dynamical snap-through of a buckled beam

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Abstract

Slender structures can undergo different forms of mechanical instabilities. For a long time they have been regarded as detrimental–one would rather not use a bridge that buckles! (1)–, but over the last 20 years this opinion have shifted. These events can indeed create large and rapid deformation which can be harnessed in numerous systems. Snap-through buckling is a particular form of mechanical instability in which a multistable system brutally goes from one stable state to another one. Venus flytraps are known to utilise this instability to swiftly close their leaves and capture their prey (2). Snap-through of buckled beams are also more and more used in flexible mechanical metamaterials to generate various forms of nonlinear waves (3). While the features of this instability are fairly well understood when the control parameter is varied in a quasistatic manner (4,5), the picture becomes less clear when its variation is dynamic. Yet, not only is this dynamical approach more relevant to real case scenarios, it might also provide additional levers to control the instability.

In this talk, I will discuss the effect of dynamical actuation on the snap-through instability of a buckled beam. We studied a model experiment in which the clamp angle of one end is swiftly varied below the static critical angle. While conceptually simple, this experiment allows us to see a strong effect of the dynamics on the deformation of the beam and on the snap-through threshold.

chronophotography a buckled beam undergoing a snap-through instability

References

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