INSTITUT FÜR MASCHINENELEMENTE
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TU BERGAKADEMIE FREIBERG
TUBAF
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Seit 1765.

Master thesis!

Finite Element Modeling of History-Dependent Hygro-Thermo-Mechanical Behavior of Leather

Motivation

Within the framework of ongoing research activities in computational science and material modeling, a finite element model for the coupled thermo-hygro-mechanical behavior of leather is being developed. Leather is a highly nonlinear collagen-based material exhibiting irreversible shrinkage, stiffness evolution, and history-dependent mechanical response under cyclic thermal and humidity loading.

Conventional material models are often unable to accurately capture these coupled mechanisms, particularly under varying environmental conditions. Therefore, advanced constitutive formulations and user-defined material implementations are required for predictive finite element simulations.

The objective of this work is the numerical investigation and further development of a user-defined constitutive material model implemented in Altair Radioss. The focus lies on the finite element representation of irreversible shrinkage behavior, stiffness evolution, and reaction force under coupled environmental conditions.

The thesis is entirely computational and does not require experimental work.

Taks:

- Understanding and analysis of history-dependent material behavior
- Investigation of irreversible shrinkage mechanisms
- Implementation of a user-defined material model (Fortran-based) in Altair Radioss.
- Investigation of material parameter sensitivity and loading-history effects
- Documentation of the work in the form of a scientific thesis Documentation (Master thesis)

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