Fundamentals of Metal Working

Mechanics of Metal Working

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Mechanics of Metal Working:

Reference: Section 14.2 Dieter, (S.I. Metric edition)

Methods of analysis:

14.2 Dieter, (S.I. Metric edition) + lecture notes

Slab analysis method (without friction)

Reference: Section 14.2 Dieter, (S.I. Metric edition)

Details derivation: lecture notes

$$\sigma_x = \frac{2}{\sqrt{3}}\sigma_0 \ln\frac{h_0}{h_f} \quad \text{--------(1)}$$

Where h_0 initial thickness and h_f final thickness

$$\sigma_x = \frac{2}{\sqrt{3}}\sigma_0 \ln\frac{1}{(1-r)} \quad \text{-------- (2)}$$

where $r = \frac{A_0 - A_f}{A_0}$

Slab analysis method (with friction)

Details derivation: class lecture

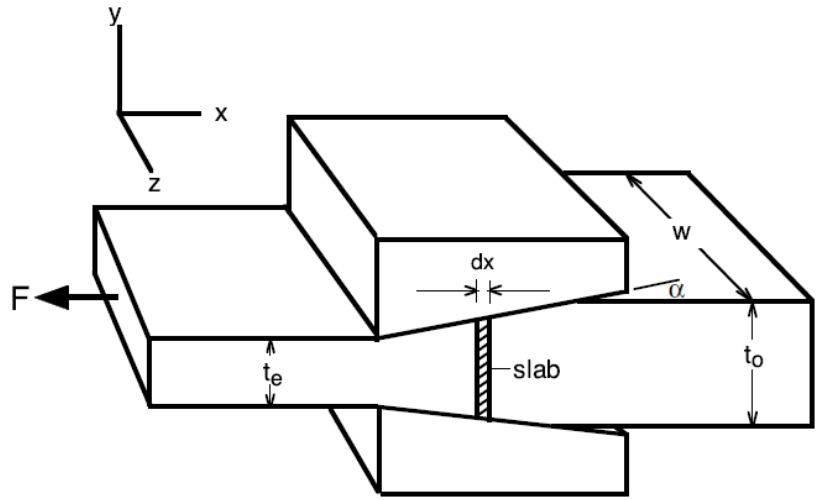
$$\frac{\sigma_d}{2K} = \frac{1+B}{B}\left[1 - \left(\frac{t_e}{t_0}\right)^B\right] \text{ --------- (1)}$$

B=μ cot α

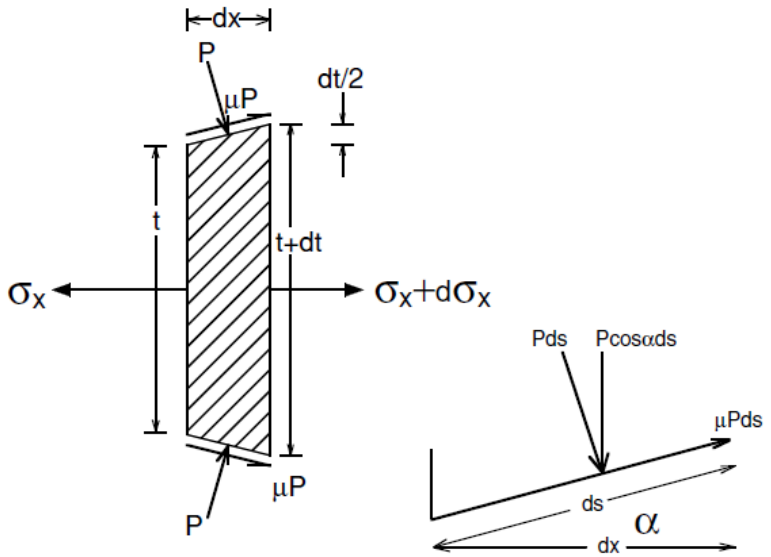
Or

$$\frac{\sigma_d}{2K} = \frac{1+B}{B}\left[1 - \exp(-B\varepsilon_h)\right] \text{ ---- (2)}$$

Where $\varepsilon_h = \ln\left({}^{t_0}/_{t_e}\right)$



7.1. Plane-strain drawing of a sheet.



7.2. Slab used for force balance in sheet drawing.

EXAMPLE

A 2.5 mm thick metal sheet 25 cm wide is drawn to a thickness of 2.25 mm through a die of included angle 30◦. The flow stress is 200 MPa and the friction coefficient is 0.08.

Calculate the drawing force using the von Mises criterion.

1. With friction
2. Without friction