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NONLINEAR BEHAVIOR AND INSTABILITY OF SOFT STRUCTURES 1900

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ABSTRACT

Detecting stability of the equilibria of compliant structures as well as other nonlinear mechanical systems has long track record in the history of solid mechanics [1].

Stability analysis enables one to understand the natural forms of soft objects. Control, and active stabilization play central roles both in biological systems and in soft robotics. Apparently, instability and bifurcations are also fundamental mechanisms of biological growth and development [2].

Linear stability analysis and Lyapunov characterization of equilibria in finite degree-of freedom systems are traditional tools of stability analysis. Far less is known about continuous systems characterized by nonlinear partial differential equations. The widely applied variational and/or perturbational techniques to verify stability are mostly numerical with some discretized approximation of the system [3]. Rigorous results regarding the original, continuous systems are scarce.

At the same time, many important phenomena, such as geometric and material nonlinearity in finite elasticity, stability under non-conservative loads, quasi-static growth, and non-smooth effects including (self-)contact and friction lead to new and open questions.

Motivated by the theoretical and practical challenges in the field, this minisymposium targets to discuss numerical, analytical, and possibly experimental results about stability and instability phenomena in compliant structures, with a focus on biological and engineering applications.

REFERENCES

[1] Antman, S. *Nonlinear Problems of Elasticity*. 2nd ed. Springer, (2004).

[2] Goriely, A. *The mathematics and mechanics of biological growth*. Springer, (2017).

[3] Hirsch, M.W., Smale S. and Devaney R.L. *Differential Equations, Dynamical Systems, and an Introduction to Chaos*. 3rd. ed. Academic Press, (2013).