

Name: _____

Homework 4

Due 20 Feb 2018

1. A large steel sheet (0.1 in. thick) containing a center-crack with length $2a = 4$ in. fractures under remote tensile stress of $\sigma = 30$ ksi. This material has a yield strength of 100 ksi. If you feel you cannot answer any of the following questions with the given data, explain why not.
 - (a) What is the fracture toughness for this sheet of steel?
 - (b) What is K_{IC} for this material?
 - (c) What remote stress, σ will fracture an identical plate with a 9 in. crack?
 - (d) What is the failure stress for a 4-in. long center crack in a 1-in. thick plate?
 - (e) What is the fracture stress if the original 0.1 in. thick panel contains a 0.1 in. center crack?
2. Consider a panel with an edge crack $a = 2$ in.. Predict the failure stress for the following conditions
 - (a) The panel is Aluminum 2024-T351 (L-T direction), 1.5 in. thick, 8 in. wide, and $\sigma_{YS} = 50$ ksi, at room temperature.
 - (b) Consider an identical panel, but with a crack in the transverse direction (T-L).
 - (c) The panel is Aluminum 7075-T6 (L-T direction), 0.5 in. thick, 8 in. wide, and $\sigma_{YS} = 72$ ksi at room temperature.
 - (d) Consider the same (7075-T6) panel, at -65°F .
 - (e) The panel is Steel 15-5 PH, 1.0 in. thick, 8 in. wide, with $\sigma_{YS} = 140$ ksi
3. The data file HW4-3.txt contains load-displacement data (P vs. v) for an aluminum alloy of an M(T) specimen. Assuming the specimen had a thickness of 0.1", a yield stress of $\sigma_{YS} = 48$ ksi, a width of 50", Young's Modulus $E = 18$ Msi, Poisson's ratio of $\nu = 0.33$ and half-span displacement measurement points at $Y = 0.75$ ":
 - (a) use the secant method to calculate the effective crack length throughout the test and plot the K_R curve
 - (b) find K_C using the tangent curve method

Note: Use the finite width center-cracked panel formula to calculate K_I .