Buffering by Buckling' allows Shape Change in Thin Materials

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Abstract

It is much easier for thin elastic objects to deform by bending, rather than stretching. On thisbasis, the deformations of such soft solids are often understood to be limited to deformationsthat do not require changes of length: isometries. Thanks to Gauss' Theorema Egregium, suchdeformations are required to maintain a constant Gaussian curvature – a flat sheet of paper (zerocurvature) cannot be deformed to wrap a sphere (positive curvature).
In the last decade, however, a number of examples of deformation modes that appear to breakthis constraint have emerged. In each case, apparent changes in Gaussian curvature are allowedbecause the apparent changes in length that are required are 'buffered' by buckling at a finescale. Prominent examples include the use of buckled Polyimide bridges between stiff elementsin curvilinear[4] and flexible[1] electronic devices. In these examples, bridges occur at predesignedsites. However, buffering by buckling may also occur spontaneously through theformation of delamination blisters[2] or wrinkles[3]. I will present detailed studies ofspontaneous buffering by buckling through wrinkling and delamination, presenting both newresults and new interpretations of old results. I will also discuss the conditions under which spontaneous buffering by buckling may occur.

References

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