CVEN 6831 - Special Topics

Advanced Mechanics of Materials II

Take Home Midterm Examination
Spring 2001

1. ## Problem: Response Analysis of Elastoplastic Drucker-Prager Model

   Perform a response study when an associated Drucker-Prager formulation is subjected to equi-biaxial tension-compression in plane strain, i.e. $\dot{\epsilon}_1 = -\dot{\epsilon}_3$ with $\epsilon_2 = 0$. Calibrate the yield strength in terms of the uniaxial strength values, $f_t = 0.6\, ksi; f_c = 4.0\, ksi$, in tension and compression using the elastic properties $E = 3,000\, ksi, \nu = 0.2$.

   Parabolic Drucker-Prager Model:

   $$F = J_2 + \alpha I_1 - \tau_y^2 = 0 \tag{1}$$

   where $I_1 = tr\sigma$ and $J_2 = \frac{1}{2}\mathbf{s} : \mathbf{s}$. In this model the frictional and cohesive strength parameters are related to the strength values in uniaxial tension and compression as follows,

   $$\alpha = \frac{f_c - f_t}{3} \quad \text{and} \quad \tau_y^2 = \frac{f_c f_t}{3} \tag{2}$$

2. ## Problem: Non-Associated Drucker-Prager Model

   Extend the associated Drucker-Prager model above to a non-associated format of pressure-insensitive plastic flow. Use the calibration above assuming that the dilatancy factor α is zero in the plastic flow potential, i.e. $Q = J_2 - \tau_y^2 = 0$.

   Implement this model in the triaxial constitutive driver above for strain control and compare the results of the non-associated D-P model with the associated case above.