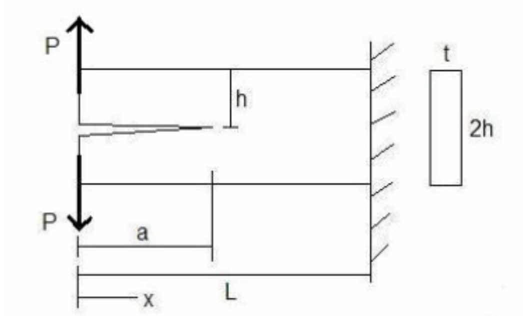
EAS4200C Aerospace Structures Homework #10 (Due: Nov. 30th)

1. A center-cracked thin Al 2025-T651 flat panel with a very large width-to-crack length ratio is subjected to uniform remote tensile stress. The initial crack length is 50mm and it grows to 55mm when the applied load reaches the maximum value of 136MPa. Determine the fracture toughness using Irwin's plastic zone adjustment method. Is the crack length valid for this method?

2. The split beam in the figure is subjected to a pair of cyclic opening force P with P_{max} = 2,000N and P_{min} = 0. Then initial crack length a_0 is 40mm. The material is 2024-T561 Al, and t = 0.02m, h = 0.01m. The crack growth rate is given by

$$\frac{da}{dN} = 1.6\times10^{-11}(\Delta K_I)^{3.59}\,\text{m/cycle}$$

in which K_I is in MPa√m. Find the number of cycles to failure (at which the crack becomes unstable under the load P_{max}). Assume that the plane strain condition exists.



3. The truss structure consists of two bars connected by a pin-joint (which allows free rotation of the bars). The other ends of the bars are hinged as shown in the figure. A weight W is hung at the joint. Find the maximum weight the truss can sustain before buckling occurs.