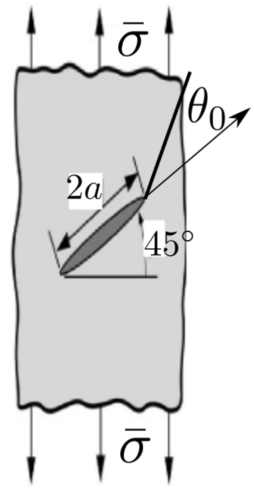
1. Anderson problem 12.2 (section 13.12).(**40 Points**)
2. Anderson problem 12.3 (section 13.12).(**40 Points**)
3. In figure below, a crack with initial angle of 45° is under uniaxial far field loading σ_0 in an sufficiently large domain (*e.g.,* infinite domain SIF formula can be used).



- Using maximum circumferential tensile stress obtain the angle θ_0 (angle relative to original crack direction not the horizontal x axis) at which the crack would propagate. Hint: Refer to Saoma notes pages 160-161.
- For a given fracture toughness K_{Ic} we can express the maximum traction $\bar{\sigma}_{\max}$ for which the crack would not propagate using maximum circumferential tensile stress criteria. Express $\bar{\sigma}_{\max} = \alpha_{\text{MCTS}} \frac{K_{Ic}}{\sqrt{a}}$ for a nondimensional value α_{MCTS}.
- Compare θ_0 you obtained with figure 10.4 in Saouma notes (p. 165/446) for the problem in figure **??** ($K_I = K_{II}$). How is this θ_0 compared with θ_0 obtained from maximum energy release rate and minimum strain energy density criteria shown in the same figure?
- Referring to figure 10.5 in Saoma notes (p.165/446) compare the traction $\bar{\sigma}_{\max}$ that would initiate crack propagation in terms of nondimensional parameter $\alpha = \frac{\bar{\sigma}_{\max}\sqrt{a}}{K_{Ic}}$ based on maximum energy release rate (α_{MERR}) and minimum strain energy density (α_{MSED}). Again, limit your discussion to the problem in figure **??** ($K_I = K_{II}$). Which one is the most conservative and which one is the lease conservative? Note that numerical values of all three α coefficients are needed (use the figure to obtain K_I/K_{I_c} and by expressing K_I in terms of $\bar{\sigma}_{\max}\sqrt{a}$ find the value of α).

(**60 Points**)

4. A crack growth at a rate $(\frac{\mathrm{d}a}{\mathrm{d}N})_1 = 8.84 \times 10^{-7} \frac{\mathrm{m}}{\mathrm{cycle}}$ when the stress intensity factor is $(\Delta K)_1 = 50\ \mathrm{MPa}\sqrt{\mathrm{m}}$ and at a rate $(\frac{\mathrm{d}a}{\mathrm{d}N})_1 = 4.13 \times 10^{-5} \frac{\mathrm{m}}{\mathrm{cycle}}$ when $(\Delta K)_2 = 150\ \mathrm{MPa}\sqrt{\mathrm{m}}$. Determine the parameters C and m in Paris equation. (**60 Points**)