

SINAM NANO SEMINAR

Center for Scalable and Integrated
Nano Manufacturing (SINAM) presents



Carbon Nanotubes as Molecular Machine Elements for Nano-scale Mechanical Devices

Prof. Martin Culpepper, M.I.T.

Friday, March 24, 2006

1:30 - 2:30 pm

3110 Etcheverry Hall

(Refreshments provided)

Abstract

Mechanisms are ubiquitous components of mechanical devices. Examples of macro-scale mechanisms are the links-bearings of robot arms and the links-joints of a bicycle derailleur. In the preceding decades, the ever-present pressures of miniaturization led to the creation of meso-scale and micro-scale mechanisms via lithographic-compatible processes and materials. Today we find the need to create smaller devices that require mechanisms comprised of bearings/links that are tens of nanometers in characteristic size. Unfortunately, lithographic techniques are not well-suited to create mechanical links/bearings of the desired size and relative accuracy. An alternative is to create the mechanisms from molecular machine elements such as Carbon nanotubes (CNTs). CNTs may be designed to serve as rigid links or compliant bearings. Combinations of rigid and compliant CNTs may be used to form nano-scale mechanisms. In this seminar, we will examine the results of research that aims to generate the design processes, design knowledge, and the supporting design tools required to engineer CNT-based mechanisms. We will examine how CNTs may be modeled and simulated as stiff or compliant machine elements and then discuss the design rules that govern how stiff and compliant CNTs may be combined to form mechanisms capable of large (relative to mechanism size) and complex motions.

About Prof. Culpepper

Prof. Culpepper received his BSME (1995) from Iowa State University, and his MS/PhD (1997/ 2000) from the Massachusetts Institute of Technology. He worked as an independent consultant from 2000 - 2001 in San Jose, Ca before joining the faculty at MIT. Prof. Culpepper is the recipient of an NSF Presidential Early Career Award (PECASE) for his work in Nanomanufacturing, two R&D 100 awards (1999, 2003), a TR100 award (2004), and a Joel and Ruth Spira Teaching Award. Prof. Culpepper is listed on seven patents issued/pending. He is the Assistant Director of the MIT Laboratory for Manufacturing and Productivity, Co-chair of the 2006 International Conference on Micromanufacturing, and Co-chair of the 2006 International Symposium on Nanomanufacturing.

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