Last Updated: February 22, 2019 at 10:49am

Name:

Homework 5

Due 5 Mar 2019

1. Use the MIL-HDBK pages copied in your text (pp. 136-143) to look up the following yield stress values. Use the A-basis for all values.
   (a) 2024-T351 bare, t=0.25, LT direction
   (b) 2024-T351 bare, t=0.25, L direction
   (c) 7075-T651 bare, t=0.5, LT direction
   (d) 7075-T651 bare, t=0.5, L direction

2. Use the charts provided in your text (pp. 111-121) to look up fracture toughness for the following conditions, at room temperature.
   (a) 2024-T351 bare, t=0.25, T-L direction
   (b) 2024-T351 bare, t=0.25, L-T direction
   (c) 7075-T651 bare, t=0.5, T-L direction
   (d) 7075-T651 bare, t=0.5, L-T direction

3. Use the Fedderson approach to plot residual strength vs. crack length for a center-cracked panel ($W = 5$ in.)
   (a) For 2024-T351 bare aluminum, with t=0.25, in the T-L and L-T directions, at room temperature.
   (b) For 7075-T651 bare aluminum, with t=0.5, in the T-L and L-T directions, at room temperature.

4. Based on a proposed inspection cycle and fatigue analysis for a 7075-T651 bare aluminum panel, we need to design a proof test to ensure there are no center-cracks greater than 0.25" long. What proof load must be applied to ensure this condition ($W = 8$ in., $t = 0.4$ in., check both grain directions, at room temperature).

5. A 120" diameter fuselage has an axial crack. The crack is centered on a circumferential stiffener. Stiffener spacing is 10", cross-section is 0.3788 in^2, skin thickness is 0.1875", and rivet spacing is 1". Use the charts on pp. 167-178 and the tables on pp. 194 - 196 to plot the σ_c vs. a curve for the skin under the following cases. Note: use $K_c = 68$ ksi$\sqrt{\text{in}}$. Assume a skin stiffness of $E = 11$ Msi and a stiffener stiffness of $E_s = 23.4$ Msi and a stiffener yield strength of $\sigma_{YS} = 120$ksi.
   (a) without stiffeners
   (b) with stiffeners
   (c) with stiffeners, but the stiffener centered over the crack is broken

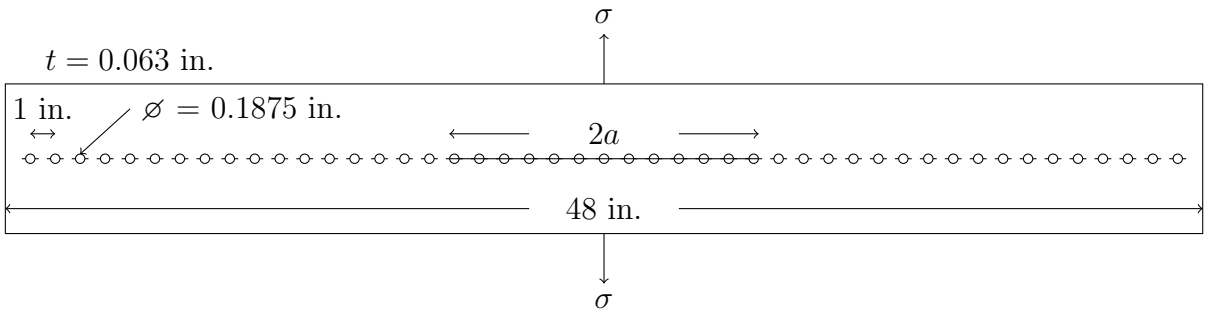
   Note: Ignore net section yield for the skin in this problem

6. Plot the residual strength of the bolted lap joint shown. Compare the following cases
   (a) Net Section Yield
   (b) Brittle Fracture
   (c) Linkup
   (d) Modified Linkup

   Where the MSD crack length $c = 0.05$ in.. Compare Al 2024-T3, Al 2524-T3, and Al 7075-T6, using the data in Table 1. Although β will be a function of crack length, assume $\beta_a = 0.934$ and $\beta_l = 2.268$ for these calculations.

Table 1: Material properties for Problem 6

Material	σ_{YS}(ksi)	K_C(ksi$\sqrt{\text{in}}$)
2024-T3	40	120
2524-T3	40	140
7075-T6	63	60



7. For the following panel assume $K_{IC} = 70$ ksi$\sqrt{\text{in}}$ and $a = 0.75$ in.
   (a) Determine the critical values of σ and τ as well as the crack extension angle using the maximum circumferential stress criterion.
   (b) Determine the critical values of σ and τ as well as the crack extension angle using the principal stress criterion.

   Note: Assume $\beta = \beta' = 1$