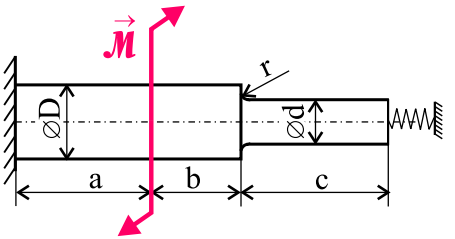
Problem 506

Determine the maximum value of the couple $\mathcal{M}_{\max}$ which the body (in the figure) can be acted upon by, if the safety factor against the limit state of elasticity should be at least 2. The body is welded to the base on one of its ends and fixed by a spring with torsional stiffness c_k on the other one.



According the Tresca criterion, the shear yield stress value is $\tau_K = \sigma_K/2$.

Input values::

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

torsion