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# Computational Stability Analysis of Soft Active Materials across Scales

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We discuss microscopic and macroscopic instability phenomena of soft active elastomers with periodic microstructure based on numerical simulations. In this connection, the overall properties of the heterogeneous materials are determined via finite-element based computational homogenization of representative volume elements [1,2]. In this framework, localization-type macroscopic instabilities are detected by checking strong ellipticity of homogenized moduli [3]. At the microscopic scale, we determine bifurcation-type instabilities via finite-element based Bloch-Floquet wave analysis [4]. The latter allows to find altered periodicities of representative microstructures together with critical macroscopic loading points [5]. Some numerical examples will highlight the applicability of the developed scheme for the detection of multiscale instability phenomena of soft active elastomers.

## REFERENCES

[1] K. Danas, Effective response of classical, auxetic and chiral magnetoelastic materials by use of a new variational principle, *J. Mech. Phys. Solids*, 105:25-53, 2017.

[2] M.-A. Keip and M. Rambausek, Computational and analytical investigations of shape effects in the experimental characterization of magnetorheological elastomers, *Int. J. Solids Struct.*, 121:1-20, 2017.

[3] A. Goshkoderia and S. Rudykh, Stability of magnetoactive composites with periodic microstructures undergoing finite strains in the presence of a magnetic field, *Comp. B Eng.*, 128:19-29, 2017.

[4] K. Bertoldi and M. Gei, Instabilities in multilayered soft dielectrics, *J. Mech. Phys. Solids*, 59:18-42, 2011.

[5] E. Polukhov, D. Vallicotti and M.-A. Keip, Computational stability analysis of periodic electroactive polymer composites across scales, *Comput. Mech. Appl. Mech. Eng.*, accepted for publication, 2018.