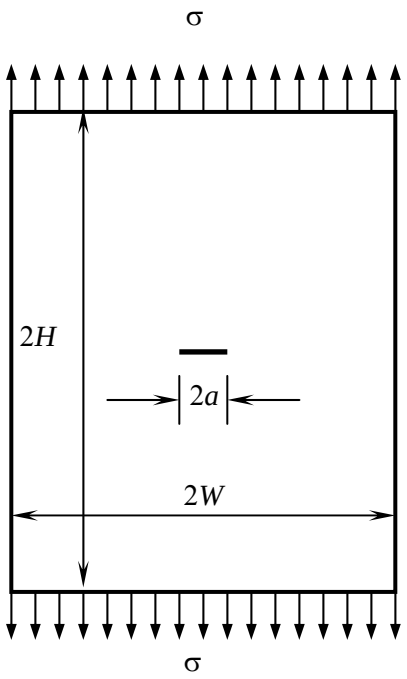
THE UNIVERSITY OF IOWA
Department of Mechanical Engineering

Fracture Mechanics	**Computer Project #5**	**Assigned: April 27, 2020**
ME:5159	**Total Points: 10**	**Due: May 04, 2020**

Consider a center-cracked plate of the AISI 4340 steel (S_y = 1255 MPa; S_u = 1296 MPa), which has dimensions, as follows: width $2W$ = 76 mm; length-to-width ratio $2H/2W$ = 5; and thickness B = 6 mm. The plate contains an initial crack of length (half) a_i = 1 mm. It is subjected to tension-to-tension cyclic loading between constant values of minimum load P_{min} = 80 kN and maximum load P_{max} = 240 kN. Also, E = 207 GPa, ν = 0.3, and K_{Ic} = 130 MPa$\sqrt{\text{m}}$.



$2W$ = 76 mm; $2H/2W$ = 5
B = 6 mm

P_{max} = 240 kN
P_{min} = 80 kN

$$C = 1.095 \times 10^{-12} \ \frac{\text{m/cycle}}{(\text{MPa}\sqrt{\text{m}})^m}$$

m = 3.24

Using CASCA and FRANC2D/L at CSS (ICAEN):

(1) Develop ΔK_I vs. a plot for 1 mm ≤ a ≤ 15.6 mm;

(2) Using the Paris-Erdogan equation, predict (half) crack length (a) as a function of applied number of cycles (N). How many cycles can be applied before failure occurs?

Using the Tada handbook solution of SIF (e.g., Lecture No. 10) and the Paris-Erdogan equation again, conduct life prediction analysis similar to Items 1 and 2 above. Compare your "hand" calculations with the results of FRANC2D/L.

Show all work and attach relevant snapshots. Provide comments to explain your answer.