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# MECHANICS OF SOFT, RESPONSIVE MATERIALS: EXPERIMENT, MODELING AND SIMULATION

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## ABSTRACT

The last years have seen an upsurge in research and development of soft, responsive materials that react mechanically on applied non-mechanical stimuli. Prominent examples are magnetorheological elastomers, electroactive polymers and hydrogels, only to name a few. The mentioned materials undergo large deformations under the application of electric and magnetic fields as well as under the action of solvents, respectively. Their multifunctional properties make them prototype candidates for innovative techanical applications reaching from large-displacement actuators over smart sensing devices to synthetic soft tissues in flexible electronics.

Most of the mentioned materials reach their full potential because of their unique microstructure. Associated material properties could thus be optimized by materials design. In case of magneto- and electro-active composites, microstructures are usually composed of a soft

matrix and embedded inclusions. From a theoretical and computational viewpoint, this calls for the development of homogenization schemes in order to provide a-priori knowledge of the composite's effective properties. Associated techniques must be based on thorough constitutive models and robust numerical implementations in order to reveal insights into the highly nonlinear and coupled interactions at micro- and macrolevel. At the same time, the further advancement of experimental techniques allowing for precise and reliable validation and testing is paramount.

A special feature of soft, responsive materials that has attracted particular attention recently is that they become unstable in certain loading ranges. The resulting instability phenomena could, for example, be harnessed to arrive at very large deformations under rather small applied fields, making materials ready for even more efficient actuation and sensing purposes.

The goal of this minisymposium is to bring together researchers from experiment, modeling and simulation in order to discuss recent advancements and new directions in the field. Topics of interest include:

- Electro- and magneto-active elastomers
- Responsive gels (hydrogels, ionic polymers, …)
- Liquid crystal elastomers and gels
- Experimental testing and validation
- Constitutive modeling and numerical simulation
- Multiscale approaches and homogenization
- Material and structural instabilities
- Materials design of soft solids

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