Mechanics and Mathematics of (soft) Materials and Structures @ DISG

Stefano Vidoli

Quasi-static and dynamic actuation of multistable shells

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Abstract

A suitable anisotropy and the presence of prestresses can lead a sufficiently curved shell to possess multiple distinct stable configurations. Similar nonlinear effects recently raise a growing scientific interest, ranging from the analysis of biological systems to the design of morphing structures. After discussing the production of simple prototypes for multistable shells, we focus on the problem of their actuation.
In particular, the case of thin "bending dominated" shells is examined, where the variations of elastic energy are quite small. It is shown that the nonlinear problem of determining the shell stable equilibria has a simple geometric interpretation, being equivalent to the problem of finding all the points on a three-dimensional cone having minimal distance from a given point. This simple interpretation has allowed to experimentally drive the actual configuration of a multistable shell between its stable equilibria avoiding any snap-through phenomenon.

Short BIO

Stefano Vidoli is Associate Professor in Structural and Solid Mechanics (ICAR/08) at Dipartimento di Ingegneria Strutturale e Geotecnica of SAPIENZA University of Rome. He received a PhD in Theoretical and Applied Mechanics in 2000 in the same university. He has been the first recipient of the AIMETA Junior prize in Structural Mechanics and he is currently an invited member of the d'Alembert Institute at UPMC, Paris.

His research interests include morphing structures, plate and shell theories, variational approaches to fracture mechanics.

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