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

creep_response.pdf

Figure 3: Viscoelastic creep compliance.

5 Dynamic Modulus

dynamic_modulus.pdf

Figure 4: Storage and loss moduli vs frequency.

6 Bone Remodeling

`bone_remodeling.pdf`

Figure 5: Bone remodeling rate vs mechanical stimulus.

7 Hyperelastic Model

hyperelastic.pdf

Figure 6: Neo-Hookean stress-stretch relationship.

8 Results

9 Conclusions

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