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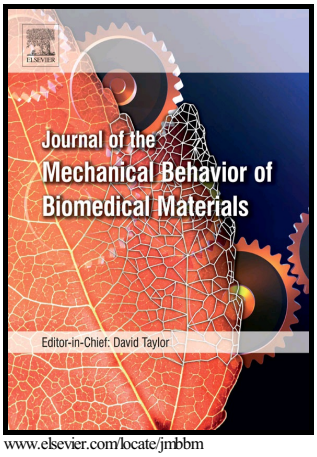

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A model of human skin under large amplitude oscillatory shear

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Abstract

Skin mechanics is of importance in various fields of research when accurate predictions of the mechanical response of skin is essential. This study aims to develop a new constitutive model for human skin that is capable of describing the heterogeneous, nonlinear viscoelastic mechanical response of human skin under shear deformation. This complex mechanical response was determined by performing large amplitude oscillatory shear (LAOS) experiments on ex vivo human skin samples. It was combined with digital image correlation (DIC) on the cross-sectional area to assess heterogeneity. The skin is modeled as a one-dimensional layered structure, with every sublayer behaving as a nonlinear viscoelastic material. Heterogeneity is implemented by varying the stiffness with skin depth. Using an iterative parameter estimation method all model parameters were optimized simultaneously. The model accurately captures strain stiffening, shear thinning, softening effect and nonlinear viscous dissipation, as experimentally observed in the mechanical response to LAOS. The heterogeneous properties described by the model were in good agreement with the experimental DIC results. The presented mathematical description

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