



MMAE SEMINAR

**WEDNESDAY, April 12, 2006
E-1 BUILDING – CRAWFORD AUDITORIUM
3:30 – 4:30 PM**

Cellular Structures: A New Material Mesostructure for Multifunctional Applications

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Low-density cellular materials - metallic bodies with gaseous voids - are a unique class of materials that have high strength and stiffness, good energy absorption characteristics, good thermal and acoustic insulation properties, and, if designed properly, low mass. Often, several of these characteristics can be designed into a cellular material, enabling multifunctionality. Significant improvements in performance have been realized with cellular structures, as compared to monolithic materials, when cell sizes are meso-scale – about 0.05 to 5 mm. Unfortunately, current cellular material manufacturing processes severely limit a designer's ability to control the part mesostructure, the material composition, and the overall part shape and properties.

In this talk, I explain and motivate cellular materials. A new analysis model for lattice structures is presented that captures geometric and material nonlinearities. A synthesis method is presented that utilizes the analysis model for designing stiff structures, as well as compliant mechanisms. Additive manufacturing (AM) technologies (known as “rapid prototyping” processes) have unique capabilities that enable the manufacture of cellular materials. We explore how these capabilities can be applied to examples of automotive components, robot arms, joint replacements, and morphing wings.

David Rosen is a Professor in the School of Mechanical Engineering at the Georgia Institute of Technology. He is Director of the Rapid Prototyping & Manufacturing Institute at Georgia Tech. He received his Ph.D. at the University of Massachusetts in 1992 and his Masters and Bachelors degrees from the University of Minnesota in 1987 and 1985, respectively, all in mechanical engineering. His research interests include computer-aided design, rapid prototyping, and design methodology. During his graduate school years, he was a software engineer at Computervision Corp. and a Visiting Research Scientist at Ford Research Laboratories. He is a Fellow of ASME and recently served on the ASME Computers and Information in Engineering Division Executive Committee.