

Axial Stress & Strain

Mechanical Engineering

Load over area, extension over length, and the modulus that links them.

Direct stress is load over area, strain is extension over original length, and E connects them.

$$\sigma = P \div A \cdot \epsilon = \delta \div L \cdot E = PL \div AE$$

20 kN on 200 mm²

1 N/mm² = 1 MPa.

$\sigma = 100 \text{ MPa}$

Steel, E = 200 GPa

100 ÷ 200000.

$\epsilon = 0.0005$

Bar 2 m long

ϵ times length.

$\delta = 1.0 \text{ mm}$

THE COMMON MISTAKE

× Dividing by the deformed area

✓ Engineering stress uses the original area

True stress uses the instantaneous area and keeps rising after necking. Design data and codes are written in engineering stress.

Valid below yield, for a prismatic member loaded along its axis with no bending or buckling.