UNRAVELING THE MECHANICAL RESPONSE OF SOFT MATERIALS – INELASTICITY AND BEYOND

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Keywords: soft materials, experimental studies, inelasticity, fracture and failure, computational modeling.

ABSTRACT

Soft materials, such as hydrogels and certain elastomers, exhibit remarkable mechanical properties, including the ability to undergo extremely large deformations - up to several hundred percent - before failure. These unique characteristics enable emerging cutting-edge applications in the fields of soft robotics and tissue engineering, driving a significant surge in research efforts devoted to unraveling the complex mechanical behavior of these extraordinary materials. These studies span a wide range of phenomena, from bulk inelastic effects to the intricate mechanics of fracture in soft solids. This mini-symposium aims to provide a platform to discuss recent advances and current challenges concerning the mechanical response of soft materials, with emphasis on both experimental and computational modeling approaches. Topics of interest to the mini-symposium include but are not limited to the following:

- **Development of constitutive models** capable of accurately capturing bulk inelastic effects, such as viscoelasticity and viscoplasticity
- **Modeling of fracture** including crack propagation as well as crack nucleation and their interaction with bulk inelastic effects - sharp crack modeling approaches (e.g., XFEM), diffuse crack/damage models (e.g., phase-field methods, gradient damage models), etc.
- **Robust numerical schemes** for handling large deformations, particularly in cases involving fracture or instability-causing phenomena such as wrinkling
- **Machine learning or data-based methods** to enhance the fidelity and/or computational efficiency of conventional phenomenological continuum modeling approaches
- **Novel experimental methods** focused on probing the multi-faceted mechanical response of soft solids – including both bulk inelastic and fracture phenomena; e.g. – advanced-imaging techniques, in-situ experiments under complex loading conditions etc.

This mini-symposium is being organized under the aegis of the **SoftFrac** project funded by the European Research Council. For further details, kindly visit: www.softfrac.research.fau.eu