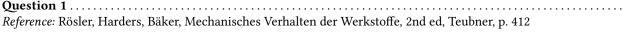
Exercise 12: Yield and fracture

Jan. 31, 2022 - Feb. 04, 2022



A component made from a polycrystalline Aluminum alloy has the yield strength of $200\,\mathrm{MPa}$ and is subjected to plane stress with

$$\sigma_{xx} = \sigma_{yy} = 155 \,\text{MPa}, \quad \tau_{xy} = 55 \,\text{MPa}.$$

- (a) Write the deviatoric stress!
- (b) Calculate the principal stresses!
- (c) Evaluate both Tresca's and von Mises' criterion to determine whether the material will yield!

Question 2

Reference: Sun, Fracture Mechanics, 1st ed, Academic Press (p. 72)

Consider the following Airy stress function,

$$\phi = Ay^2$$
,

where A is a constant. Compute the stress components and the displacements, assuming zero rigid body rotation.

Question 3

A Si plate has a thickness of 775 µm and a width of 240 mm. It has a rectangular cross-section and contains a 100 µm deep notch. The plate is subjected to pure bending with a moment of $M=0.03\,\mathrm{N\,m}$. Will it break? K_I for this load case is given in the figure. The material has fracture toughness $K_{1c}=0.9\,\mathrm{MPa}\sqrt{\mathrm{m}}$ and a Youngs modulus of $E=165\,\mathrm{GPa}$.

