CAD for Microelectromechanical Systems

Personnel

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Sponsorship

DARPA and Coventor

The goal of this project has been to create a CAD system that is directed toward mechanical and electromechanical aspects of microsystem design. The MIT-developed MEMCAD system has been licensed to Coventor, Inc. for commercial distribution. With the publication of this report, the MIT MEMCAD project will officially end.

Perhaps the most critical need in MEMCAD systems is the ability to construct low-order dynamic macro-models of device behavior that can be used in system-level simulators (such as SPICE), while maintaining consistency with the true behavior as represented by meshed simulation. The TCAD portion of the MEMCAD system generates the device shape based on masks and process information, and the device simulators evaluate responses to applied loads in a highly meshed, numerically intensive environment. At the system level, however, where it is desirable to connect the MEMS device into circuits, and to understand the effects of feedback, accurate and energetically correct low-order dynamical behavior models are needed, either in the form of equivalent lumped circuit models, or as a small number of coupled Ordinary Differential Equations (ODE's).

Our group has worked extensively on the use of modal and basis-function methods for creating dynamic reduced-order models. In a series of papers presented at recent conferences, Varghese has reported an extension to magnetic microsystems and to multi-electrode electrostatic microsystems of the Gabbay-developed CHURN method for using modal basis functions in nonlinear reduced-order-model extraction, and he has developed a robust extension of this method to the case where stress-stiffening of structures is important. His PhD thesis was completed during the Fall of 2001.