Yi-Chao Chen: Elastic stability, the energy criterion, and bifurcation theory

Despite tremendous progress in elastic stability since Euler's pioneering 1744 work on elastic curves, some fundamental questions remain open, and new issues of conceptual importance continue to emerge. In this talk, we briefly discuss two such questions, namely the justification of the minimum energy principle from dynamics, and the relation between stability and bifurcation.

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John Biggins: Wrinkling, creasing and fingering in soft elastic layers

I will discuss two large-deformation instabilities in soft elastic layers, using a combination of numerics and approximation. In the first a thin layer lies between two rigid plates, and a fluid is pumped into a cavity in the layer. When a critical pressure is reached, fingers of the fluid suddenly protrude into the layer. The fingering transition is reversible and purely elastic. In the second instability, the layer is bonded to an infinite substrate, and then is induced to grow or swell. This leads to wrinkling of the layer if it is stiffer than the substrate, and cusped creasing of the layer if it is much softer than the substrate. I will discuss the transition between these two regimens, and link the complex patterns that form in 3D to the patterns of sulci found on the human brain.

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Peter Palffy-Muhoray: Dam deception: the magic of elasticity

We examine the physics behind the ‘coin through the rubber’ trick; an impressive demonstration of conjuring, well known to close-up magicians and a favorite of Martin Gardner. The phenomenon is based on an elastically stabilized invagination in a thin sheet of isotropic rubber. We model the process using both Hookean and neo-Hookean descriptions, and identify the conditions for stability. The magic happens when stability is lost.

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Basile Audoly: Elastic ribbons: models and stability

We consider the equilibrium shapes of an elastic ribbon, i.e. a solid whose thickness is much smaller than its width, and whose width is much smaller than its length. A ribbon can be obtained by cutting out an annular region in a piece of paper, or by closing a metallic strip in a loop. We demonstrate some instabilities that can be obtained with such ribbons. To describe these instabilities, we establish a 1D model governing the equilibrium of elastic ribbons. This model is derived from a plate model in the limit of small width, and appears to be a special type of elastic rod model. Next, we carry out stability analyses and show that we can account for the shapes obtained in experiments. This work has been done in collaboration with Marcelo Dias and Keith A. Seffen.