

PROMOTION RECOMMENDATION

University of Michigan
College of Engineering

Katsuo Kurabayashi, assistant professor of mechanical engineering, Department of Mechanical Engineering, and assistant professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering and Computer Science, College of Engineering, is recommended for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering, and associate professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering and Computer Science, College of Engineering.

Academic Degrees

B.S. 1992 The University of Tokyo, Japan, Precision Engineering
M.S. 1994 Stanford University, Materials Science and Engineering
Ph.D. 1998 Stanford University, Materials Science and Engineering

Professional Record

2004-present Assistant Professor of Electrical Engineering and Computer Science, University of Michigan
2000-present Assistant Professor of Mechanical Engineering, University of Michigan
2000-2002 Assistant Professor of Macromolecular Science and Engineering, University of Michigan
1999 Research Associate, Stanford University
1994-1998 Research Assistant, Stanford University

Summary of Evaluation:

Teaching: Professor Kurabayashi is a dedicated instructor in and outside the classroom. Throughout the 4 undergraduate and 1 graduate courses he has taught, the student evaluations have been consistently positive (Q2 marked well over 4.0 with only a few exceptions). The students' feedback describes him as "well prepared," "accessible," "knowledgeable," and "patient." In ME 330 *Thermal and Fluid Sciences II*, he introduced modern research topics related to microfluidics. He has revitalized ME 553 Microelectromechanical Systems, covering truly interdisciplinary subjects necessary for modern MEMS devices. He has graduated 1 MS and 3 Ph.D. students (1 as a co-chair), one of whom became an Assistant Professor at Brigham Young University, and is currently advising 5 Ph.D. students (2 as a co-chair), all in the pipeline of graduation during the next few years.

Research: Professor Kurabayashi has positively impacted the MEMS field with his contributions towards enhancing the fundamental understanding of micro- and nano-scale physics and his innovative applications. After joining U of M, he has made major research contributions in three areas, polymer MEMS, RF-MEMS, and BioMEMS, all of which extend significantly beyond his PhD work. For the development of the first PDM-on-silicon optical MEMS device, he has won the best paper award at *SPIE Photonics East 2004* and his work appeared in the highly prestigious *Applied Physics Letters* as a cover article. He has also won NSF CAREER Award. He has published 10 full-length papers with his students in top quality journals such as *IEEE/ASME Journal of Microelectromechanical Systems*. In addition, he has 3 letter papers in *Applied Physics Letters* and *IEEE Photonics Technology Letters*, which should be considered as equivalent to full-length journal papers. Considering the experimental focus of his research that would require substantial start-up efforts, these remarkable numbers clearly indicate his outstanding productivity and further growth.

Recent and Significant Publications:

- Jensen, B, Chow, L., Huang, K., Saitou, K., Volakis, J., and Kurabayashi, K., "Effect of Nanoscale Heating on Electrical Transport in RF MEMS Switch Contacts," *J. Microelectromechanical Systems*, 14:935-946, 2005.
- Tung, Y.-C., and Kurabayashi, K., "A Single-Layer PDMS-on-Silicon Hybrid Micro Actuator with Multi-Axis Out-of-Plane Motion Capabilities: Part I: Modeling and Design," *J. Microelectromechanical Systems*, 14:548-557, 2005.
- Tung, Y.-C., and Kurabayashi, K., "A Single-Layer PDMS-on-Silicon Hybrid Micro Actuator with Multi-Axis Out-of-Plane Motion Capabilities: Part II: Fabrication and Characterization," *J. Microelectromechanical Systems*, 14:558-566, 2005.
- Jensen, B., Huwang, K, Chow, L., and Kurabayashi, K., "Adhesion Effects on Contact Opening Dynamics in Micromachined Switches," *J. Applied Physics*, 97(103535), 2005.
- Tung, Y.-C., Zhang, M., Lin, C.-T., Kurabayashi, K., and Skerlos, S.J., "PDMS-based Opto-Fluidic Microflow Cytometer with Two-Color, Multi-Angle Fluorescence Detection Capability using PIN Photodiodes," *Sensors and Actuators B*, 98(2-3): 356-367, 2004.
- Huh, D., Tkaczky, A., Bahng, J., Chang, Y., Wei, H.-H., Grotberg, J., Kim, C.-J., Kurabayashi, K., and Takayama, S., "Reversible Switching of High-Speed Air-Liquid Two-Phase Flows Using Electrowetting-Assisted Flow-Pattern Change," *J. American Chemical Society*, 125(48): 14678-14679, 2003.
- Kurabayashi, K. and Khalkhali, H. "Anisotropic Thermal Energy Transport in Polarized Liquid Crystalline (LC) Polymers under Electric Fields," *Microscale Thermophysical Engineering*, 7(2): 87-99, 2003.
- Jensen, B., Mutlu, S., Miller, S., Kurabayashi, K., and Allen, J., "Shaped Comb Fingers for Compensation of Mechanical Restoring Force in Tunable Resonators," *J. Microelectromechanical Systems*, 12(3): 373-383, 2003.
- Huh, D., Tung, Y.-C., Grotberg, J.B., Skerlos, S., Kurabayashi, K., and Takayama, S., "Air-Liquid Two-Phase Microfluidic System for Low-Cost, Low-Volume, and Low-Power Micro Flow Cytometer," *Biomedical Microdevices*, 4(2): 141-149, 2002.
- Asheghi, M., Kurabayashi, K., Kasnavi, R., and Goodson, K., "Thermal Conduction in Doped Single-Crystal Silicon Films," *Journal of Applied Physics*, 91(8): 5079-5088, 2002.
- Kurabayashi, K., "Anisotropic Thermal Properties of Solid Polymers," *International J. Thermophysics*, 22(1): 277-288, 2001.

Service: Professor Kurabayashi's departmental service contributions are commensurate with what is expected of an assistant professor. At U of M, he has served as the ME departmental seminar committee, the ME faculty search committee, the Rackham Fellowship Panel, and the College Student Fellowship panel. Externally, he has participated in the programs of the ASME heat transfer executive committee and chaired one session in 2001. He has also been part of two NSF review panels. In addition, he has been participating in the review process used by several professional journals. We believe the service contributions will continue to increase after tenure and promotion.

External Reviewers:

Reviewer (A): "I particularly like his paper demonstrating diffusive-ballistic electron-transport transitions (APL, 2005) in which he demonstrated experimentally the existence of ballistic transport in the contact problem. This observation makes new contributions to understanding of the electric contact problem, and provides useful insights to overcoming contact problems in RF MEMS switches."

Reviewer (B): "The paper on wavelength tuning (APL cover-image article) is particularly provocative because it combines his knowledge of soft materials... with traditional MEMS and electrostatics to provide a truly unique optical grating structure with large response ratio. This is a concept that would not readily occur to a purely mechanical-engineering MEMS specialist, nor to a materials scientist working on more traditional topics."

Reviewer (C): "His approach of combining multiple materials in one single MEMS is goal-oriented and of great impact for the MEMS community. We will find more of these approaches from different groups in the future, which will benefit from his work."

Reviewer (D): "I very much admire his willingness to cut loose from his core background and to try something new. I believe that these are good indication that he is not afraid of exploring new engineering/scientific frontiers and could lead him to produce good scholarly work for years to come."

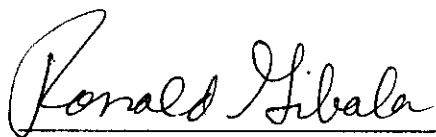
Reviewer (E): "What I admire about Katsuo is that he has leveraged his background in polymers to build his research in polymeric optomechanical device design and fabrication. That was smart.... I think he has sufficiently separated from his PhD work and is either pioneering or making significant contributions in the new fields. This is a very good sign!"

Reviewer (F): "What impressed me so much about his subsequent work is that he has made very significant progress in three different areas: nanoscale transport, polymer-silicon hybrid microsystems and biosensors."

Reviewer (G): "In total, the seminal work that Prof. Kurabayashi has accomplished in understanding the mechanisms underlying RF contact switches have and will continue to have impact in the MEMS field, and will help to bring these important devices into practice.... Due to this work, he had already made national reputation as one of the top experts in his field."

Reviewer (H): "In my opinion, his record leaves little doubt that Katsuo will continue to grow the number of his students, and his research for many years to come. He has perfect academic attitude and tireless work ethic to pursue excellence for years to come."

Summary of Recommendation: Professor Kurabayashi has acquired an international recognition as a top researcher in the MEMS field. He has inexhaustibly contributed to teaching, research and service. It is with the support of the College of Engineering Executive Committee that I recommend him for promotion to associate professor of mechanical engineering, with tenure, Department of Mechanical Engineering and associate professor of electrical engineering and computer science, without tenure, Department of Electrical Engineering and Computer Science, College of Engineering.



Ronald Gibala
Interim Dean, College of Engineering

May 2006