CPS: Small: Collaborative Research: Automated and Robust Nano-Assembly with Atomic Force Microscopes

Submitted by Xiaoping Qian on Thu, 04/07/2011 - 6:24pm

Project Details

Lead PI:	Xiaoping Qian
Performance Period:	09/15/10 - 08/31/14
Institution(s):	Illinois Institute of Technology
Sponsor(s):	National Science Foundation
Award Number:	1035844

1857 Reads. Placed 85 out of 803 NSF CPS Projects based on total reads on all related artifacts.

Abstract: The objective of this research is to develop an atomic force microscope based cyber-physical system that can enable automated, robust and efficient assembly of nanoscale components such as nanoparticles, carbon nanotubes, nanowires and DNAs into nanodevices. The proposed approach is based on the premise that automated, robust and efficient nanoassembly can be achieved through tip based pushing in an atomic force microscope with intermittent local scanning of nanoscale components. In particular, in order to resolve temporally and spatially continuous movement of nanoscale components under tip pushing, we propose the combination of intermittent local scanning and interval non-uniform rational B-spline based isogeometric analysis in this research. Successful completion of this research would lead to foundational theories and algorithmic infrastructures for effective integration of physical operations (pushing and scanning) and computation (planning and simulation) for robust, efficient and automated nanoassembly. The resulting theories and algorithms will also be applicable to a broader set of cyber physical systems. If successful, this research will lead to leap progress in nanoscale assembly, from prototype demonstration to large-scale manufacturing. Through its integrated research, education and outreach activities, this project will provide advanced knowledge in cyber-physical systems and nanoassembly for students from high schools to graduate schools and will increase domestic students? interest in science and engineering and therefore strengthen our competitiveness in the global workforce.

CPS Domains Medical Devices Design Automation Tools Modeling Health Care Resilient Systems CPS Technologies Foundations