Computational Micromechanics Laboratory

Fall 2021 Seminar Series #02

On the fitting performance of invariant and dispersion-type anisotropic hyperelastic constitutive models for soft biological tissues

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ABSTRACT

The heterogeneity of biological tissues, often due to an uneven distribution of fibres throughout the ground matrix, results in experimentally observed anisotropy, i.e. they present different properties depending on the direction of loading. Soft biological tissues also display hyperelastic behavior when stretched above their linear region. Here we review nine anisotropic hyperelastic constitutive models for biological tissues based on their fitting performance to three different human tissues. We used a hybrid multi-objective optimization procedure. A genetic algorithm is devised to generate the initial guesses followed by a gradient-based search algorithm. The constitutive models are fitted to various experiments having either different deformation states and/or orientation direction. Accordingly, models are ranked with respect to an objective normalized quality of fit metric.

BIOGRAPHY

Alp Kağan Açan holds a Bachelor's degree from the Department of Mechanical Engineering at Izmir Institute of Technology in Izmir. Upon completing his Bachelor's study in 2018, Alp enrolled in the Mechanical Engineering Master's degree program at Middle East Technical University where he performed the Master's thesis study under the supervision of Assoc. Prof. Dr. Hüsnü Dal. He received his M.Sc. degree in 2021 with the thesis entitled "A comparative study on anisotropic hyperelastic models of biological soft tissues".