

# I. Curriculum Vitae

## Metin Sitti

Assistant Professor

Mechanical Engineering Department and Robotics Institute

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### Research Interests:

- Robotics
  - Micro/Nanorobotic Systems
  - Mechatronic Design, Analysis, and Control
  - Surgical and Space Microrobots
  - Automatic and Teleoperated Control
  - Virtual Reality and Haptic Interfaces
- Micro/Nanoscale Science and Engineering
  - Nanoscale Manufacturing, Assembly, and Manipulation
  - Nanoscale System Integration
  - Micro/Nanoelectromechanical Systems
  - Biomimetic Micro/Nanoscale Structures, Actuators, Mechanisms and Sensors
  - Polymer Nanofabrication
  - Manipulated and Directed Self-Assembly
  - Scanning Probe Microscopy

### Education:

- **University of Tokyo**, Tokyo, Japan, **Ph.D./Dr.Eng.** in Electrical Engineering, September 1999.  
*Supervisor:* Prof. Hideki Hashimoto  
*Thesis Title:* Teleoperated 2-D Micro/Nanomanipulation using Atomic Force Microscope.  
*Thesis Committee:* Hideki Hashimoto, Fumio Harashima, Hiroyuki Fujita, Yasuhiko Arakawa, Yoichi Hori, and Katsushi Ikeuchi.  
*Keywords:* Micro/Nanorobotics, Atomic Force Microscopy, Tele-Robotics, Nanomanipulation, Micro/Nano Physics, Haptic Devices, Micro/Nanoassembly, MEMS Nanoprobes.
- **Bogazici University**, Istanbul, Turkey, **M.Sc.** in Electrical and Electronics Engineering, September 1994.  
*Supervisor:* Prof. Isil H. Bozma and Prof. Ahmet Denker  
*Thesis Title:* Visual Tracking: An Integration of Control and Vision  
*Keywords:* Visual Servoing, Robot Control, Computer Vision.
- **Bogazici University**, Istanbul, Turkey, **B.Sc.** in Electrical and Electronics Engineering, July 1992.
- **Bogazici University**, Istanbul, Turkey, **B.Sc.** in Physics (double major with EE), July 1992.

## Professional Experience:

### *Research*

- 2002-present: **Assistant Professor** at the Carnegie Mellon University, Mechanical Engineering Department, Pittsburgh, PA.
- 2002-present: **Assistant Professor** at the Carnegie Mellon University, Robotics Institute, Pittsburgh, PA.
- 1999- 2002: **Research Scientist** at the University of California at Berkeley, Department of Electrical Engineering and Computer Sciences, Robotics Laboratory, Berkeley, CA.
- 1996-1999: **Research Assistant** at the University of Tokyo, Institute of Industrial Science, Intelligent Mechatronics Laboratory, Tokyo, Japan.
- 1994-1996: **Research Engineer** at TUBITAK (Turkish Scientific and Technical Research Council) Marmara Research Center, CAD/CAM Robotics Department, Gebze, Kocaeli, Turkey.

### *Teaching*

- Spring 2002: **Lecturer** at the University of California at Berkeley, Department of Electrical Engineering and Computer Science:  
Title: EECS 290G, *Micro/Nano-Robotics*  
(Advanced Topics in MEMS, Microsensors and Microactuators)  
Graduate Level  
Enrollment: 26 + 12 audits  
Student Evaluation Results:  
Rate of the overall teaching effectiveness: 5.3/7
- Spring 2001: **Guest Lecturer** at the University of California at Berkeley, Bioengineering Department:  
Title: *Introduction to Micro/Nanotechnology: Bio-MEMS*  
Senior and Graduate levels  
Instructor: Luke P. Lee  
Enrollment: 60
- 1992-1994: **Teaching Assistant** at the Bogazici University, Physics Department, Istanbul, Turkey:  
*Mathematical Physics*: Junior level, Instructor: Alpar Sevgen, Enrollment: 35  
*Advanced Mechanics*: Junior level, Instructor: Meral Serdaroglu, Enrollment: 45  
*Advanced Physics Experiments*: Senior level, Instructor: Metin Arik, Enrollment: 30  
*Modern Physics*: Freshman and Sophomore levels, Enrollment: 400

### *Other Activities*

- February 1998: **Visiting Researcher** in the CNRS, Institute of Microsystems, University of France-Comte, Besancon, France, for a month with the Japanese Science Promotion Society Fellowship, working on piezoresistive MEMS probes for micro/nano manipulation.

## Honors and Awards

- 2002: Best Video Award in the IEEE Robotics and Automation Conference (ICRA'02) for the research video entitled, "The Micromechanical Flying Insect".
- 2001: Anton Philips Best Student Paper Nomination in the IEEE Robotics and Automation Conference (ICRA'01) for the research paper entitled, "Development of a Scaled Teleoperation System for Nano Scale Interaction and Manipulation" (Six papers are nominated out of around 1200 papers).
- 2000: Best Paper Nomination in the IEEE Robotics and Automation Conference (ICRA'00) for the research paper entitled, "Wing Transmission for a Micromechanical Flying Insect" (Five papers are nominated out of around 1100 qualified papers).
- 1998: Best Paper Award in the IEEE/RSJ Intelligent Robot Systems Conference (IROS'98) for the research paper entitled, "Tele-Nanorobotics Using Atomic Force Microscope".
- 1998: Japanese Science Promotion Society (JSPS) Research Fellowship.
- 1996-1999: Monbusho Research Fellowship during all Ph.D. education from the Japanese Ministry of Education.
- 1989-1994: Education Fellowship from TELETAS Inc. (one of the major telecommunication companies in Turkey) for excellent academic achievement.
- 1987: Ranked 99<sup>th</sup> from around 1,000,000 students at the National University Entrance Exam in Turkey.

## Patents

- 2002: Metin Sitti and Ronald S. Fearing, "Synthetic Gecko Foot-Hair Fabrication," filed by UC Berkeley, 15 May 2002 (pending).

## Research Grants

- Oct. 2002: Berkman Faculty Development Fund grant, \$5,500.  
PI: Metin Sitti
- Nov. 2002: NSF Nanoscale Science and Engineering, NSF 02-148, Nanoscale Exploratory Research proposal, "Atomic Force Microscope Probe based Dielectrophoretic Transport and 3D Assembly of Nanoobjects," \$100,000/1 year (*pending*)  
PI: Metin Sitti
- Jan. 2003: NSF Major Research Instrumentation, "Development of a New Generation of Proximal Probe-based Characterization and Manipulation/Manufacturing Tools," \$800,000 (selected as one of the three proposals to be submitted from CMU, and *pending*)  
PIs: Metin Sitti, Tomasz Kowalewski, Elias Towe, and James Schneider
- Dec. 2002: NASA RASC Program, "WaalBots: Revolutionary Miniature Space Robots," around \$3,000,000/5 years (*pending*)  
PIs: Metin Sitti and William Whittaker
- Jan. 1999: Monbusho Outstanding Research Grant for excellent research achievement related to Nanorobotics and Nanotechnology, "Tele-Nanorobotics using Atomic Force Microscope probes," around \$500,000/1 year.  
PI: Metin Sitti
- July 1998: Research grant for the Tele-Nanorobotics project from the Institute of Industrial

Science, University of Tokyo, around \$70,000/1 year.

PI: Metin Sitti

1998: Conference attendance grants from C&C, NEC Co., Engineering Faculty of the University of Tokyo, and TUBITAK.

## Scientific Activities

- **Technical Committee Chair**, IEEE Nanotechnology Council, Nanorobotics and Nanomanufacturing Technical Committee, Feb. 2002-present.
- **Subcommittee Chair for Continuing Education**, ASME MEMS Division, Dec. 2002-present.
- **Program Committee Member** at the IEEE Conference on Nanotechnology, 2001 and 2003, and International Conference on Industrial Electronics, Technology & Automation, Dec. 2001.
- **Invited Talks**
  - IEEE ICRA'03 conference related to nanomanufacturing, May 2003, Taiwan.
  - IEEE ICRA'01 conference related to bio-nanotechnology, May 2001, Seoul, Korea.
  - IEEE MHS'99 related to nanomanipulation, October 1999, Nagoya, Japan.
- **Organizer, Chair, and Presenter**
  - NSF Workshop on Nanoscale Dynamics, Systems and Control, Denver, June 2003.
  - ASME IMECE'03 Conference, Nanoscale Dynamics, Systems and Control Symposium, Washington DC, USA, Nov. 2003.
  - IEEE/ASME Advanced Intelligent Mechatronics Conference, Micro/Nano Manipulation Invited Session, Atlanta, USA, 21 Sept. 1999.
  - IEEE Conference on Nanotechnology, Nanorobotics and Nanomanipulation Special Session, Maui, Hawaii, USA, Oct. 2001.
  - IEEE/ASME Advanced Intelligent Mechatronics Conference, Micro/Nano Mechatronics for Nanotechnology Tutorial, Atlanta, 9 Sept. 1999.
- **Reviewer** for the IEEE/ASME Trans. on Mechatronics, IEEE Trans. on Robotics and Automation, IEEE Proceedings, Journal of Micromechatronics, Advanced Robotics, Journal of Adhesion Science and Technology, and Telepresence journals.
- **Conference Presentations**: IEEE-NANO'01-'02, Gordon Research Conference on Adhesion-'02, ICRA'99-'00-'01-'02, IROS'98-'99, STM'99, AIM'99, MHS'98-'99, etc.
- **Society Memberships**
  - American Society of Mechanical Engineers (ASME)
  - Institute of Electrical and Electronics Engineers (IEEE)
  - American Association for the Advancement of Science (AAAS)
  - Robotics Society of Japan (RSJ)

## Attended Projects

1999-2002: **Biologically Inspired Micromechanical Flying Insect Project**

- **Aim**: Using biomimetic insect flight mechanism principles to design, fabricate and control the flying micromechanical insect robot with exceptional flight performance, and real fly size.
- **Project Team**: Robotics Laboratory (Prof. Ronald S. Fearing and Prof. Shankar Sastry), MEMS Laboratory (Prof. Kris Pister), Material Science and Engineering Department (Prof. Timothy D. Sands), Integrative Biology Department (Prof. Michael H. Dickinson), and Department of Mechanical Engineering (Prof. Dorian Liepmann) at the University of California, Berkeley.
- **Keywords**: Biomimetic Robotics, Insect Aerodynamics, Micromechatronics, Laser Micromachining, MEMS, Smart Sensors, Actuators and Control, Rapid Prototyping, Microassembly,

Distributed Intelligent Systems, Hybrid System Control, Virtual Simulator.

- **My Contribution:** Design, analysis, fabrication, characterization, and control of the micromechanical wing mechanisms and PZT and PZN-PT based unimorph actuators.
- **Milestone Publications:**

Michael H. Dickinson, F. Lehmann, and Sanjay P. Sane, "Wing Rotation and the Aerodynamic Basis of Insect Flight", *Science*, vol. 284, no. 5422, pp. 1956-1960, 18 June 1999.

M. Sitti, "Piezoelectrically actuated four-bar mechanism with two flexible links for micromechanical flying insect thorax," *IEEE/ASME Trans. on Mechatronics*, 2002 (under review).

J. Yan, M. Dickinson, J. Birch, M. Sitti, T. Su, and R. Fearing, "Wing Transmission for a Micro-mechanical Flying Insect", *Journal of Micromechatronics*, vol. 1, no. 3, pp. 221-237, 2002.

D. Campolo, M. Sitti, and R. Fearing, "Efficient charge recovery method for driving piezoelectric actuators in low power applications," *IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control*, December 2002 (to appear).

#### 2000-2002: **Biomimetic Nanostructures: Gecko Foot-Hair Project**

- **Aim:** Understanding the biomimetic principles of the gecko foot-hair sticking to surfaces for fabricating novel adhesives, and constructing wall-climbing robots in all environments such as liquid and air.
- **Project Team:** IS Robotics Inc., Robotics Laboratory (Prof. Ronald S. Fearing) and Integrative Biology Department (Prof. Robert J. Full) at the University of California at Berkeley, Mechanical Engineering Department (Prof. Tom Kenny) at the Stanford University, and Department of Biology (Prof. Keller Autumn) at Lewis and Clark College.
- **Keywords:** Biomimetics, Nanotechnology, Nanoforce Modeling, Bio-MEMS, MEMS, Smart Structures, Scanning Probe Microscopy.
- **My Contribution:** Design, analysis and characterization of the gecko foot-hair sticking using nano scale force modeling and Atomic Force Microscopy, and fabrication of the synthetic gecko hairs using the polymer nanofabrication techniques such as nano-molding.
- **Milestone Publications:**

K. Autumn, Y. Liang, T. Hsieh, W. Zesch, W.-P. Chan, T. Kenny, R. Fearing, and R.J. Full, "Adhesive force of a single gecko foot-hair," *Nature*, vol. 405, pp. 681-685, June 8, 2000.

K. Autumn, M. Sitti, Y. A. Liang, A. Peattie, W. Hansen, S. Sponberg, T. Kenny, R. Fearing, J. Israelachvili & R. J. Full, "Evidence for van der Waals Attachment by Gecko Foot-Hairs Inspires Design of Synthetic Adhesive", *Proc. Nat. Acad. Science*, vol. 99, no. 19, pp. 12252-12256, September 17, 2002.

M. Sitti and R. S. Fearing, "Synthetic gecko foot-hair micro/nano-structures as dry adhesives," *Journal of Adhesion Science and Technology*, 2002 (under review).

#### 1998-2000: **Tele-Nanorobotics Project**

- **Aim:** Development of the Atomic Force Microscopy, tele-robotics, and advanced human-machine user interface technologies for micro/nano-robotic applications, i.e. micro/nano manipulation, observation, and fabrication of 2D micro/nano objects and materials for micro/nanotechnology, material science, and bioengineering applications.
- **Project Team:** JEOL Co., Intelligent Mechatronics Laboratory (Prof. Fumio Harashima and Prof. Hideki Hashimoto), and Laboratory for Integrated Micro-Mechatronic Systems (Dr. Moussa Hoummady, Prof. Hiroaki Fujita and Prof. Yasuhiko Arakawa) at the Institute of Industrial Science, University of Tokyo, Japan.
- **Keywords:** Micro/Nanorobotics, Scanning Probe Microscopy, Tele-Robotics, Virtual Reality User Interfaces, Haptic Devices, Precision Positioning and Design, MEMS Microprobes.

- **My Contribution:** Project proposal, budget applications, and all research work as my Ph.D. thesis, and leading two graduate students.
- **Milestone Publication:**  
M. Sitti and H. Hashimoto, "Tele-Nanorobotics Using Atomic Force Microscope as a Robot and Sensor," *Advanced Robotics Journal*, vol. 13, no. 4, pp. 417-436, 1999.

1998-2000: **Tele-Micromanipulation Project (Industrial Project)**

- **Aim:** Low cost and user friendly teleoperated micro scale manipulation system for various applications such as integrated circuit board quality check, biological sample manipulation, microassembly, etc.
- **Project Team:** Sony Inc., and Intelligent Mechatronics Laboratory (Prof. Hideki Hashimoto) at the Institute of Industrial Science, University of Tokyo.
- **Keywords:** Tele-Microrobotics, Parallel Robot Mechanisms, Advanced Human-Machine Interfaces, Haptic Devices, Computer Networks.
- **My Contribution:** Project proposal, design and development of the whole scaled teleoperation system.

1997-1999: **Intelligent Space Project: Multimodal Human-Machine User Interfaces and Intelligent ATMs (Industrial Project)**

- **Aim:** Using visual face and body motion recognition, and sound information for understanding the human behavior status for intelligent ATM user interfaces.
- **Project Team:** OMRON Inc., and Intelligent Mechatronics Laboratory (Prof. Hideki Hashimoto) at the Institute of Industrial Science, University of Tokyo.
- **Keywords:** Advanced Human-Machine Interfaces, Computer Vision, Sound Recognition, Computer Networks.
- **My Contribution:** Color image processing for segmenting the human face region at real-time.

1996: **Chaotic Control of Mechanisms**

- **Aim:** Controlling chaotic systems (robot dynamics) using OGY Method for enabling minimum power consumption oscillating systems.
- **Project Team:** Department of Electrical and Electronics Engineering (Prof. Yagmur Denizhan), Bogazici University, Turkey.
- **Keywords:** Chaos, Nonlinear Dynamics, Chaos Control.
- **Main Contribution:** Developing oscillation control algorithms for robotic mechanisms and chaotic maps.

1995-1996: **Automatic Quality Detection of Textile Fabrics (Industrial Project)**

- **Aim:** Automizing the textile fabric quality control process using real-time computer vision.
- **Project Team:** CAD/CAM Robotics Department at the TUBITAK Marmara Research Center, and many textile companies in Turkey.
- **Keywords:** Computer Vision, Parallel Algorithms, Real-Time Image Processing, Object Recognition.
- **My Contribution:** Image processing for segmenting and recognizing the textile fabric defects using Neural Networks at real-time.

1994-1996: **Robot Vision Project**

- **Aim:** Automatic recognition and picking of unknown multiple moving objects on the assembly lines by robotic manipulators utilizing visual feedback.
- **Project Team:** CAD/CAM Robotics Department at the TUBITAK Marmara Research Center.

- **Keywords:** Robot Vision, Robot Control, Intelligent Control, Object Recognition, Robot Grasping, Flexible Manufacturing.
- **My Contribution:** Whole research as my M.Sc. thesis work while leading four research engineers for developing image processing software and robot control schemes for the automatic recognition and picking of unknown multiple objects moving on the assembly lines.

1994-1995: **Automatic Quality Detection of Painted Surfaces (Industrial Project)**

- **Aim:** Real-time defect detection on the painted metallic surfaces using real-time computer vision.
- **Project Team:** Arcelik Inc., and CAD/CAM Robotics Department at the TUBITAK Marmara Research Center.
- **Keywords:** Computer Vision, Digital Signal Processors, Statistical Image Processing.
- **My Contribution:** Implementing and developing the real-time parallel DSP software and hardware for detecting the color changes on the metallic surfaces by stochastic image processing techniques.

### III. Publication List

#### A. Thesis:

1. M. Sitti, "Teleoperated 2-D Micro/Nanomanipulation using Atomic Force Microscope," Department of Electrical Engineering, University of Tokyo, Tokyo, Sept. 1999.
2. M. Sitti, "Visual Tracking: An Integration of Control and Vision," *M.Sc. Thesis*, Department of Electrical and Electronics Engineering, Bogazici University, Bebek, Istanbul, Sept. 1994.
3. M. Sitti, "An Obstacle Avoidance Approach for Mobile Robots Based on the Artificial Potential Field Approach and Least Squares Method," *B.Sc. Engineering Thesis*, Department of Electrical and Electronics Engineering, Bogazici University, Bebek, Istanbul, July 1992.

#### B. Book Articles:

1. R.S. Fearing, S. Avadhanula, D. Campolo, M. Sitti, J. Yan and R. Wood, "A Micromechanical Flying Insect Thorax," *Neurotechnology for Biomimetic Robots*, MIT Press, 2002.
2. M. Sitti and H. Hashimoto, "Teleoperated Nano Scale Object Manipulation," *Recent Advances in Mechatronics*, pp. 322-335, edited by O. Kaynak, S. Tosunoglu, and M.J. Ang, Springer Verlag Pub., 1999.
3. M. Sitti, M. Hoummady, and H. Hashimoto, "Trends on Mechatronics for Micro/Nano Telemanipulation: Survey and Requirements," *IFAC Information Control in Manufacturing*, edited by G. Morel and F. B. Vernadat, Elsevier Science Pub., UK, pp. 235-240, 1999.

#### C. Journal Papers:

1. K. Autumn, **M. Sitti**, Y. A. Liang, A. Peattie, W. Hansen, S. Sponberg, T. Kenny, R. Fearing, J. Israelachvili & R. J. Full, "Evidence for Van der Waals Attachment for Geckos," *Proc. Nat. Acad. Science*, vol. 99, no. 19, pp. 12252-12256, September 17, 2002.
2. **M. Sitti** and H. Hashimoto, "Teleoperated Touch Feedback of Surfaces at the Nanoscale: Modeling and Experiments," *IEEE/ASME Trans. on Mechatronics*, vol. 8, no. 1, March 2003 (to appear).
3. **M. Sitti**, "Piezoelectrically Actuated Four-Bar Mechanism with Two Flexible Links for Micromechanical Flying Insect Thorax," *IEEE/ASME Trans. on Mechatronics*, vol. 8, no. 1, March 2003 (to appear).
4. D. Campolo, **M. Sitti**, and R.S. Fearing, "Efficient charge Recovery Method for Driving Piezoelectric Actuators in Low Power Applications," *IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control*, vol. 50, no. 1, January 2003 (to appear).
5. **M. Sitti**, "Nanotribological Characterization System by AFM Probe based Controlled Pushing," *IEEE/ASME Trans. on Mechatronics*, submitted in Sept. 2002 (under review).
6. **M. Sitti** and R. S. Fearing, "Synthetic gecko foot-hair micro/nano-structures as dry adhesives," *Journal of Adhesion Science and Technology*, submitted in Sept. 2002 (under review).
7. **M. Sitti** and H. Hashimoto, "Controlled Pushing of Nanoparticles: Modeling and Experiments," *IEEE/ASME Trans. on Mechatronics*, vol. 5, no. 2, pp. 199-211, June 2000.
8. J. Yan, M. Dickinson, J. Birch, **M. Sitti**, T. Su, and R. Fearing, "Wing Transmission for a Micro-mechanical Flying Insect", *Journal of Micromechatronics*, vol. 1, no. 3, pp. 221-237, 2002.
9. **M. Sitti**, B. Aruk, K. Shintani, and H. Hashimoto, "Scaled Teleoperation System for Nano Scale Interaction and Manipulation," *Advanced Robotics*, January 2003 (to appear).
10. **M. Sitti** and H. Hashimoto, "Two-Dimensional Fine Particle Positioning Under Optical

Microscope Using a Piezoresistive Cantilever as a Manipulator," *Journal of Micromechatronics*, vol. 1, no. 1, pp. 25-48, 2000.

11. **M. Sitti** and H. Hashimoto, "Macro to Nano Tele-Manipulation Towards Nanoelectromechanical Systems," *Journal of Robotics and Mechatronics*, pp. 209-217, vol. 12, no. 3, June 2000.
12. **M. Sitti** and H. Hashimoto, "Tele-Nanorobotics using Atomic Force Microscope as a Robot and Sensor," *Advanced Robotics*, vol. 13, no. 4, pp. 417-436, 1999.
13. S. Horiguchi, **M. Sitti**, and H. Hashimoto, "Investigation of Virtual Reality Interface for AFM-Based Nanomanipulation," *IEEJ Trans. on Electronics, Information and Systems (C)*, pp. 1948-1956, Dec. 2000 (in Japanese).
14. **M. Sitti** and H. Hashimoto, "Micro/Nano Manipulation using Atomic Force Microscope," *Journal of Industrial Science Research*, University of Tokyo, vol. 51, no. 8, pp. 31-33, 1999.
15. **M. Sitti** and H. Hashimoto, "Virtual Reality-Based Teleoperation in the Micro/Nano World," *Journal of Industrial Science Research*, University of Tokyo, vol. 51, no. 8, pp. 34-36, 1999.

#### **D. Invited Talks and Seminars:**

1. M. Sitti, "Issues in Bio-Nanotechnology Education and Research," *IEEE Robotics and Automation Conference*, Korea, 24 May 2001.
2. M. Sitti, "Robotics at the Micro/Nano Scale: Tele-Nanorobotics using Nanoprobes, and Biologically Inspired Micromechanical Flying Insects,"
  - a. *Carnegie Mellon University*, Mechanical Engineering Department, 16 January 2002.
  - b. *University of Washington*, Electrical Engineering Department, April 2002.
  - c. *Johns Hopkins University*, Mechanical Engineering Department, April 2002.
  - d. *Swiss Federal Institute of Technology at Zurich, ETHZ*, Institute of Automatic Control, Switzerland, 14 December 2001.
  - e. *SUNY Stony Brook University*, Mechanical Engineering Department, 14 May 2001.
  - f. *Carnegie Mellon University*, Robotics Institute, Pittsburgh, PA, USA, 4 May 2001.
  - g. *Swiss Federal Institute of Technology at Zurich, ETHZ*, Mechanical and Process Engineering Department, Switzerland, 6 June 2001.
3. M. Sitti, "Nanorobotic Manipulation and Fabrication using Atomic Force Microscope,"
  - a. *Stanford University*, Electrical Engineering Department, April 2002.
  - b. *MIT*, Mechanical Engineering Department, April 2002.
  - c. *California Institute of Technology*, Electrical Engineering Department, April 2002.
  - d. *University of California at Berkeley*, Electrical Engineering Department, April 2002.
  - e. *Purdue University*, Electrical and Computer Engineering Department, 29 Nov. 2001.
  - f. *Swiss Federal Institute of Technology at Zurich, ETHZ*, Institute of Polymers, Material Science Department, Switzerland, 12 December 2001.
4. M. Sitti, "Biologically Inspired Micromechanical Flying Insects," *Institute of Industrial Science, University of Tokyo*, Tokyo, Japan, 28 May 2001.

#### **E. Tutorials:**

1. M. Sitti, "Survey of Nanorobotic Systems," *IEEE Robotics and Automation Conference, Micro/Nano-Manipulation Tutorial*, Taiwan, May 2003 (to be held).
2. M. Sitti, "Advanced Micro/Nanorobotic Systems," *FIRA Robot Congress*, Korea, 26 May 2002.
3. M. Sitti, "Micro/Nanomechatronics for Nanotechnology," *IEEE/ASME Advanced Intelligent Mechatronics Conference*, Atlanta, USA, 19 September 1999.

## F. Conference Papers:

1. M. Sitti and R. S. Fearing, "Synthetic Gecko Foot-Hair Micro/Nano-Structures as Dry Adhesives for Future Wall-Climbing Robots," *IEEE Robotics and Automation Conference*, May 2003, Taiwan (to appear).
2. M. Sitti and R. S. Fearing, "Nanomolding based Fabrication of Synthetic Gecko Foot-Hair Micro/Nanostructures," *IEEE Nanotechnology Conference*, pp. 137-140, DC, USA, Aug. 2002.
3. K. Castelino, S. Satyanarayana, and M. Sitti, "Manufacturing Two- and Three-Dimensional Micro/Nanostructures by Integrating Optical Tweezers with Chemical Assembly," *IEEE Robotics and Automation Conference*, May 2003, Taiwan (to appear).
4. M. Sitti, "Survey of Nanomanipulation Systems," *IEEE Nanotechnology Conference*, pp. 75-80, Maui, USA, Nov. 2001.
5. M. Sitti, "Nanotribological Characterization System by AFM Based Controlled Pushing," *IEEE Nanotechnology Conference*, pp. 99-104, Maui, USA, Nov. 2001.
6. B. Aruk, M. Sitti, and H. Hashimoto, "Human-Machine Interface for Nanomanipulation with AFM Probe," *IEEE Nanotechnology Conference*, pp. 151-156, Maui, USA, Nov. 2001.
7. J. Yan, S. Avadhanula, J. Birch, M. Dickinson, M. Menon, E. Park, T.D. Sands, S.Sane, M. Sitti, T. Su, R.J. Wood, and R.S. Fearing, "The Micromechanical Flying Insect", *Video Proc. of the IEEE Robotics and Automation Conference*, Washington, USA, May 2002 (**Best Video Award**).
8. J. Yan, S. Avadhanula, M. Sitti, R.J. Wood, and R.S. Fearing, "Thorax Design and Wing Control for a Micromechanical Flying Insect", *Proc. of the 39th Annual Allerton Conference on Communication, Control, and Computing*, Monticello, IL. Oct 3-5, 2001 (*Invited Paper*).
9. M. Sitti, "PZT Actuated Four-Bar Mechanism with Two Flexible Links for Micromechanical Flying Insect Thorax," *Proc. of the IEEE Robotics and Automation Conference*, pp. 3893-3900, Korea, May 2001.
10. M. Sitti, D. Campolo, J. Yan, R.S. Fearing, T. Su, D. Taylor, and T. Sands, "Development of PZT/PZN-PT Unimorph Actuators for Micromechanical Flapping Mechanisms," *Proc. of the IEEE Robotics and Automation Conference*, pp. 3839-3846, Korea, May 2001.
11. M. Sitti, B. Aruk, K. Shintani, and H. Hashimoto, "Development of a Scaled Teleoperation System for Nano Scale Interaction and Manipulation," *Proc. of the IEEE Robotics and Automation Conference*, pp. 860-867, Korea, May 2001 (**Best Student Paper Nomination**).
12. J. Yan, R. Wood, S. Avadhanula, D. Campolo, M. Sitti, and R. Fearing, "Towards Flapping Wing Control for a Micromechanical Flying Insect," *Proc. of the IEEE Robotics and Automation Conference*, pp. 3901-3908, Korea, May 2001.
13. B. Aruk, H. Shintani, H. Hashimoto and M. Sitti, "Man-Machine Interface for Micro/Nano Manipulation," *Int. Symp. on Robotics*, Korea, April 2001 (to appear).
14. R. S. Fearing, K. Chiang, M. Dickinson, D. Pick, M. Sitti and J. Yan, "Wing Transmission for a Micromechanical Flying Insect," *Proc. of the IEEE Robotics and Automation Conference*, pp. 1509-15, San Francisco, USA, Apr. 2000 (**Best Paper Nomination**).
15. M. Sitti, S. Horiguchi, and H. Hashimoto, "Tele-Touch Feedback of Elastically Deformable Surfaces at the Micro/Nano Scale: Modeling and Experiments," *Proc. of the IEEE/RSJ Intelligent Robots and Systems Conference*, pp. 882-888, IROS'99, Korea, Nov. 1999.
16. H. Shintani, M. Sitti, K. Hirahara, and H. Hashimoto, "Force Display Method for Teleoperation Using Scanning Probe Microscope," *Human Machine Symposium*, Osaka, Japan, Oct. 1999 (in Japanese).
17. M. Sitti and H. Hashimoto, "Force-Controlled Pushing of Nano Particles: Modeling and Experiments," *IEEE/ASME Advanced Intelligent Mechatronics Conference*, pp. 19-26, Atlanta, USA, Sept. 1999.

18. M. Sitti, S. Horiguchi, and H. Hashimoto, "Tele-Nanorobotics 2-D Manipulation of Micro/Nano Particles Using Atomic Force Microscope," *Video Proceedings of IEEE/ASME Advanced Intelligent Mechatronics Conference*, Atlanta, USA, Sept. 1999.
19. M. Sitti and H. Hashimoto, "Pushing Micro/Nano Scale Particles on Substrates Using Atomic Force Microscope Probe Towards Tribological Characterization of Particle-Substrate Interfaces," *STM'99 Conference*, Korea, July 1999.
20. S. Horiguchi, M. Sitti, and H. Hashimoto, "Visualization Interface for AFM-based Nano Manipulation," *Proc. of the IEEE Int. Symp. on Industrial Electronics*, Slovenia, pp. 310-315, July 1999.
21. M. Sitti and H. Hashimoto, "Two-Dimensional Fine Particle Positioning Using a Piezoresistive Cantilever as a Micro/Nano-Manipulator," *Proc. of the IEEE Robotics and Automation Conference*, Detroit, USA, pp. 2729-2735, May 1999.
22. M. Sitti and H. Hashimoto, "Teleoperated Micro/Nano Particle Manipulation using Atomic Force Microscope," *RSJ Robotics and Mechatronics Conference*, Tokyo, June 1999.
23. S. Horiguchi, M. Sitti, and H. Hashimoto, "3-D Nano Scale Tactile Feedback Interface," *RSJ Robotics and Mechatronics Conference*, Tokyo, June 1999.
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