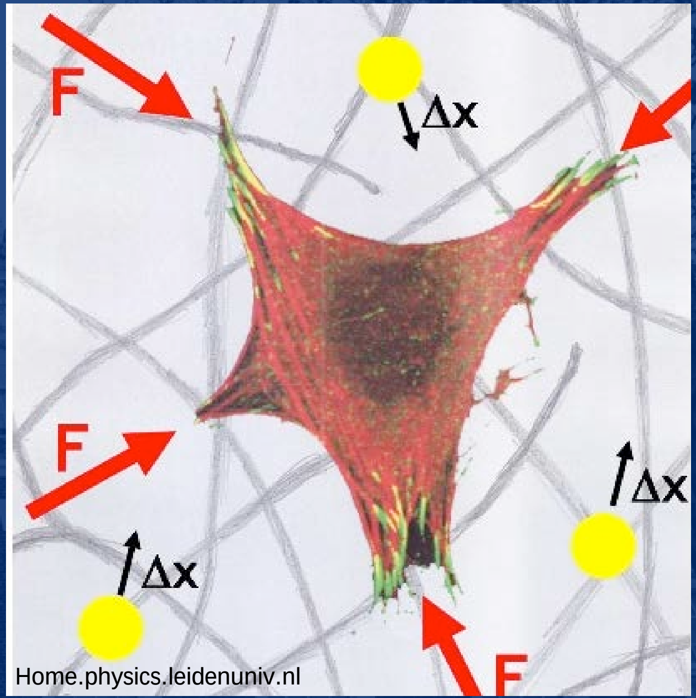
Johns Hopkins
Whiting School of Engineering

Cell and Tissue Engineering

Non-ideal Mechanics in the Human Body



Home.physics.leidenuniv.nl

Modeling non-ideal human tissues

Lifecell.com

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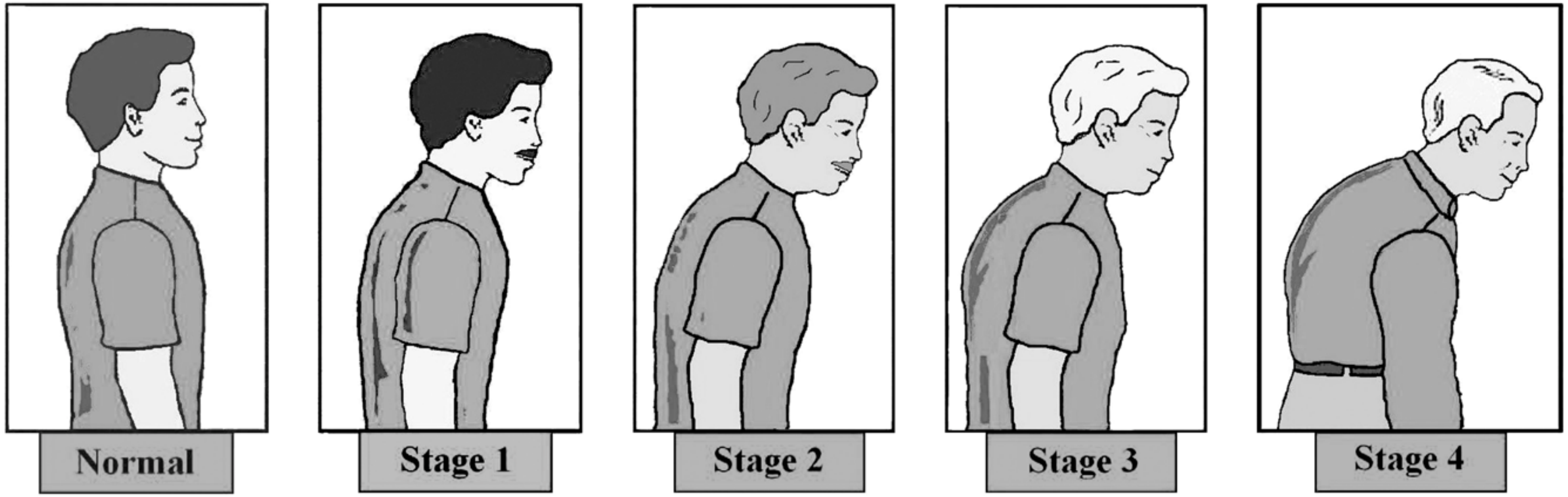
of ENGINEERING

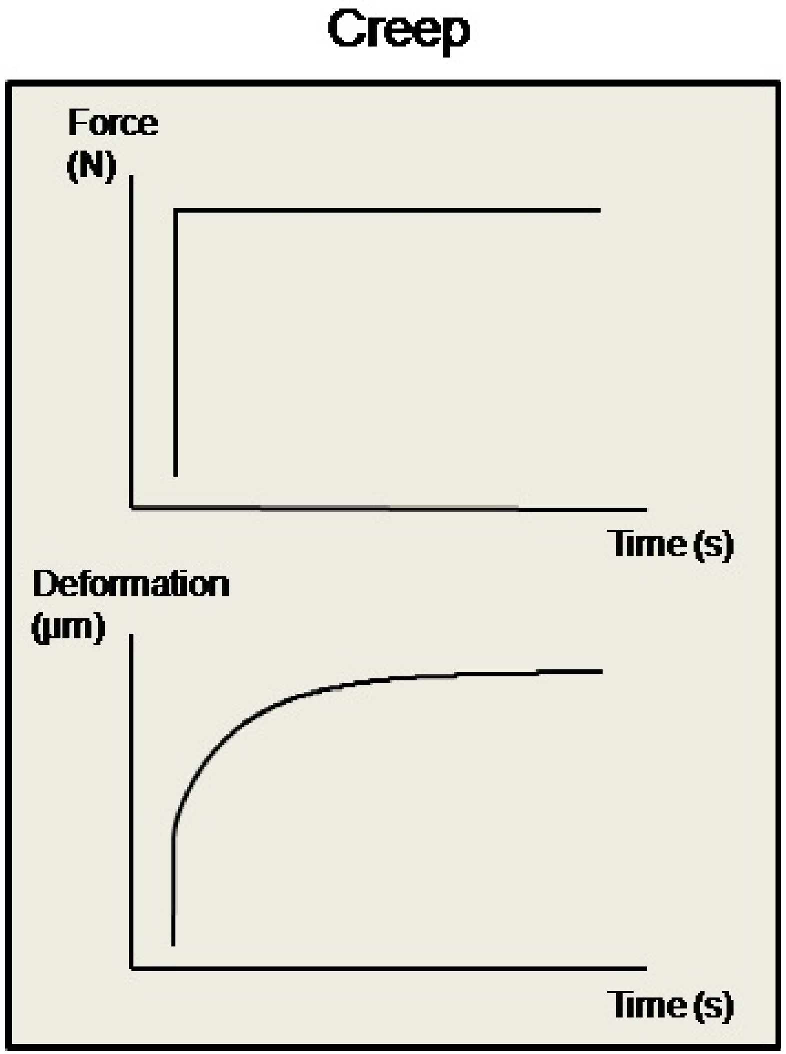
Muscular hydrostats are both solid and fluid

Superstock.com; Wikipedia.org

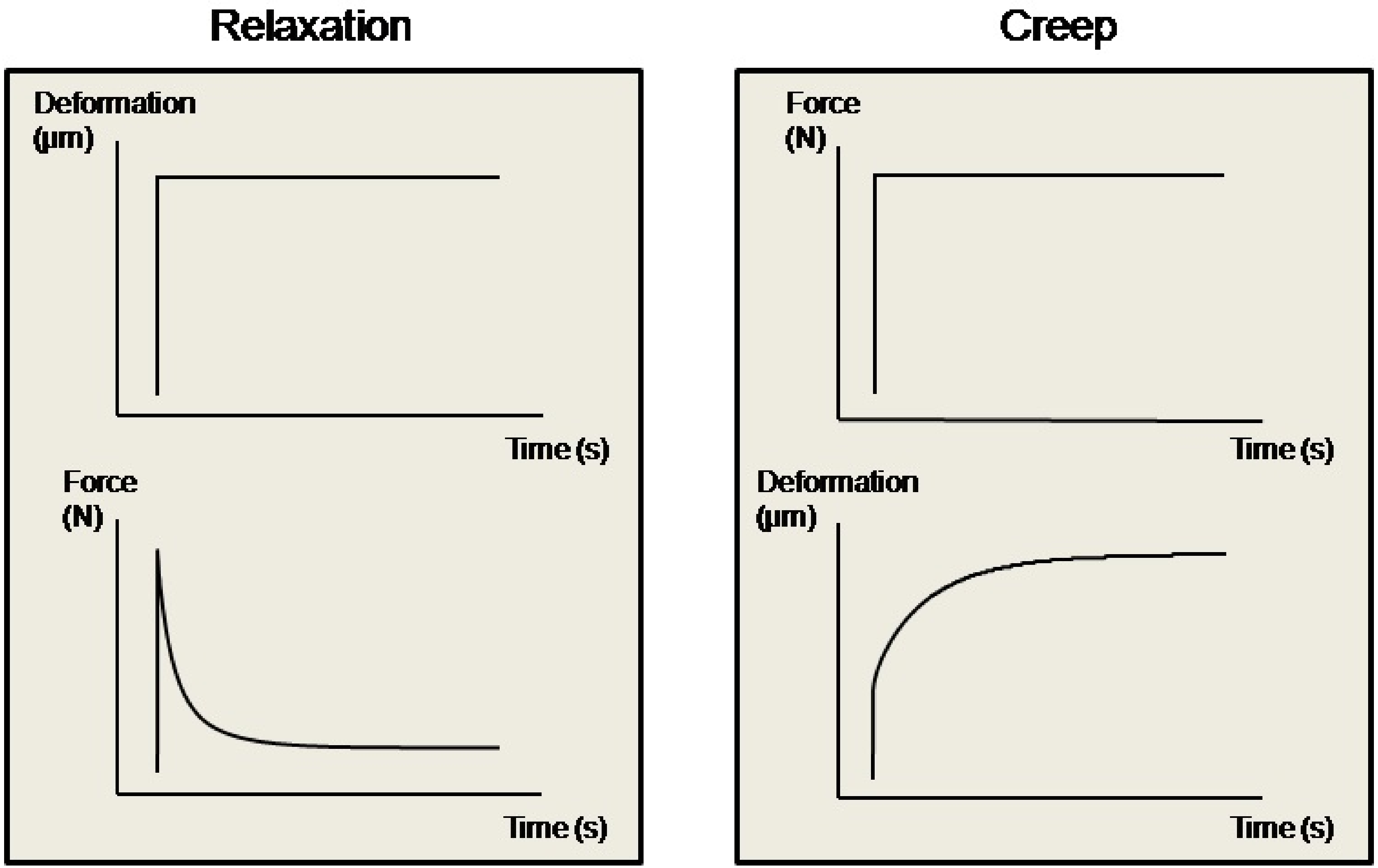
Biological tissues: creep and stress relaxation behaviors



Biological tissues: creep and stress relaxation behaviors

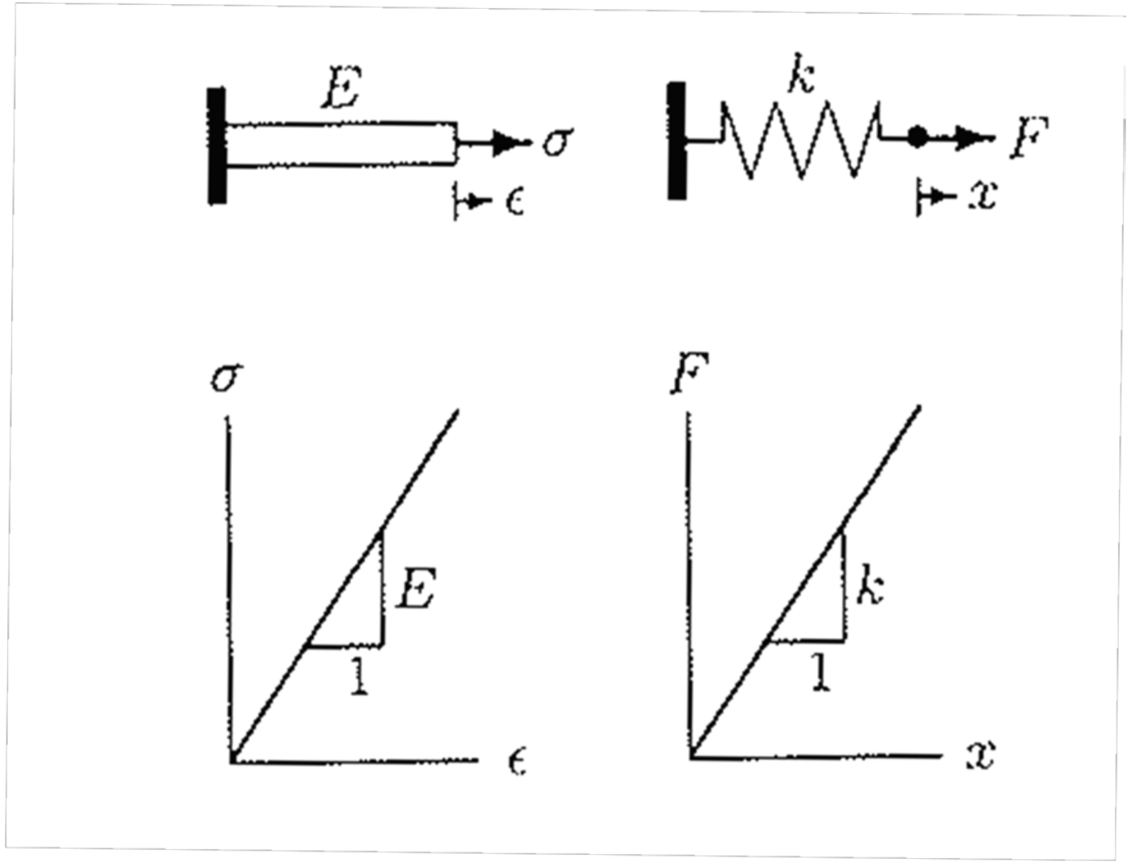


Biological tissues: creep and stress relaxation behaviors

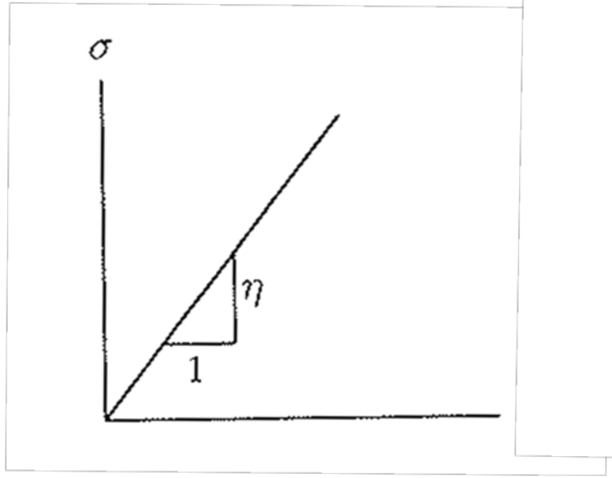


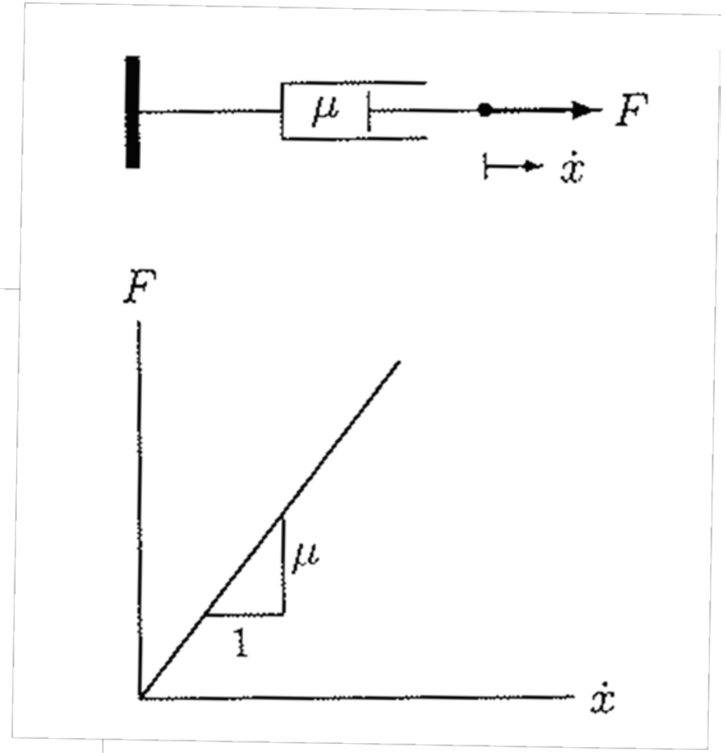
Modeling viscoelastic materials with springs and dashpots

$$\sigma = E\varepsilon \qquad F = kx$$



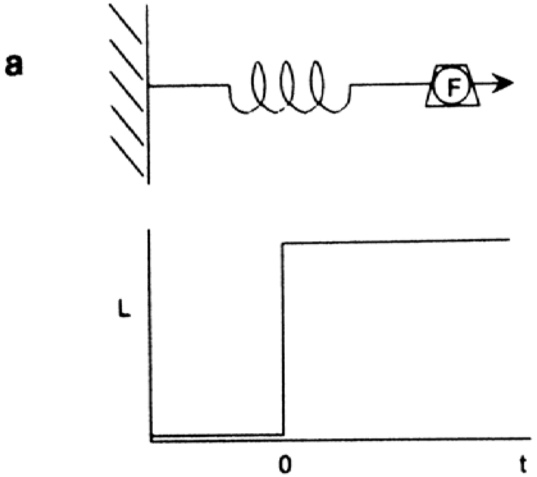
$$\sigma = \eta\dot{\varepsilon} \qquad F = \eta\frac{dx}{dt}$$

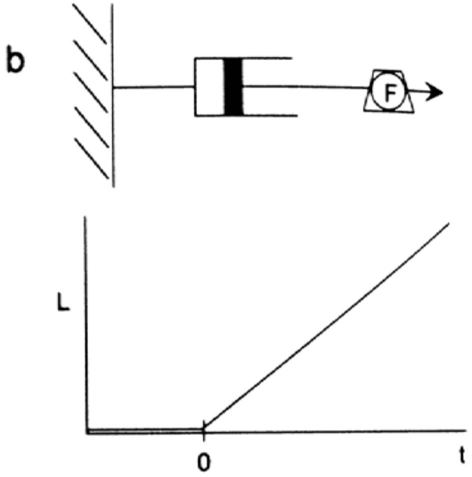




Modeling viscoelastic materials with springs and dashpots

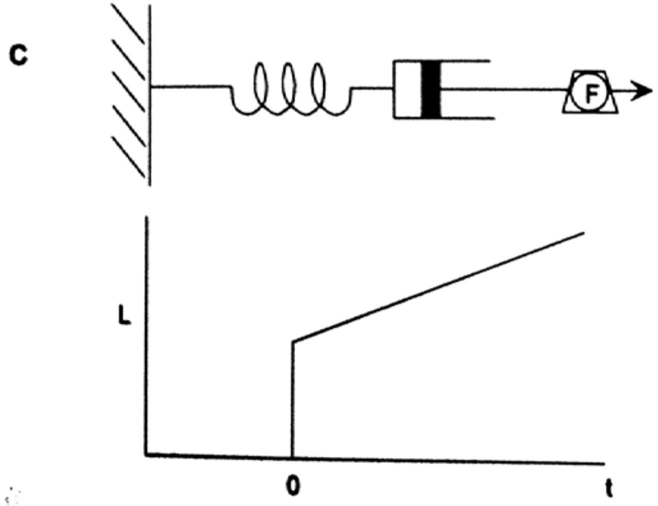
Spring Model

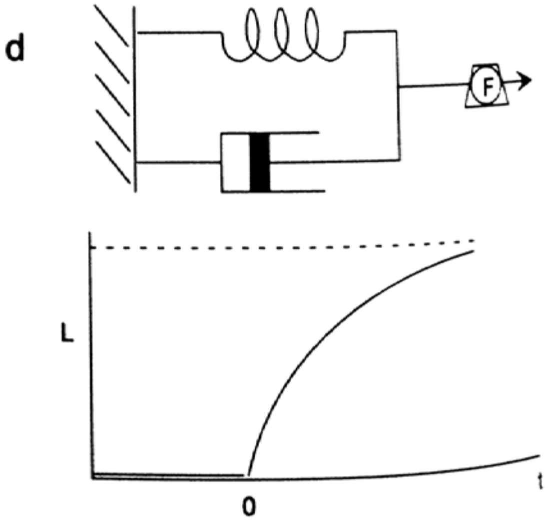




Dashpot Model

Maxwell Model

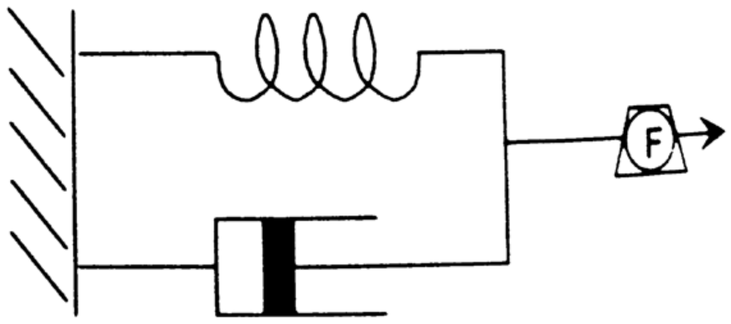




Voigt Model

Deriving differential equations for viscoelastic models

Voight Model



$$F = kx$$ **spring**

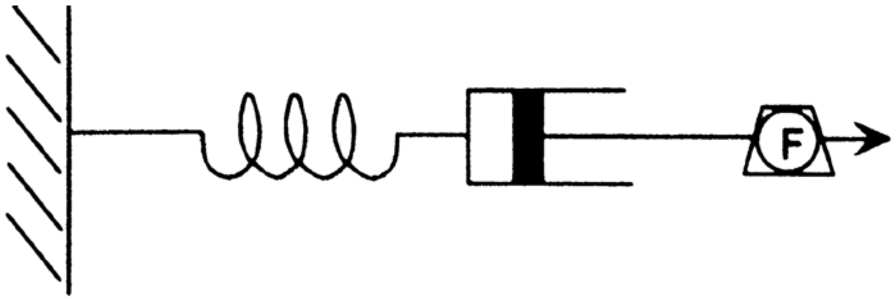
$$F = \eta \frac{\delta x}{\delta t}$$ **dashpot**

$$F = F_1 + F_2$$

$$F = kx + \eta \frac{\delta x}{\delta t}$$

Deriving differential equations for viscoelastic models

Maxwell Model



$$F = kx \qquad \textbf{spring}$$

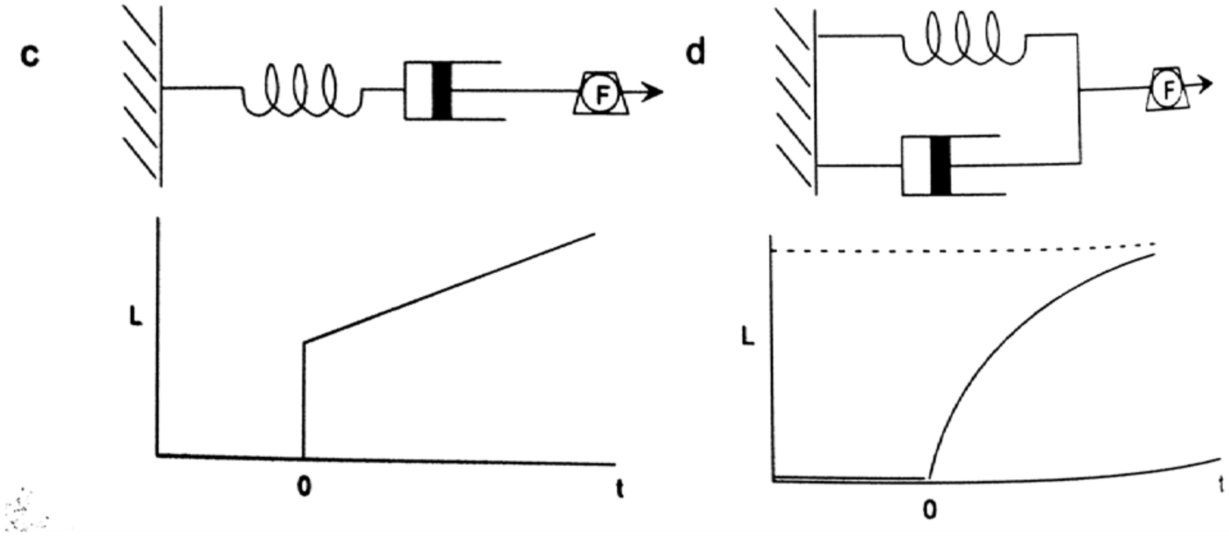
$$F = \eta \frac{\delta x}{\delta t} \qquad \textbf{dashpot}$$

$$x = x_1 + x_2 \qquad \frac{dx}{dt} = \frac{dx_1}{dt} + \frac{dx_2}{dt}$$

$$\frac{dx}{dt} = \frac{dF/dt}{k} + \frac{F}{\eta}$$

Review and rewind

Viscoelastics modeling

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