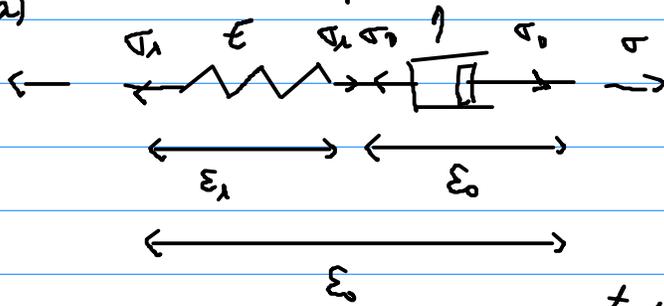


Modèle de Maxwell : le liquide viscoélastique

1) (a)

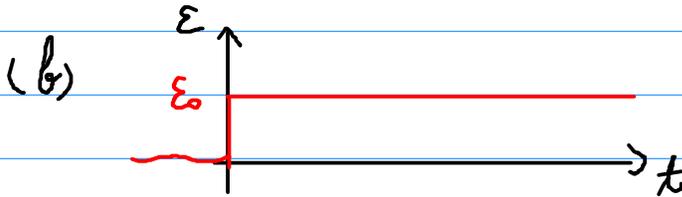


$$\begin{aligned} \sigma_1 &= E \epsilon_1 \\ \sigma_0 &= \eta \dot{\epsilon}_0 \end{aligned}$$

En série, les contraintes sont toutes les mêmes $\sigma_0 = \sigma_1 = \sigma$

$$\begin{aligned} \epsilon &= \epsilon_0 + \epsilon_1 \\ \dot{\epsilon} &= \dot{\epsilon}_0 + \dot{\epsilon}_1 = \frac{\sigma}{\eta} + \frac{\dot{\sigma}}{E} \end{aligned}$$

$$\left| \dot{\sigma} + \frac{E}{\eta} \sigma = E \dot{\epsilon} \right|$$

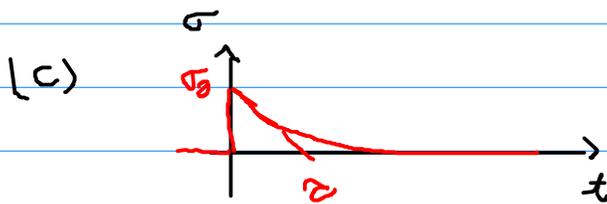


$$\dot{\epsilon} = 0$$

$$\dot{\sigma} + \frac{E}{\eta} \sigma = 0 \quad \text{and} \quad \sigma(t) = \sigma_0 e^{-t/\tau}$$

$$\tau = \frac{\eta}{E}$$

$$\oplus \sigma(0) = \sigma_0$$



Ex - $\tau = \frac{\eta}{E}$ Polystyrène $\left. \begin{aligned} E &= 3 \cdot 10^6 \text{ Pa} \\ \eta &= 1011 \text{ Pa} \cdot \text{s} \end{aligned} \right\} \tau = \frac{10^3}{3 \cdot 10^6} \approx 3 \cdot 10^{-4} \text{ s}$

Quil $\left. \begin{aligned} E &= 10^3 \text{ Pa} \\ \eta &= 10 \text{ Pa} \cdot \text{s} \end{aligned} \right\} \tau \approx 10^{-2} \text{ s}$

$t \gg \tau$ comportement visqueux $t \lesssim \tau$ comportement élastique