Curvy cuts: Programming axisymmetric kirigami shapes

Supplementary document

Marie Tani[1], Joo-Won Hong[2], Takako Tomizawa[3], Étienne Lepoivre[2], José Bico[2], and Benoît Roman[2]

[1]Department of Physics, Kyoto University, Kyoto, Japan
[2]Physique et Mécanique des Milieux Hétérogènes (PMMH), ESPCI Paris, PSL University, CNRS, Sorbonne Université, Université Paris Diderot, Paris, France
[3]Department of Physics, Ochanomizu University, Tokyo, Japan

Inflating kirigami structures

In the experiment described in Figure 6, a rubber balloon inserted in the kirigami structure is progressively inflated by the means of a manual pump. Each inflation introduces a volume of $35\,\mathrm{cm}^3$ (taken at atmospheric pressure). The evolution of the inner pressure of the balloon (with respect to the atmospheric pressure) and the vertical extension of the structure are monitored as a function of the input volume. Due to the finite compressibility of air, the actual volume of the inflated balloon is slightly lower than the input volume. The case of a free balloon is presented as a reference. The design cut corresponds to the "Dc" configuration used to generate a cone with a PET sheet of thickness $100\,\mu\mathrm{m}$. The kirigami structure breaks above a maximum volume (which is far from the volume a free balloon can sustain).

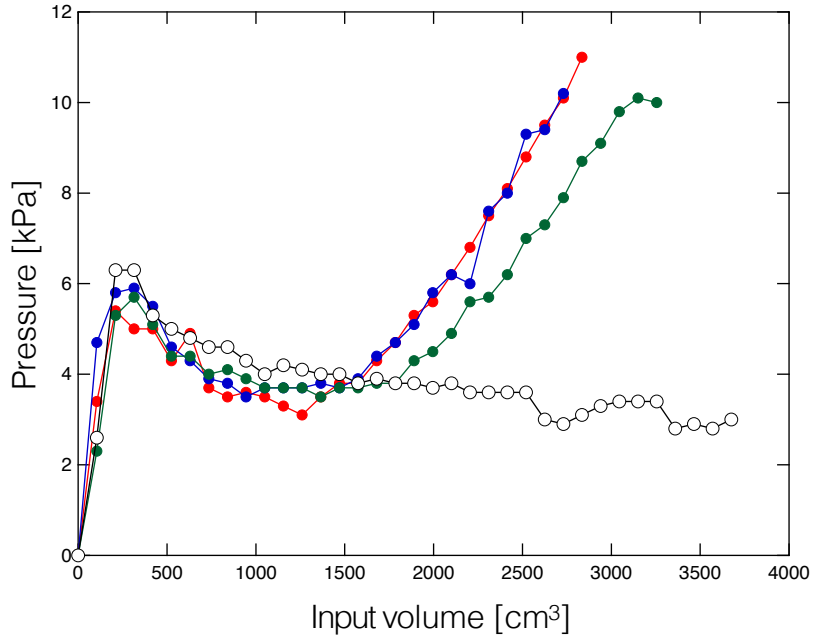

Figure 1: Evolution of the pressure in the balloon as a function of the input volume. Colored circles correspond to experiments conducted with different specimens of the same design. The reference experiment with a free balloon is represented with open circles.

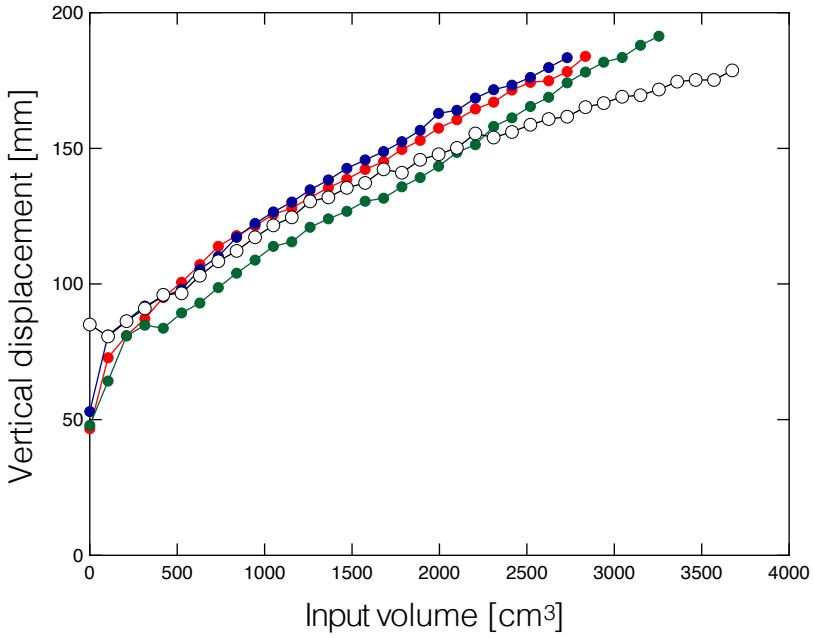

Figure 2: Evolution of the vertical displacement of the structure as a function of the input volume. Colored circles correspond to experiments conducted with different specimens of the same design. The reference experiment with a free balloon is represented with open circles.

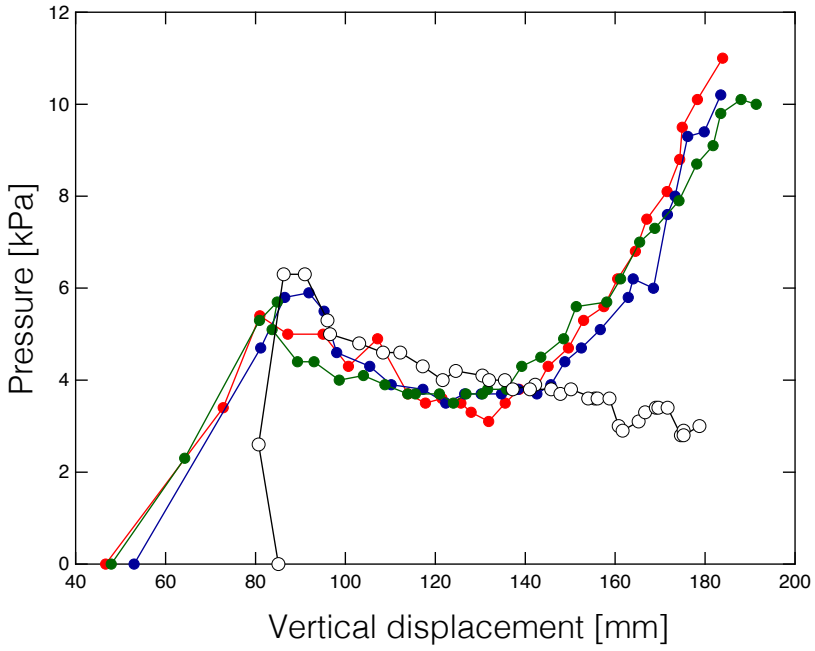

Figure 3: Pressure in the balloon as a function of the vertical displacement of the structure. Colored circles correspond to experiments conducted with different specimens of the same design. The reference experiment with a free balloon is represented with open circles.