Motion Control, Planning and Manipulation of Nanowires under Electric-Fields in Fluid Suspension with Applications in Nanodevice Fabrication

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Abstract:

The automated manipulation of nanowires and nanotubes would enable the scalable manufacturing of nanodevices for a variety of applications, including micro- and 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. Next, I will demonstrate an integrated, electric-field based method for the simultaneous automated characterization, manipulation, and assembly of nanowires (ACMAN) with selectable electrical conductivities into functional nanodevices. The ACMAN design is validated by precise control and assembling silicon nanowires into field-effect transistors (FETs) with desired electrical properties.

Biography:

Kaiyan Yu is an Assistant Professor in Mechanical Engineering Department at Binghamton University, NY, USA. She received the B.S. degree in Intelligent Science and Technology from Nankai University in Tianjin, China in 2010, and the Ph.D. degree in Mechanical and Aerospace Engineering from Rutgers University in Piscataway, NJ, USA in 2017. She joined Binghamton University in 2018. Her current research interests include autonomous robotic systems, motion planning and control, mechatronics, automation science and engineering with applications to nano/micro particles control and manipulation, Lab-on-a-chip and biomedical systems.