

## MEK3220 - FORMULAE SHEET

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THE DISPLACEMENT GRADIENT

$$\nabla \mathbf{u} = \begin{pmatrix} \frac{\partial u_x}{\partial x} & \frac{\partial u_x}{\partial y} & \frac{\partial u_x}{\partial z} \\ \frac{\partial u_y}{\partial x} & \frac{\partial u_y}{\partial y} & \frac{\partial u_y}{\partial z} \\ \frac{\partial u_z}{\partial x} & \frac{\partial u_z}{\partial y} & \frac{\partial u_z}{\partial z} \end{pmatrix}$$

Comment: If  $\nabla \mathbf{u} = (\nabla \mathbf{u})^T$  we have that  $\nabla \mathbf{u} = \epsilon$ , the *strain tensor*.

STRAIN TENSOR

CAUCHY'S EQUILIBRIUM EQUATION

HOOKE'S LAW

$$\begin{aligned} \sigma_{xx} &= (2\mu + \lambda)\epsilon_{xx} + \lambda(\epsilon_{yy} + \epsilon_{zz}), & \sigma_{yz} &= \sigma_{zy} = 2\mu\epsilon_{yz} \\ \sigma_{yy} &= (2\mu + \lambda)\epsilon_{yy} + \lambda(\epsilon_{xx} + \epsilon_{zz}), & \sigma_{xz} &= \sigma_{zx} = 2\mu\epsilon_{xz} \\ \sigma_{zz} &= (2\mu + \lambda)\epsilon_{zz} + \lambda(\epsilon_{yy} + \epsilon_{xx}), & \sigma_{xy} &= \sigma_{yx} = 2\mu\epsilon_{xy} \end{aligned}$$

INVERTED HOOKE'S LAW

LAMÈ COEFFICIENTS

EQUATION OF CONTINUITY

EQUATION OF MOTION FOR MEDIA UNDER STRESS