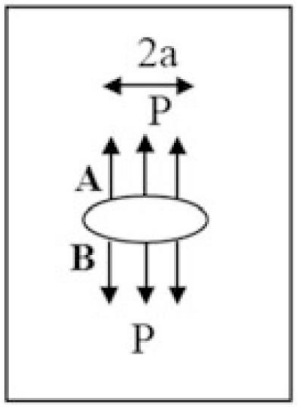
تکلیف سری دوم مکانیک شکست موعد تحویل: سه‌شنبه ۹۷/۱۱/۱٤ در کلاس

1- A steel strap 1-mm thick and 20-mm wide with a through-thickness center crack 4 mm long is loaded to failure. (a) Determine the critical load if $K_{IC}$ = 80 MPa.$m^{1/2}$ for the strap material. (b) Use an available correction factor, f (a/w), for this crack configuration and calculate the critical stress as $\sigma_c$.

2- The plate below has an internal crack subjected to a pressure P on the crack surface. The stress intensity factors at points A and B are




$$K_A = \int \frac{P}{\sqrt{\pi a}} \sqrt{\frac{a+x}{a-x}} \cdot dx$$

$$K_B = \int \frac{P}{\sqrt{\pi a}} \sqrt{\frac{a-x}{a+x}} \cdot dx$$

Use the principle of superposition to show that the total stress intensity factor is defined by $K_I = P\sqrt{\pi a}$ .

3- A material exhibits the following crack growth resistance behavior: $R = 6.95\sqrt{a - a_0}$

where $a_0$ is the initial crack size. $R$ has units of kJ/$m^2$ and the crack size is in mm.

The elastic modulus of this material 207,000 MPa. Consider a wide plate with a through crack ($a << W$ ) that is made from this material.

a. If this plate fractures at 138 MPa, compute the following:

i. The half crack size at failure ($a_c$).

ii. The amount of stable crack growth (at each crack tip) that precedes failure ($a_c - a_0$).

b. If this plate has an initial crack length ($2a_o$) of 50.8 mm and the plate is loaded to failure, compute the following:

i. The stress at failure.

ii. The half crack size at failure.

iii. The stable crack growth at each crack tip.