

Homework Tutorial Session 8b

1) From the isotropic Hooke's law equations for elastic strain in terms of stress, find the elastic hydrostatic strain for a general state of stress (in principal coordinates).

2) Hence, find the deviatoric elastic strains, $\hat{\varepsilon}_i^{el}$.

3) Hence show that the elastic energy density corresponding to the deviatoric strains, which in principal coordinates is defined by $\hat{\xi} = \frac{1}{2} \hat{\varepsilon}_i^{el} \sigma_i$, is given by $\hat{\xi} = \frac{(1+\nu)}{3E} \bar{\sigma}^2$.

Hence, the Mises yield criterion, $\bar{\sigma} = \sigma_0$, is equivalent to a critical elastic distortion energy density criterion, $\hat{\xi} = \hat{\xi}_0$, where, $\hat{\xi}_0 = \frac{(1+\nu)}{3E} \sigma_0^2$.

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