# Analytical and experimental study of snap-through instability in truss structures

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Equilibrium and stability of truss structures are often analyzed considering only geometric nonlinearities. However, the assumption of linear elastic material is not consistent with the response of solids subjected to large deformations. Therefore, an accurate model should take into account both geometric and constitutive nonlinearities. In this contribution, we consider a two-bar truss composed of rubber bars and subjected to a vertical load. The highly deformable material allows observing large displacements and deformations. We present a theoretical model that is entirely developed in three-dimensional finite elasticity [1]. The nonlinear constitutive behavior of the rubber is simulated using the Mooney-Rivlin law, whose parameters are identified by fitting experimental data from uniaxial tests. Experiments are carried out and snap-through instability is observed. A simple formulation to determine the critical Eulerian buckling load of the truss is presented and its accuracy is validated through experimental observation [2]. Comparisons with a linear elasticity based approach demonstrate that an accurate prediction of snap-through and Eulerian buckling requires nonlinear formulations, such as the ones proposed in this work.

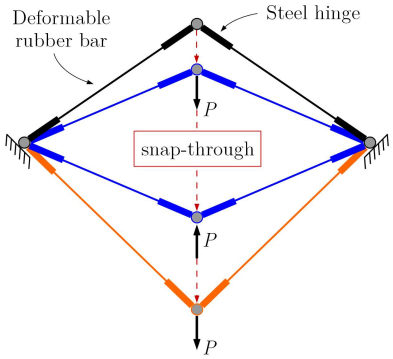


*Fig. 1: The von Mises (or two-bar) truss subjected to a vertical load*

*References*

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*[2] Falope, F. O., Pelliciari, M., Lanzoni, L., & Tarantino, A. M. (2021). Snap-through and Eulerian buckling of the bi-stable von Mises truss in nonlinear elasticity: A theoretical, numerical and experimental investigation. International Journal of Non-Linear Mechanics, 134, 103739.*