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10 rue Vauquelin, 75231 Paris Cedex 05

Séminaire PMMH

Bureau d'Études, Bâtiment L, 2 ème étage

Vendredi 20 mai 2016, 11h00-12h00

Ryan Hayward

Polymer Science and Engineering
University of Massachusetts Amherst

Folding gels and shells : Origami-based design of reconfigurable 3D structures and 'mechanical meta-materials'

Centuries of artistic tradition, coupled with recent advances in the mathematics and mechanics of folded structures, have made origami a powerful method for the design of materials with reconfigurable shapes and tailored mechanical properties. Inspired by these possibilities, our group has studied the design and fabrication of patterned elastic films and shells capable of undergoing controlled shape transitions. In a first example, we focus on the design of complex and small-scale self-folding structures. Using a trilayer design consisting of patterned rigid plastic films sandwiching a stimuli-responsive hydrogel core, we have demonstrated the formation of reversibly self-folding structures with characteristic fold dimensions as small as several tens of micrometers, and containing hundreds of crease segments. By considering the competition in elastic bending energy between the hinges and the panels, we have characterized the hysteretic folding of a simple non-rigidly foldable design based on the well-known 'square twist' origami. In a second effort, we have studied the folding of curved elastic shells. A simple geometric design rule based on the normal curvature of the crease line is found to describe the continuity of folding, enabling snap-through folding transitions for a variety of shell geometries. Finally, we consider the multi-stability of corrugated tubes, inspired by the remarkable reconfigurability of 'bendy straws' and related structures.

Prochain séminaire : vendredi 27 mai, Philippe Marmottant (LIPhy, Grenoble)
Programme des séminaires : www.pmmh.espci.fr, onglet *Séminaires PMMH*
Contact : Antonin Eddi, Sylvain Patinet, Étienne Reyssat, seminaires@pmmh.espci.fr