

Linearized Strain-Displacement Relations (Cylindrical Coordinates)

$$\epsilon_{rr} = \frac{\partial u_r}{\partial r}$$

$$\epsilon_{\theta\theta} = \frac{1}{r} \frac{\partial u_\theta}{\partial \theta} + \frac{1}{r} u_r$$

$$\epsilon_{zz} = \frac{\partial u_z}{\partial z}$$

$$\epsilon_{r\theta} = \frac{1}{2} \gamma_{r\theta} = \frac{1}{2} \left[\frac{1}{r} \frac{\partial u_r}{\partial \theta} - \frac{1}{r} u_\theta + \frac{\partial u_\theta}{\partial r} \right]$$

$$\epsilon_{rz} = \frac{1}{2} \gamma_{rz} = \frac{1}{2} \left[\frac{\partial u_r}{\partial z} + \frac{\partial u_z}{\partial r} \right]$$

$$\epsilon_{\theta z} = \frac{1}{2} \gamma_{\theta z} = \frac{1}{2} \left[\frac{\partial u_\theta}{\partial z} + \frac{1}{r} \frac{\partial u_z}{\partial \theta} \right]$$