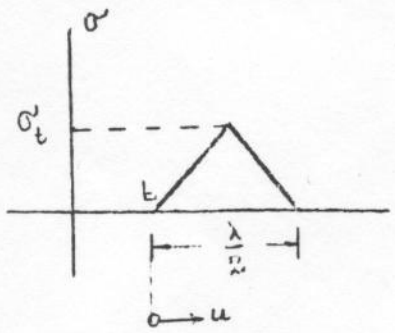
MAE 233A - SPRING 2009 HOMEWORK

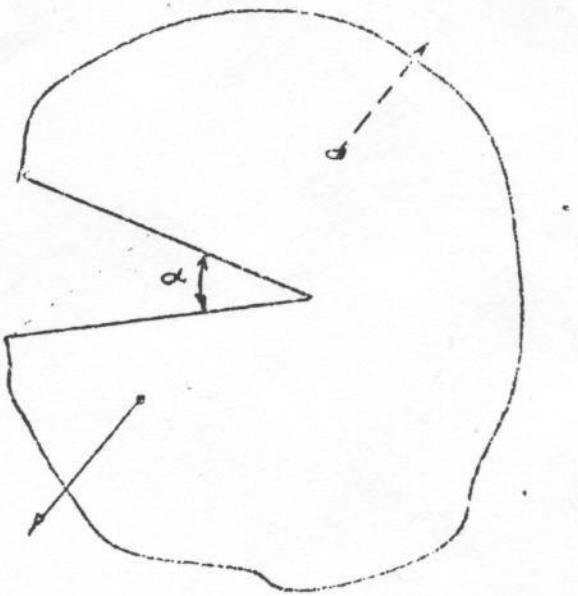
4/9/09

1. Let the atomic stress-displacement curve be approximated by a triangle as shown. Estimate the theoretical fracture strength.

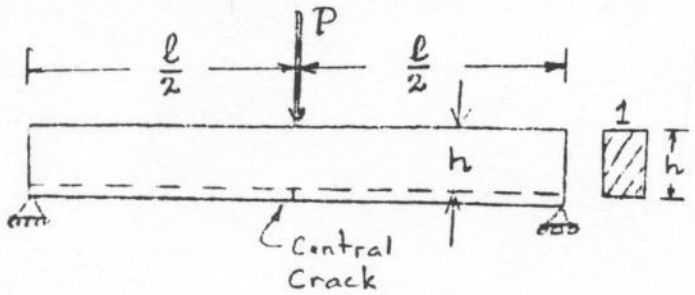


Under what conditions this strength can be approached in metals?

2. For a wedge in anti-plane shear deformation, find the asymptotic expressions for stresses and the displacement close to the wedge tip. What is the nature of the singularity when $\alpha = 0^+$?



3. Consider a simply-supported beam of rectangular cross-section, which has a central crack and carries a concentrated central load P, as shown. Assume that the effective depth of the beam, h, is up to the crack tip.



Find G by the compliance method. Let $\Delta = \frac{1}{48}\frac{P\ell^3}{EI}$ be the central deflection; $I = \frac{1}{12}h^3$.