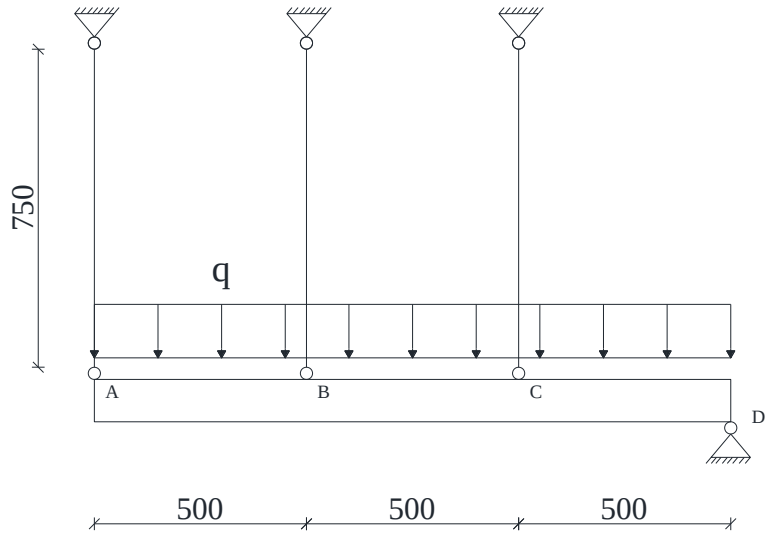
Home exercise 2.1. (5p)

In Figure 1 (top), the rigid element AD is subjected to a distributed load with intensity q. The rigid element is supported by a simple support at point D and three vertical elastic bars attached in hinges A, B, and C. An elastic-perfectly plastic material model is assumed for the bars. The stress-strain graph is shown in Figure 1 (bottom). The bars have circular cross sections with a diameter of 25 mm. All the dimensions in Figure 1 (top) are in mm.

a) Determine the yield load q_y and the corresponding displacement at point A.
b) Determine the plastic load q_p and the corresponding displacement at point A when the load just reaches the value q_p.
c) Determine the permanent deformation at point A when the load (with value $\mathrm{q} = 280$ kN/m) is removed.
d) Draw a load-displacement diagram with the load q as ordinate and the displacement δ_A of point A as abscissa.
e) Solve part c) using the plot in d).



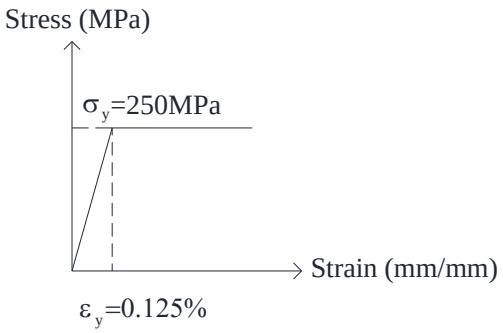


Figure 1. Problem sketch (top) and stress-strain graph (bottom).

Home exercise 2.2. (5p)

The stress-strain curve with linear hardening from a uniaxial test is shown in Figure 2.

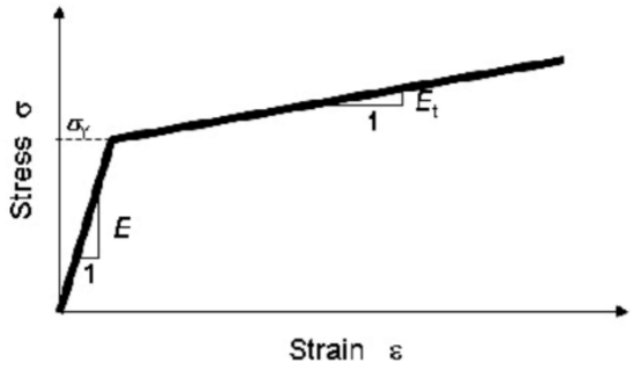


Figure 2. Stress-strain curve.

Derive the relation between equivalent yield stress named Y and equivalent plastic strain $\bar{\varepsilon}_p = \varepsilon_p$.

Partial solution: $Y = \sigma_y + \frac{EE_t}{E-E_t}\bar{\varepsilon}_p$.