Special MIE Seminar
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******MEC 221******

Motion Control, Planning and Manipulation of Nanowires under Electric-Fields in Fluid Suspension

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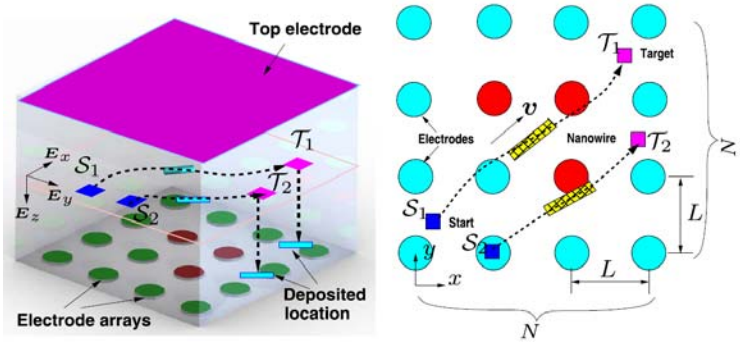
Abstract

Automated manipulation of nanowires and nanotubes would enable the scalable manufacturing of nanodevices for a variety of applications, including micro/nanoelectronics and biomedical applications. Precisely placement of nanostructures such as nanowires or nanotubes and automated scalable characterization, manipulation and assembly of nanostructures are among technological challenges to fabricate these nanodevices. In this presentation, I will first present an electric-field-based autonomous system to motion plan and control of individual and simultaneous multiple nanowires in liquid suspension with a simple, generic set of electrodes. The proposed robust motion control has been proved to be stable for precisely drive multiple various types of nanowires. The motion planning algorithms significantly reduce the computational complexity while maintain suboptimal performance in both the travel time and distances. The performance of the motion planning algorithms is guaranteed by analyses and design. We fabricate the microfluidic devices and extensively demonstrate experimental results to validate the analysis and the design of nanowire motion control, planning and manipulation.

Bio

Kaiyan Yu received the B.S. degree in intelligent science and technology from Nankai University, Tianjin, China, in 2010. She is currently completing the Ph.D. degree in mechanical and aerospace engineering with Rutgers University, Piscataway, NJ, USA. Her current research interests include autonomous robotic systems and control, mechatronics, automation science, and engineering, with applications to microfluidic devices and biomedical systems. Ms. Yu is a Student Member of the Institute of Electrical and Electronics Engineers (IEEE) and the American Society of Mechanical Engineers (ASME). Ms. Yu has published 8 papers on journal articles and 11 conference proceedings. Her paper has been selected as a Finalist of the Best Student Paper Award at the 2014 IEEE/ASME International Conference on Advanced Intelligent Mechatronics. She is an active reviewer for highly reputed journals including IEEE transactions and ASME journals, and peer-reviewed conference proceedings.



(a) (b)

(a) 3-D view of microfluidic device with N × N independently actuated electrodes on a bottom substrate, with a common top electrode.

(b) Top view of the motion trajectories of two nanowires induced by the electrode array.