



Seminar



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Mechanics of soft composites: Patterns, instabilities and deployable structures

The design of new materials has recently started considering composite materials with soft components, since there are several applications that can take advantage of their flexibility and nonlinear mechanical response. In this talk, I will focus on two examples of this trend. First, a composite in which stiff carbon fibers are embedded in a soft elastomeric matrix. Elastic fiber microbuckling allows thin sheets made with this material to be folded to virtually zero radius while retaining their tensile stiffness, which makes them interesting as components in deployable structures for aerospace satellites. A combination of experiments and simulations will be used to characterize the micro mechanics of this composite, and provides accurate estimates for its mechanical response and failure properties. Second, I will present a study of the different self-organized patterns that result from the wrinkling of elastic bilayers under compression. By controlling the material properties and the geometry of the problem, the instabilities range from dimples to high-aspect ratio ridges. I will show how these patterns offer an experimental system to explore and model different physical phenomena, from curved crystals to the growth of biological tissue, as well as a technique to design materials with enhanced functionality, such as tunable optical transparency.

Monday, February 22, 2016
12:00 noon
Onizuka Conference Room

Bio: Francisco López Jiménez earned his BSc in Mechanical Engineering from the University of Seville (Spain), and a MSc in Aerospace Engineering and a PhD in Aeronautics from Caltech. His PhD thesis focused on the experimental and computational study of fiber composites for deployable space structures. He then completed postdoctoral research at the Laboratoire de Mécanique des Solides in École Polytechnique (Palaiseau, France), studying instabilities in cellular solids. He is currently a postdoctoral associate at the Elasticity, Geometry and Statistics Laboratory at MIT, where he focuses on the mechanics of soft solids. His research interests lie in the intersection of composite materials, lightweight structures and soft solids, with focus on their instabilities and nonlinear mechanics.