

Master Thesis or Project Work

FEM-Based Modelling and Component-Level Simulation of Leather for Automotive Applications

Motivation

Leather used in automotive applications is exposed to seasonal variations in temperature and humidity, which can cause shrinkage, expansion, and permanent dimensional changes over time. These environmental changes can cause thermal and hygroscopic deformation, permanent shrinkage, and changes in mechanical response. When leather is attached to a rigid or semi-rigid component, these deformations can generate stresses and forces at the interfaces and may lead to local deformation or failure.

A user-defined FEM material model for leather is available and shall be further investigated and validated at the component level.

Taks:

- **Material Model Investigation** – Understand and evaluate the thermo-hygro-mechanical leather material model.
- **Parameter Sensitivity Analysis** – Study the influence of key material parameters on deformation, stress, force, and shrinkage.
- **Component FEM Simulation** – Simulate leather attached to a representative component under temperature and humidity cycles.
- **Dashboard Panel Simulation** – Apply the FEM model to a real automotive dashboard panel and identify critical stress/deformation regions.
- **Validation and Evaluation** – Compare FEM results with experiments and assess the accuracy and limitations of the model.
- Documentation (Master Thesis)

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