* Fatigue test
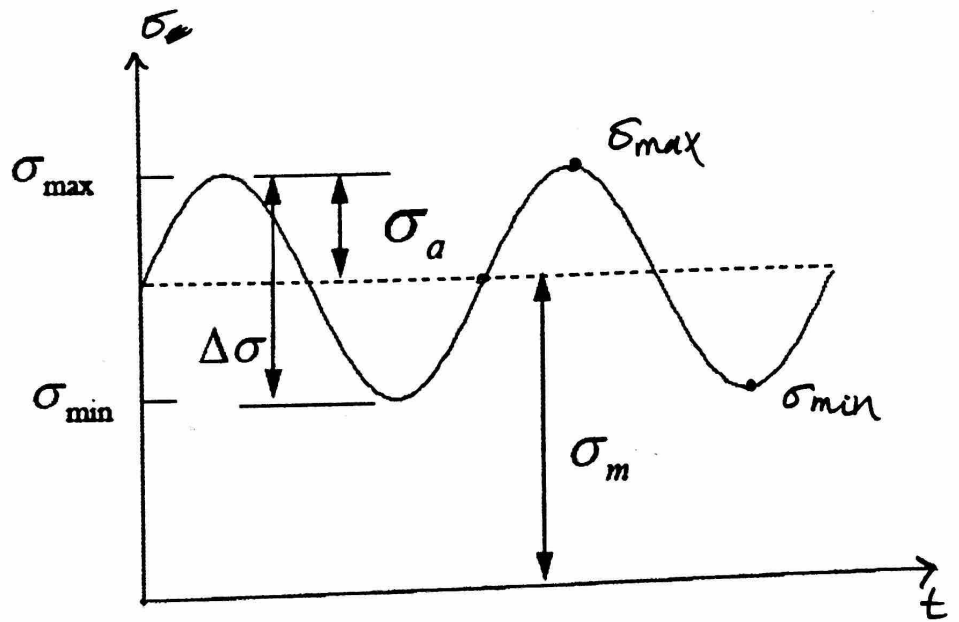
Fatigue : Failure resulted from repeated loading.

Fluctuating stress

the +/- changing stress

maximum stress (σ_{max})
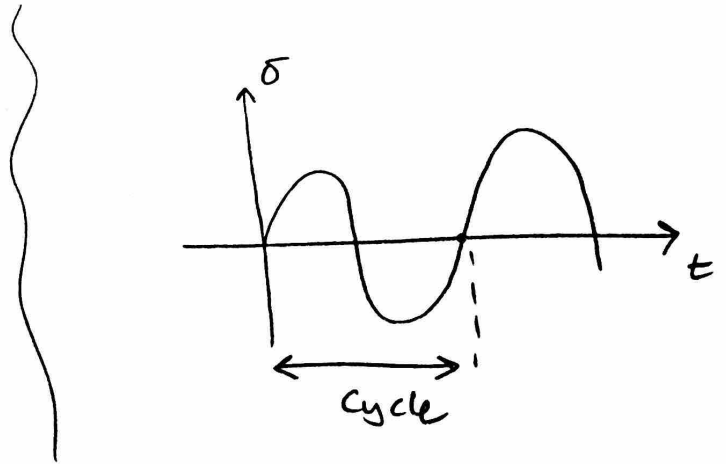
Minimum stress (σ_{min})

Fluctuating stress

mean stress (σ_m)

$$\sigma_m = \frac{\sigma_{max} - \sigma_{min}}{2}$$

Alternating stress

$$\sigma_a = \sigma_{max} - \sigma_m$$

$$\sigma_a = \sigma_m - \sigma_{min}$$

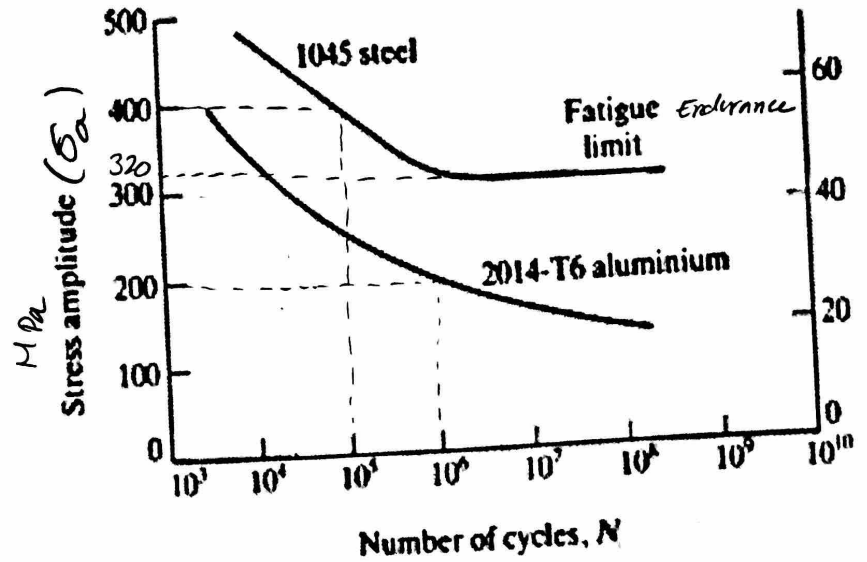Stress Range $\Delta\sigma = \sigma_{min} - \sigma_{max}$

* Fatigue Curves (S-N) curves

Fatigue life : Number of cycles to cause failure at certain σ_a

Example at $\sigma_a = 200$ MPa } Aluminium

    Fatigue life $= 10^6$ cycles

Fatigue strength

The stress at which
failure will occur
at certain number of cycles

For steel

at cycles $= 10^5$ the fatigue strength $= 400$ MPa

Fatigue Endurance limit

Stress level at which failure will never occur
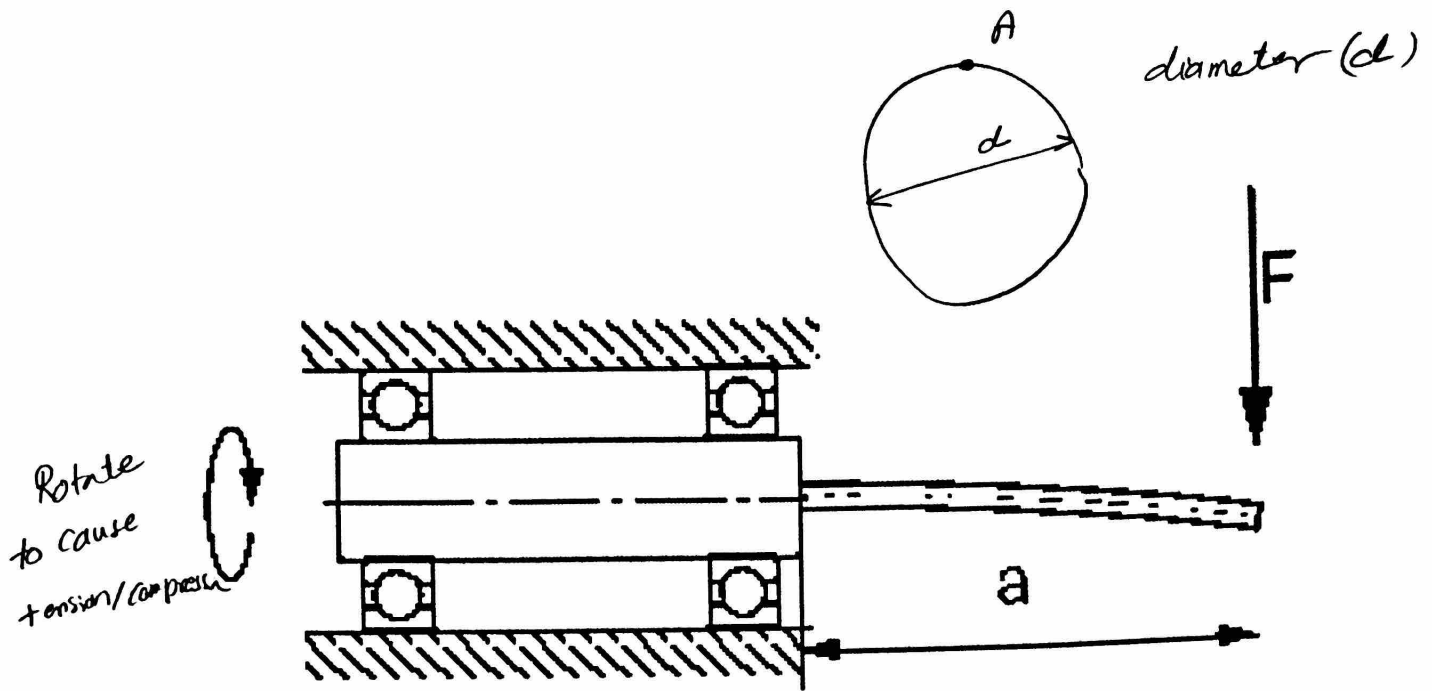for infinite number of cycles.

→ Not all materials have endurance limits

– Basically steel alloys have endurance limit
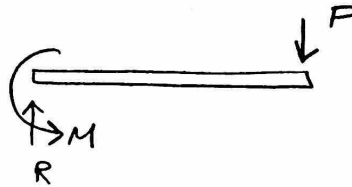
Endurance

Number of cycles before failure at certain

In the lab, what will we do?

A

diameter (d)

F

Rotate to cause tension/compression

a

F.B.D

$R = F$

$M = Fa$

↑→M
R

↓F

Normal stress at point A

$$\sigma_A = \frac{My}{I} = \frac{Fa \, d/2}{\frac{\pi}{64} d^4}$$

$$I = \frac{\pi}{64} d^4$$

$$\boxed{\sigma_A = \frac{32 \, Fa}{\pi \, d^3}}$$ ⟶ Alternating stress (σ_a)

Run till failure ⟶ measure all previously discussed quantities.