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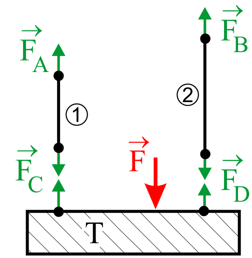
Analysis:

A system of two straight bars, each of the bars supported by the base and by the body T, all the supports modelled as pin supports.

system of bars

Free body diagram:

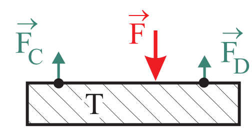
a) We isolate all the members as free bodies and use static equations to solve the external forces.
The bars are binary unloaded members ⇒ static equilibrium can exist only if both the forces act in the same line, are equal in magnitude and opposite in orientation. Thus the reactions in supports have the direction of the centrelines of the bars.



statical analysis

Statical analysis:
two times in-line system of forces ⇒ $\nu^{(1+2)} = 2$
one time system of parallel in-plane forces ⇒ $\nu^{(T)} = 2$
$\nu = \nu^{(1+2)} + \nu^{(T)} = 4, \quad \mu = 4,$
$s = \mu - \nu = 0$ ⇒ statically determinate problem.

b) Since it holds $F_A = F_C, F_B = F_D$, the free body diagram of the body T is sufficient for solution:
Statical analysis:
$\mu = 2 \qquad \nu = 2$ (system of parallel in-plane forces)
$s = \mu - \nu = 0$ ⇒ statically determinate problem.



Applicable conditions of static equilibrium:

$$\begin{array}{ll} \sum F_z = 0: & F_C + F_D - F = 0 \\ \sum M_{Cy} = 0: & Fa - F_D(a+b) = 0 \end{array}$$

Forces in bars:

$$F_D = \frac{Fa}{a+b}, \qquad F_C = F - F_D = \frac{Fb}{a+b}.$$

Distribution of stresses: stress

Since the bars are loaded in simple tension (compression), the stress is constant throughout the cross section and can be calculated using the following formula: $\sigma(x) = \dfrac{N(x)}{S(x)}$:

$$\sigma_1 = \frac{N_1}{S_1} = \frac{Fb}{S_1(a+b)}, \quad \sigma_2 = \frac{N_2}{S_2} = \frac{Fa}{S_2(a+b)}.$$

Check for the limit state of elasticity: limit state

We calculate the safety factor against the limit state of elasticity for both of the bars of the system and the lowest of them will determine the safety factor of the whole system:

$$k_{K1} = \frac{\sigma_{K1}}{|\sigma_1|}, \quad k_{K2} = \frac{\sigma_{K2}}{|\sigma_2|}, \quad k_K = \min\{k_{K1}, k_{K2}\}.$$

Note:

The calculation does not account for the stress concentration in the surroundings of the supports. This concentration depends on the technology of the support realization and, in practice, the choice of the suitable safety factor value is based mostly on experience and accounts for the technology of supports.