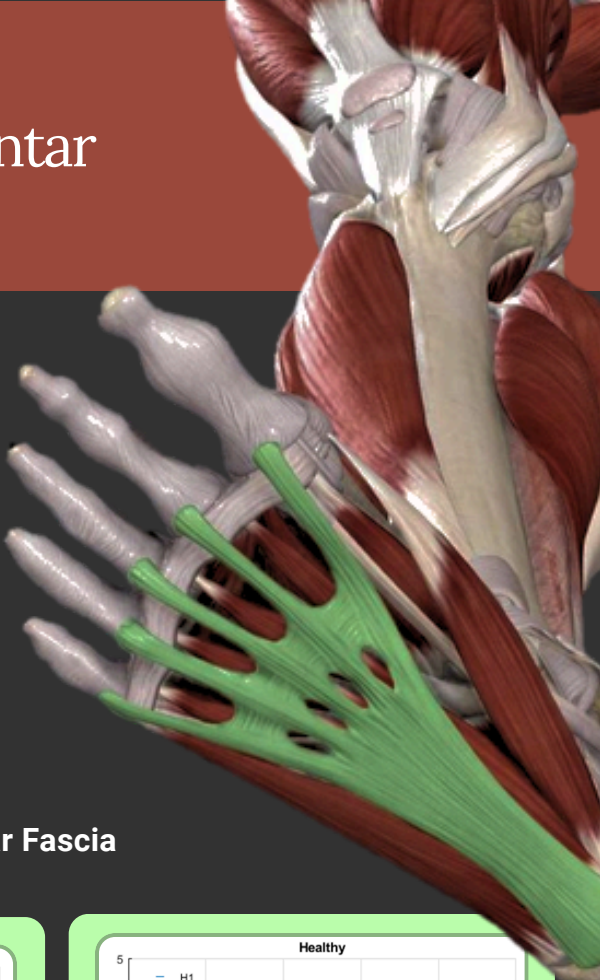# Comparative Analysis of Constitutive Models for Plantar Fascia Tissue

Summary

The plantar fascia connects the heel with the toes and supports the arch of the foot. Diabetes and plantar fibromatosis affect its biomechanical properties. This study fits hyperelastic models to simulate force-displacement curves in healthy and affected individuals. Through numerical simulations, structural responses under different loading conditions were compared between the affected groups and the healthy ones, obtaining fitting errors ranging from 1.12% to 16.28%.

Methodology
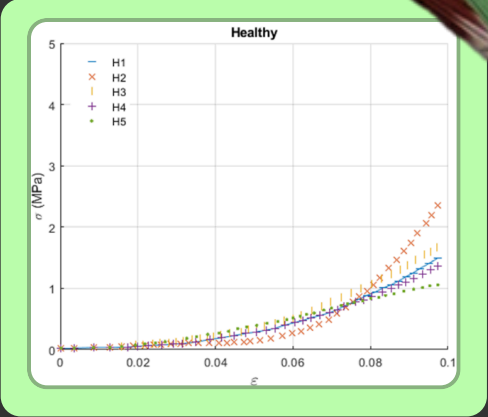
2.1 Mechanical Properties of the Plantar Fascia
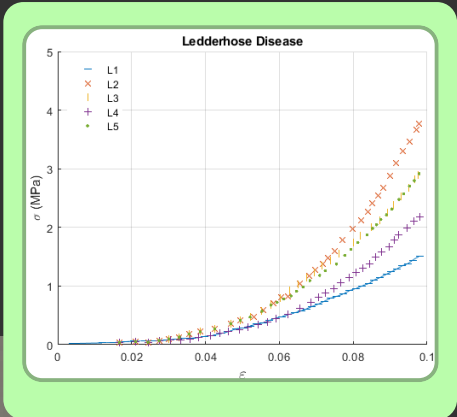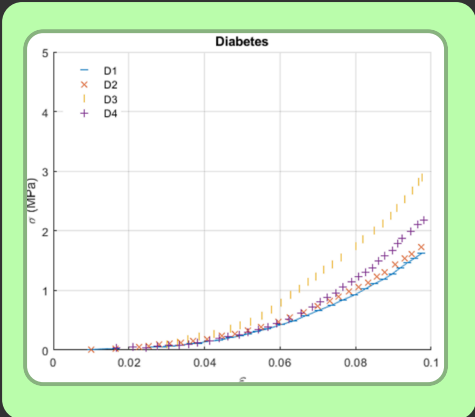
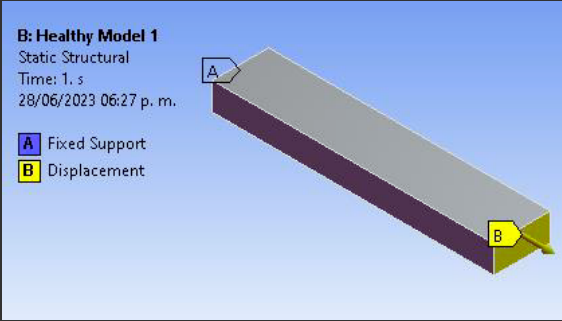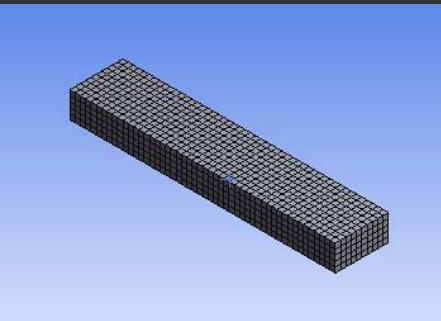a)   b)   c)

Results of the tensile tests for PF (plantar fascia) of subjects with (a) Ledderhose disease (plantar fibromatosis), (b) diabetes, and (c) healthy, the results are reported in terms of nominal stress σ vs. strain ε.

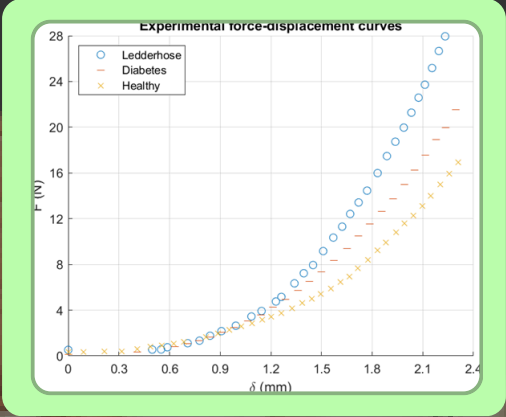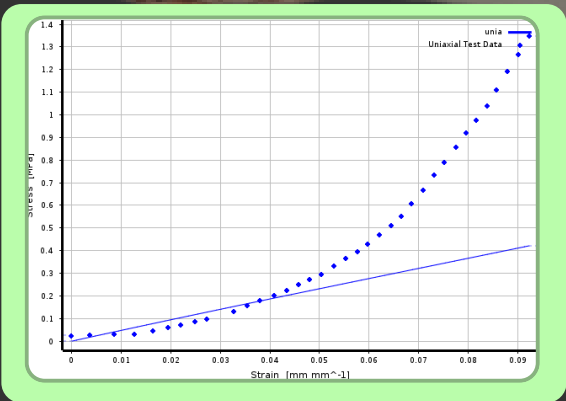### 2.2 Modeling CAD-CAE

a)   b)

Finite element model, (a) boundary conditions, and (b) model mesh.
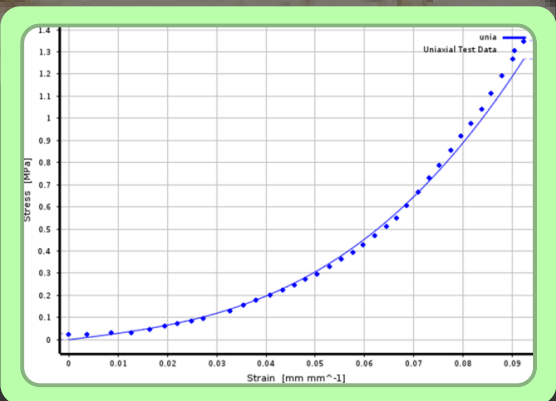

Force vs. displacement curves with experimental data for the cases of LD (Ledderhose Disease), diabetes, and healthy.

2.3 Hyperelastic Material Modelss

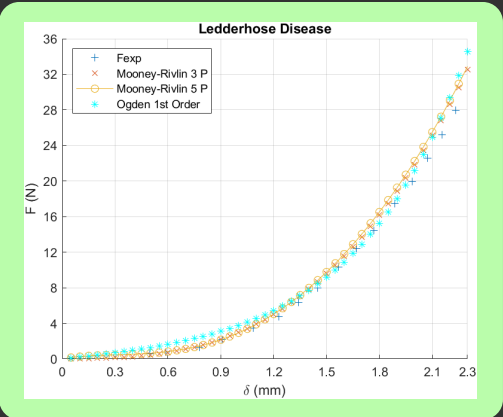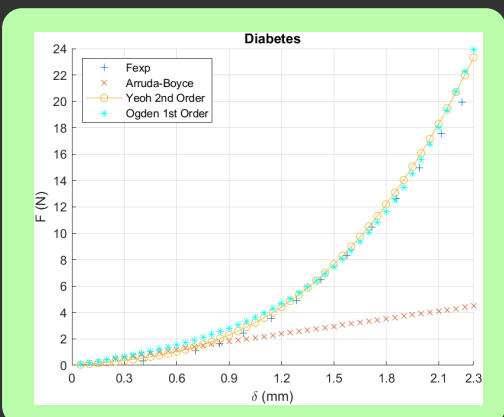a)   b)

Hyperelastic fitting with the methods (a) Arruda-Boyce and (b) Yeoh 2nd Order.

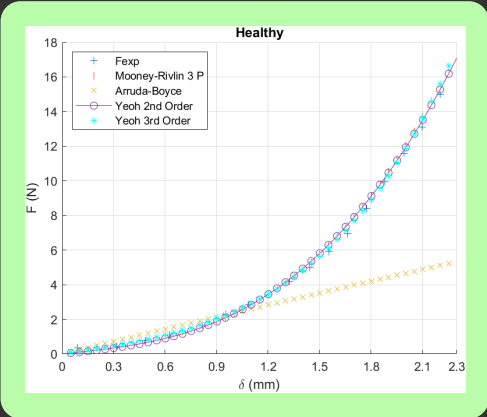## Results

a)   b)   c)

Experimental and simulation force-displacement curves for models with (a) LD (Ledderhose Disease), (b) Diabetes, and (c) Healthy.

prediction errors obtained : LD 16.28%, Diabetes 8.36%, and Healthy 1.12%.

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