Stochastic Manufacturing Processes: Massively Parallel Micro-Scale Self-Assembly

Self-assembly is the spontaneous and reversible organization of components into ordered structures, representing an alternative to the conventional manufacture of systems made of components from milli to nano scales. First commercial applications of self-assembly have appeared in recent years, for example in the fabrication of radio frequency identification (RFID) tags. However, the full impact of this new approach towards heterogeneous system integration will only be realized once self-assembly can be programmed on demand. This presentation gives a review of several projects that aim at programmable self-assembly and an outlook on future developments for 2d and 3d assemblies. Several crucial topics are discussed: real time control of interfacial properties; optimization of binding site designs; and algorithms for the modeling and control of self-assembly. Promising novel manufacturing methods are emerging that combine the precision and reproducibility of semiconductor fabrication with the scalability and parallel.

Karl F. Böhringer
University of Washington

Karl F. Böhringer received his Dipl.-Inform. degree from the University of Karlsruhe, Germany in 1990 and his M.S. / Ph.D. degrees in computer science from Cornell University, Ithaca, NY in 1993 / 1997. He was a Visiting Scholar at Stanford University in 1994-5 and a Postdoctoral Researcher at the University of California, Berkeley from 1996 to 1998. He joined the University of Washington in Seattle, WA in 1998, where he is Professor of Electrical Engineering and Bioengineering and currently holds the John M. Fluke Distinguished Chair of Engineering. He is Director of the Microfabrication Facility and of the National Nanotechnology Infrastructure Network site at the University of Washington. He held visiting faculty positions at the Universities of Tohoku, Tokyo, Kyoto (Japan), and Sao Paulo (Brazil). His research interests include microelectromechanical systems (MEMS), manipulation and assembly from macro to nano scales, microfluidic systems for the life sciences, and microrobotics. He has created, among others, multi-batch selfassembling systems, massively parallel microactuator arrays, and a walking microrobot.

Karl F. Böhringer is a fellow of IEEE and he is member of the Society for Nanoscale Science, Computing and Engineering (ISNSCE), the American Society for Engineering Education (ASEE), and the German Society for Information Sciences (GI). He was awarded a Long-term Invitational Fellowship for Research in Japan by the Japan Society for the Promotion of Science (JSPS) in 2004, an IEEE Robotics & Automation Society Academic Early Career Award in 2004, an NSF CAREER Award in 1999, and an NSF Postdoctoral Associateship in 1997. His work was listed among the "Top 100 Science Stories of 2002" in Discover magazine. He is an editor of the *ASME/IEEE Journal of Microelectromechanical Systems* and the *IEEE Transactions on Automation Science and Engineering*. He has served, among others, on the technical program committees for the *IEEE MEMS and Transducers* conferences and he was general co-chair of IEEE MEMS in 2011.

