Recap (11/5/2019)

Strain – Deformation

Perfect Elastic (Hook):

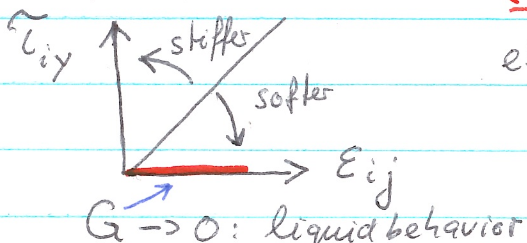
strain: $\varepsilon_{ij} = \frac{1}{2}\left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}\right)$

$\underline{\underline{\Gamma}}^* = (\varepsilon_{ij})$; $\vec{u} = (u_1, u_2, u_3)$ displacement

strain tensor

Simple shear: $\boxed{\underline{\underline{\tau}} = G\,\underline{\underline{\Gamma}}^*}$ G shear modulus $[G] = [Pa]$

elastic, isotropic material



Perfect Viscous (Newtonian)

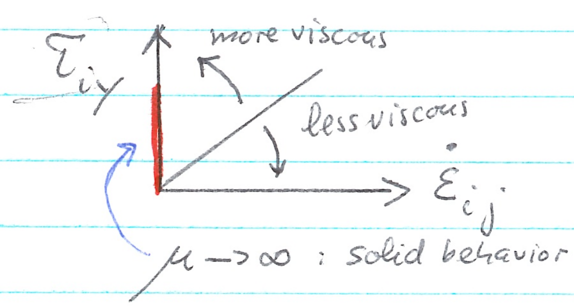
strain rate: $\dot{\varepsilon}_{ij} = \frac{1}{2}\left(\frac{\partial v_i}{\partial x_j} + \frac{\partial v_j}{\partial x_i}\right)$ *

$\underline{\underline{\Gamma}} = (\dot{\varepsilon}_{ij})$; $\vec{v} = (v_1, v_2, v_3)$ velocity (displacement rate)

total strain rate tensor

Simple shear: (Couette Flow) $\boxed{\underline{\underline{\tau}} = 2\mu\,\underline{\underline{\Gamma}}}$ μ viscosity $[\mu] = [Pa \cdot s]$ (10 poise)

Newtonian fluid
incompressible ($\rho = $ const.)



$$\underline{\underline{\Gamma}} = \begin{pmatrix} \frac{\partial v_1}{\partial x_1} & & \\ & \frac{\partial v_2}{\partial x_2} & \\ & & \frac{\partial v_3}{\partial x_3} \end{pmatrix}$$