



**Southeastern Michigan Section  
"Chapter IV" Speaker Series  
Mon, Apr. 13, 2009, 5:00 pm  
Appetizers and Networking at 4:30 pm  
Room #1005, EECS Bldg,  
North Campus, University of Michigan  
1301 Beal Ave, Ann Arbor, MI**



## **A Methodology for Fast, Fully Coupled Electro-Mechanical Modelling of RF-MEMS Capacitive Switches**

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### **Abstract:**

We present a methodology for expediting the coupled electro-mechanical finite element of electrostatically-actuated MEMS devices, with particular emphasis placed on the important class of RF MEMS capacitive switches. More specifically, we propose a methodology for transforming the electrostatic boundary value problem that needs to be solved repeatedly during the mechanical deformation of the device into one on a fixed domain with fixed boundaries. The fixed domain is simply that of the device in the absence of actuation. Thus, the need for geometry update, new finite element mesh generation and finite element matrix decomposition during mechanical deformation is eliminated. We achieve this through the definition of an equivalent electrostatic boundary value problem on the fixed domain with boundary conditions properly modified for its solution to recover accurately the electrostatic field in the deformed configuration. The proposed methodology is demonstrated through several case studies involving different geometries of RF MEMS capacitive switches.

### **Speaker's Biography:**

Andreas Cangellaris is M. E. Van Valkenburg Professor in the Department of Electrical and Computer Engineering, at the University of Illinois, Urbana-Champaign. Professor Cangellaris received his Diploma in Electrical Engineering from the Aristotle University of Thessaloniki, Greece, in 1981, and the MS and PhD degrees in Electrical Engineering from the University of California, Berkeley, in 1983 and 1985. Professor Cangellaris has spent over twenty years in academia, first at the University of Arizona (1987-1997) and then at the University of Illinois (1997 – to date). Professor Cangellaris' current teaching and research interests include computational electromagnetics; CAD methodologies and tools for signal and power distribution network design in high-speed/high-frequency electronics; EMI/EMC modeling and simulation; and techniques for MEMS CAD. He is Fellow of IEEE and serves Editor of the IEEE Press Series on Electromagnetic Field Theory. In 2005 he received the Alexander von Humboldt Research Award from Germany for his contributions to engineering applications of electromagnetic field theory.

**Public Invited**

Appetizers and Networking at 4:30 pm