6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

# MULTI-SCALE MECHANICS OF THE FATIGUE BEHAVIOR OF SOFT FIBROUS TISSUES

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**Keywords**: *Collagen, Damage, Fatigue, Multi-scale model*

This contribution presents a multi-scale constitutive model[**?**] describing the long-term damage of collagenous tissues under cyclic loading. Focusing on the interplay between different length-scales and basing on experimental findings, two main damage mechanisms are proposed: Failure of the hydrogen bonds inside the tropocollagen molecule, leading to local defects of the collagen fibril, and bond-reduction of the interfibrillar matrix.

Adhesive debonding depends on the force-time history [1] and results in irreversible damage even under physiological loading conditions, when growth and remodelling are disregarded. The proposed model aims to give more insight to the mechanical phenomena of collagen turnover. The entropic and energetic contributions [3] of single tropocollagen molecules are considered utilizing the extendible worm-like chain formulation [4].

All material parameters of the proposed model have a clear physical meaning. The model has been validated using experimental data obtained by uniaxial tension tests until rupture and uniaxial fatigue tests with 1 000 load cycles [2]. Good agreement between the experimental data and the model predictions was observed.

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