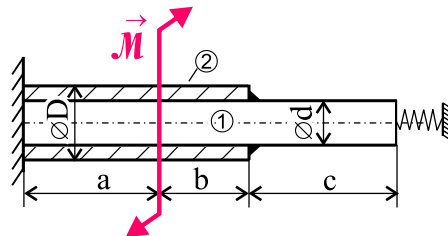


Problem 505

Determine the maximum value of the couple \mathcal{M}_{\max} which the shaft (in the figure) can be acted upon by, if the safety factor against the limit state of elasticity should be at least 2. The system of bodies consists of the bar No. 1 (yield stress σ_{K1} and Young's modulus E_1) and of the tube No. 2 (σ_{k2} , E_2). The bar and the tube are welded to the base on one of its ends. The tube is welded to the bar on the second end. The bar No. 1 is fixed by a spring with torsional stiffness c_k on the second end. Shear yield stress value is $\tau_K = \sigma_K/2$.



Input values:

$$\begin{array}{lll}
 a = 400 \text{ mm}, & b = 200 \text{ mm}, & c = 500 \text{ mm}, \\
 \varnothing D = 50 \text{ mm}, & \varnothing d = 30 \text{ mm}, & \mu^{(1)} = \mu^{(2)} = 0,3 \\
 E^{(1)} = 1,5 \cdot 10^5 \text{ MPa}, & E^{(2)} = 2 \cdot 10^5 \text{ MPa}, & c_k = 3 \cdot 10^4 \text{ Nm.rad}^{-1}, \\
 \sigma_K^{(1)} = 400 \text{ MPa}, & \sigma_K^{(2)} = 450 \text{ MPa}. &
 \end{array}$$

torsion