

# Biomechanics

## Tissue Mechanics and Viscoelasticity

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### **Abstract**

Analysis of biological tissue mechanics including stress-strain relationships, viscoelasticity, and bone mechanics.

## **1 Introduction**

Biomechanics applies mechanical principles to biological systems.

## 2 Stress-Strain Curves



tissue\_stress\_strain.pdf

Figure 1: Stress-strain behavior of different tissues.

## 3 Viscoelastic Models

Standard Linear Solid:  $\sigma + \tau_\sigma \dot{\sigma} = E_R \epsilon + \tau_\epsilon E_R \dot{\epsilon}$

`stress_relaxation.pdf`

Figure 2: Viscoelastic stress relaxation.

## 4 Creep Response



Figure 3: Viscoelastic creep compliance.

## 5 Dynamic Modulus



Figure 4: Storage and loss moduli vs frequency.

## 6 Bone Remodeling

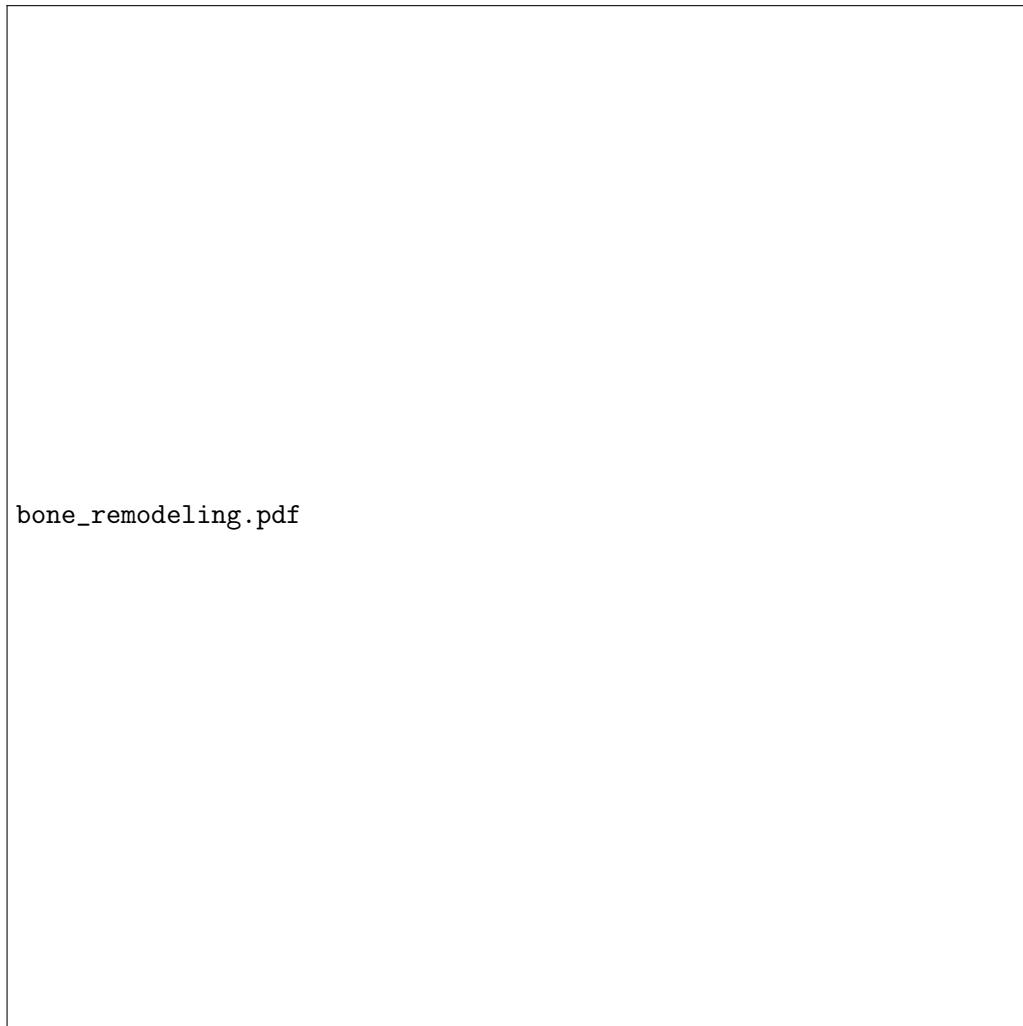


Figure 5: Bone remodeling rate vs mechanical stimulus.

## 7 Hyperelastic Model

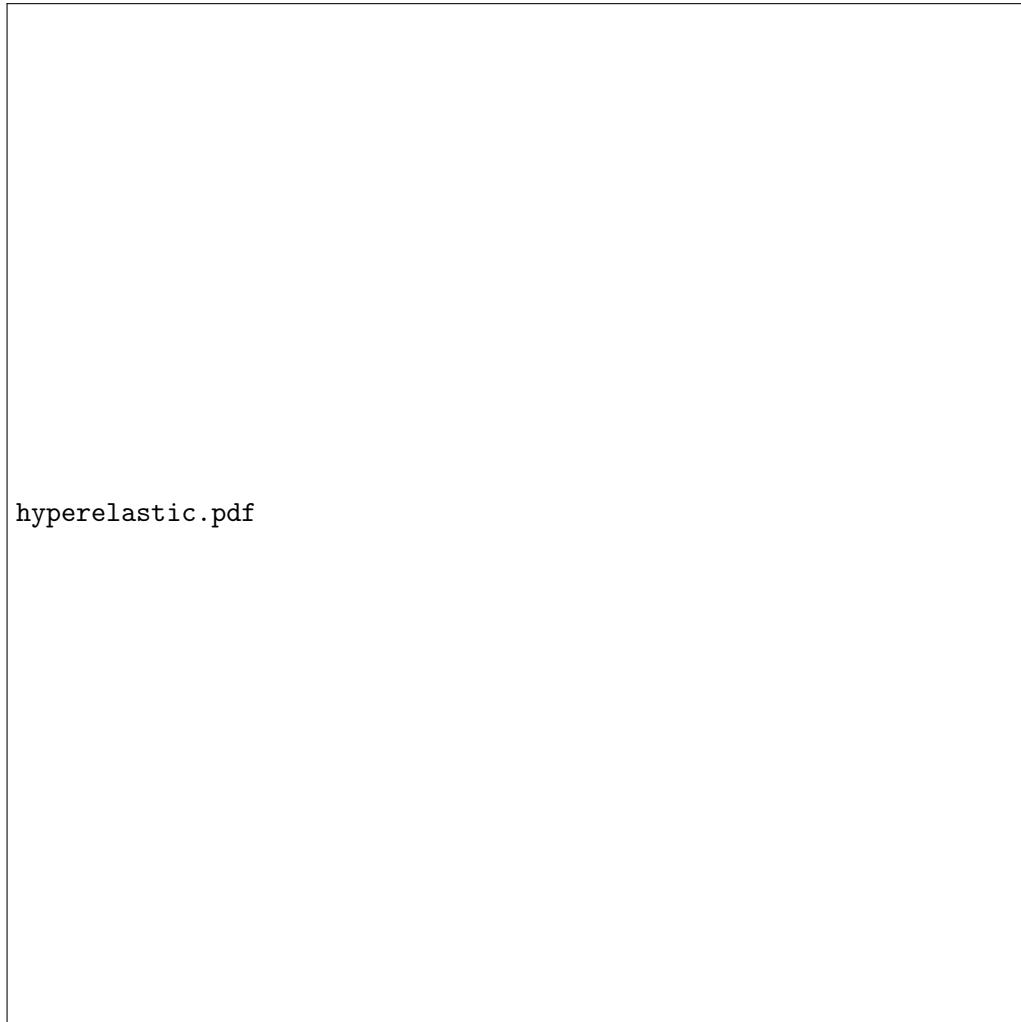


Figure 6: Neo-Hookean stress-stretch relationship.

## 8 Results

## 9 Conclusions

Biological tissues exhibit complex nonlinear and time-dependent mechanical behavior.