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# How Curvature Governs the Snap-Through Dynamics of a Bi-Stable Arch

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## Abstract

Recent research on the snap-through buckling of elastic structures has undergone a paradigm shift, transitioning from the classic "buckliphobic" approach of determining buckling loads to avoid catastrophic failure to a "buckliphilic" approach of using shape transitions to enable novel modes of functionality. While static buckling loads and linearly stable configurations are well-documented for the former, the dynamic behaviour critical to the latter remains underexplored. In this work, we consider a compressible bi-stable circular arch under a central load, which acts as the controlling parameter to trigger snap-through. Using a combination of finite-element analysis and multiple-scales asymptotic methods, we characterise the dynamic behaviour of this system during snap-through transitions. Our findings reveal how the nature of the snap-through bifurcation, the total time of snapping, and the evolution of the snap-through event can be tuned via changing the curvature of the arch. Specifically, we show how increases in the curvature of the system can dramatically prolong the time taken for the structure to snap through. These results provide new insights into the dynamic nature of snap-through instabilities and highlight potential engineering applications for thin curved structures.

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