Wesley Ave.
Oakland, CA 94606
Tel/Fax: (510) 845-0112
aflynn@micropropulsion.com

EDUCATION

1990-1995 *Massachusetts Institute of Technology*, Electrical Engineering and Computer Science Dept.
PhD Thesis: "Piezoelectric Ultrasonic Micromotors"

1983-1985 *Massachusetts Institute of Technology*, Electrical Engineering and Computer Science Dept.
Master's Thesis: "Redundant Sensors for Mobile Robot Navigation"

1980-1983 *Massachusetts Institute of Technology*, Electrical Engineering and Computer Science Dept.
Bachelor's Thesis: "A Runner's Speedometer"

1978-1979 *United States Naval Academy*, Annapolis, MD
Dean's List, Commandant's List, Superintendent's List

EXPERIENCE

Present – President, MicroPropulsion Corporation, specializing in consulting services in miniature power products and micro-electromechanical systems (MEMS) design. Collaborated with UC Berkeley to develop an 8 mm x 4 mm x 0.3 mm, 10 mg solar-powered silicon microrobot. Presently investigating dielectric elastomer actuators for microrobot applications with both UC Berkeley and SRI International.

8/00-5/01 Member Technical Staff, Onix Microsystems. Hardware and software design for servo control electronics for micromechanical mirrors used in a new all-optical switch for backbone-of-the-internet digital communications. Designed analog, FPGA and DSP-based control boards, wrote driver software and tested final system of silicon micromachined mirrors for position control.

8/99-6/00 Visiting Assistant Professor in the Mechanical Engineering Department at UC Berkeley. Taught ME102B, Senior Design, and created a new graduate course, Design of Embedded Systems. Developed a flight simulator for a fruit fly with Prof. Michael Dickenson in the Integrative Biology Dept. Also worked on the micromechanical flying insect project, a joint collaboration of professors, post-doctoral assistants and graduate students from Electrical Engineering, Mechanical Engineering and Biology.

7/97-98 Independent design consultant to various companies. Projects included: software development for laser chemically-assisted stereolithography (*Revise*), communications software for surgical telerobotic system (*Endorobotics*), vacuum self-assembly system of micromechanical parts (*UCB IEOR Dept.*), MEMS processing for constrained assembly (*MicroAssembly*), virtual reality flight simulator for a fruit fly (*UCB Integrative Biology Dept.*), robotic aquarium (*UCB Integrative Biology Dept.*), and single-phase induction motor controllers (*Anacon Systems*).

8/95-6/97 Lecturer/post-doctoral associate in the Electrical Engineering and Computer Science Department at the University of California, Berkeley. Taught EE192 - Mechatronics, EE40 - Introduction to Electronics and EE43 - Introductory Electronics Laboratory, including significant curriculum development, formulating new laboratories and overseeing individual projects. Conducted research

in the area of piezoelectric power transformers for high efficiency power electronics for high-voltage loads.

9/90-5/95 Received PhD degree in Electrical Engineering and Computer Science in May, 1995. Thesis research developed a new technology for micromotors: piezoelectric ultrasonic micromotors. Designed, modeled, fabricated and tested these new devices. Organized a joint project with the MIT Lincoln Laboratory Solid State Division and the Pennsylvania State University Materials Research Laboratory. Built the world's first ferroelectric thin film ultrasonic micromotor. Developed models of contact conditions at the rotor-stator interface to predict efficiencies and performance characteristics. Fabricated a sequence of prototypes using lead zirconate titanate in both bulk ceramic and thin-film form. Built and evaluated bulk ultrasonic motors, in a Design of Experiments process, that displayed 50 times the stall torque density of commercially available DC motors.

7/85-9/90 Research Scientist in the Mobile Robot Group at the MIT Artificial Intelligence Laboratory, creating autonomous mobile robots. Developed vision algorithms for navigation, engineered novel people-finding pyroelectric sensors, built the world's largest one-cubic inch robot along with Rodney Brooks, David Barrett and William Wells. Ran the Mobile Robotics Laboratory.

PATENTS

“Vapor-Immersion Stereolithographic Methods and Systems,” Theodore M. Bloomstein, Daniel J. Ehrlich and Anita M. Flynn, U.S. Patent 5,389,196, February 14, 1995.

“Miniature Actuator,” Anita M. Flynn, Lee S. Tavrow, Rodney A. Brooks, Leslie Eric Cross and Stephen F. Bart, U.S. Patent 5,293,094, March 8, 1994.

“Miniature Electrical and Mechanical Structures Useful for Constructing Miniature Robots,” Rodney A. Brooks, Lee S. Tavrow and Anita M. Flynn, U.S. Patent 5,113,117, May 12, 1992.

“Infrared Sensor Operable Without Cooling,” Lee S. Tavrow, Rodney A. Brooks and Anita M. Flynn, U.S. Patent 5,034,608, July 23, 1991.

BOOKS

Mobile Robots: Inspiration to Implementation, Joseph L. Jones and Anita M. Flynn A.K. Peters, Wellesley, MA, 1993.

Sold 30,000 copies in the United States to date. Library of Science Bookclub best seller. Used in universities and high schools across the country and around the world. Translated and published in Japanese, German and French.

TALKS

Given over 70 invited talks around the world.

PAPERS

Articles in Refereed Journals

1. Anita M. Flynn and Seth R. Sanders, “Fundamental Limits of Piezoelectric Transformers,” *IEEE Transactions on Power Electronics*, January, 2002.

2. Anita M. Flynn, K.R. Udayakumar, David S. Barrett, James D. McLurkin, Dean L. Franck and Arthur N. Sheckman, "Tomorrow's Surgery: Micromotors and Microrobots for Minimally Invasive Procedures," *Journal of Minimally Invasive Therapy and Allied Technologies*, Vol. 4, 1998.
3. Anita M. Flynn, "Performance of Ultrasonic Mini-Motors Using Design of Experiments," *Smart Materials and Structures*, IOP Publishing Ltd., Vol. 7, pp. 1-9, 1998.
4. K. R. Udayakumar, S. F. Bart, A. M. Flynn, J. Chen, L. S. Tavrow, L. Eric Cross, R. A. Brooks and D. J. Ehrlich, "Ferroelectric Thin Films for Ultrasonic Micromotors," *Ferroelectrics*, Vol. 160, pp. 347-356, 1995. Also appears in *Proceedings of the Micro Electro Mechanical Systems Conference*, Nara, Japan, Jan. 30-Feb. 2, 1991.
4. K. R. Udayakumar, A. M. Flynn and L. Eric Cross, "Large Strain Ferroelectrics for Mechatronics," *International Journal of Applied Electromagnetics in Materials, Sprint*, 1992. Also appears in *Proceedings of the Fourth International Symposium on Non-linear Phenomena in Electromagnetic Fields*, Nagoya, Japan, Jan. 26-30, 1992.
5. Anita M. Flynn, Lee S. Tavrow, Stephen F. Bart, Rodney A. Brooks, Daniel J. Ehrlich, K.R. Udayakumar and L Eric Cross, "Piezoelectric Micromotors for Microrobots," *IEEE Journal of Microelectromechanical Systems*, Vol. 1, No. 1, pp. 44-51, March, 1992. Also appears in *Proceedings of the 1990 Ultrasonics Symposium*, Honolulu, Hawaii, Dec. 4-7, and as *MIT AI Laboratory Memo 1269*.
6. Anita M. Flynn, Rodney A. Brooks, William M. Wells III and David S. Barrett, "Intelligence for Miniature Robots," *International Journal of Sensors and Actuators*, Vol. 20, November 15, 1989.
7. Rodney A. Brooks and Anita M. Flynn, "Fast, Cheap and Out of Control: A Robot Invasion of the Solar System," *Journal of the British Interplanetary Society*, October, 1989. Also appears as *MIT AI Laboratory Memo 1186*, November, 1989.
8. Anita M. Flynn, "Combining Sonar and Infrared Sensors for Mobile Robot Navigation," *International Journal of Robotics Research*, December, 1988.
9. Anita M. Flynn and John G. Harris, "Recognition Algorithms for the Connection Machine," *Journal of Computational Intelligence*, 2(3):131--135, 1986.

Proceedings of Refereed Conferences

1. S. Hollar, A. Flynn, C. Bellew and K.S.J. Pister, "Solar Powered 10mg Silicon Robot," *MEMS 2003*, Kyoto, Japan, January 19-23, 2003.
2. Seth Hollar, Anita Flynn, Sarah Bergbreiter and K.S.J. Pister, "Robot Leg Motion in a Planarized-SOI, 2 Poly Process," *Hilton Head 2002 Workshop*, Hilton Head, SC, June 2-6, 2002.
3. Anita M. Flynn and Seth R. Sanders, "Fundamental Limits on Energy Transfer and Circuit Considerations for Piezoelectric Transformers," *Power Electronics Specialists' Conference*, Nagoya, Japan, May, 1998.
5. K.R. Udayakumar, Keith Brooks, J. Chen, Anita M. Flynn and Daniel J. Ehrlich, "Piezoelectric Thin Film Ultrasonic Motors," *MRS Symposium Proceedings on Ferroelectric Thin Films II*, Vol. 243, edited by A.I. Kingon, Edward Myers and Bruce Tuttle, published by the Materials Research Society, Pittsburgh, PA, 1992.

6. Richard Amster, Lee S. Tavrow and Anita M. Flynn, "Intelligent CAD for Micro Mechanics," *Proceedings of the Micro System Technologies Conference*, Berlin, Germany, September 10-14, 1990. Published by Springer-Verlag, Berlin, Germany, 1990.
7. Anita M. Flynn, Rodney A. Brooks, William M. Wells III and David S. Barrett, "The World's Largest One Cubic Inch Robot," *IEEE Micro Electro-Mechanical Systems Conference*, Salt Lake City, UT, February, 1989.
8. Anita M. Flynn and Rodney A. Brooks, "Building Robots: Expectations and Experiences," *Proceedings of the IEEE Intelligent Robots and Systems Conference*, Tsukuba, Japan, September, 1989.
9. Rodney A. Brooks and Anita M. Flynn, "Robot Beings," *Proceedings of the IEEE Intelligent Robots and Systems Conference*, Tsukuba, Japan, September, 1989.
10. Rodney A. Brooks and Anita M. Flynn, "A Robot Being," *Proceedings of the NATO Workshop on Robotics and Biological Systems*, Tuscany, Italy, June, 1989.
11. Anita M. Flynn and Rodney A. Brooks, "MIT Mobile Robots - What's Next?" *Proceedings of the IEEE Robotics and Automation Conference*, Philadelphia PA, April, 1988.
12. Anita M. Flynn, "Gnat Robots (and How They Will Change Robotics)" *Proceedings of the IEEE Micro Robots and Teleoperators Workshop*, Hyannis, MA, November 1987.
13. Rodney A. Brooks, Jonathan H. Connell, and Anita M. Flynn, "A Mobile Robot with Onboard Parallel Processor and Large Workspace Arm," *Proceedings of the American Association of Artificial Intelligence Conference*, Philadelphia, PA, August 1986.
14. John G. Harris and Anita M. Flynn, "Object Recognition Using the Connection Machine's Router," *Proceedings of the IEEE Computer Vision and Pattern Recognition Conference*, Miami, FL, June 1986.

Other Major Publications

1. Anita M. Flynn, "Piezoelectric Ultrasonic Micromotors," *MIT Ph.D Thesis in Electrical Engineering and Computer Science*, MIT, Cambridge, MA, June, 1995.
2. Anita M. Flynn, "The Scoop on Ultrasonic Motors in Japan," *Office of Naval Research Asian Office Scientific Information Bulletin*, NAVSO P-3580, Vol. 17, No. 2, April - June 1992.
3. Rodney A. Brooks and Anita M. Flynn, "Rover on a Chip," *Aerospace America*, October, 1989.
4. Herbert E. M. Vighh and Anita M. Flynn, "Infrared People Sensors for Mobile Robots," *Proceedings of the SPIE Conference on Mobile Robots*, Cambridge, MA, November, 1988.
5. Anita M. Flynn, "Gnat Robots: A Low-Cost, Low-Intelligence Approach," *Proceedings of the IEEE Sensors and Actuators Workshop*, Hilton Head, SC, June, 1988 (invited).
6. Anita M. Flynn, "Gnat Robots," *AI Expert Magazine*, December 1987.
7. Rodney A. Brooks, Anita M. Flynn, and Thomas Marill, "Self Calibration of Motion and Stereo Vision for Mobile Robot Navigation," *Fourth International Symposium of Robotics Research*, Santa Cruz, CA, August 1987. Also as *MIT AI Laboratory Memo 984*, August 1987.