

Mechanical Characterization of Porcine Skin with the Finite Element Method Based Inverse Optimization Approach

Authors : Djamel Remache, Serge Dos Santos, Michael Cliez, Michel Gratton, Patrick Chabrand, Jean-Marie Rossi, Jean-Louis Milan

Abstract : Skin tissue is an inhomogeneous and anisotropic material. Uniaxial tensile testing is one of the primary testing techniques for the mechanical characterization of skin at large scales. In order to predict the mechanical behavior of materials, the direct or inverse analytical approaches are often used. However, in case of an inhomogeneous and anisotropic material as skin tissue, analytical approaches are not able to provide solutions. The numerical simulation is thus necessary. In this work, the uniaxial tensile test and the FEM (finite element method) based inverse method were used to identify the anisotropic mechanical properties of porcine skin tissue. The uniaxial tensile experiments were performed using Instron 8800 tensile machine®. The uniaxial tensile test was simulated with FEM, and then the inverse optimization approach (or the inverse calibration) was used for the identification of mechanical properties of the samples. Experimentally results were compared to finite element solutions. The results showed that the finite element model predictions of the mechanical behavior of the tested skin samples were well correlated with experimental results.

Keywords : mechanical skin tissue behavior, uniaxial tensile test, finite element analysis, inverse optimization approach

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