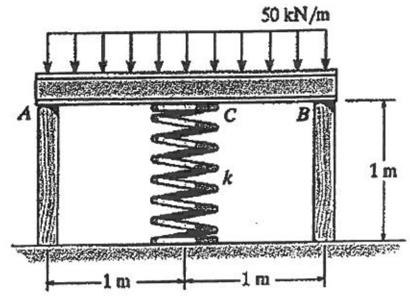
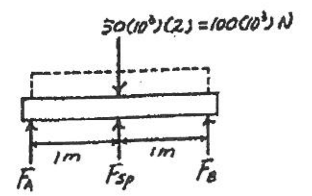
The rigid bar is supported by the two short white spruce wooden posts and a spring. If each of the posts has an unloaded length of 1 m and a cross-sectional area of 600 mm², and the spring has a stiffness of $k = 2$ MN/m and an unstretched length of 1.02 m, determine the force in each post after the load is applied to the bar.



Equations of Equilibrium :

$\curvearrowleft + \Sigma M_C = 0; \quad F_B(1) - F_A(1) = 0 \quad F_A = F_B = F$

$+\uparrow \Sigma F_y = 0: \quad 2F + F_{sp} - 100(10^3) = 0 \qquad [1]$

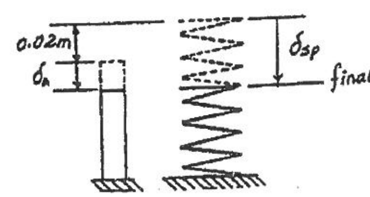


Compatibility :

$(+\downarrow) \qquad \delta_A + 0.02 = \delta_{sp}$

$$\frac{F(1)}{600(10^{-6})9.65(10^9)} + 0.02 = \frac{F_{sp}}{2.0(10^6)}$$

$$0.1727F + 20(10^3) = 0.5\,F_{sp} \qquad [2]$$

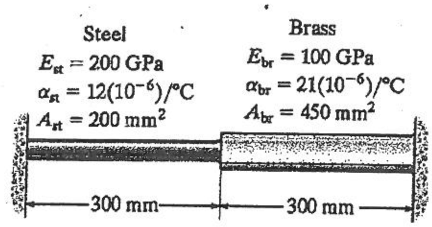


Solving Eqs. [1] and [2] yields :

$F_A = F_B = F = 25581.7$ N $= 25.6$ kN **Ans**

$F_{sp} = 48\,836.5$ N

Two bars, each made of a different material, are connected and placed between two walls when the temperature is $T_1 = 10°C$. Determine the force exerted on the (rigid) supports when the temperature becomes $T_2 = 20°C$. The material properties and cross-sectional area of each bar are given in the figure.



Compatibility :

$(\overset{+}{\leftarrow}) \qquad 0 = \delta_T - \delta_F$

$$0 = 12(10^{-6})(20-10)(0.3) + 21(10^{-6})(20-10)(0.3) - \frac{F(0.3)}{200(10^{-6})(200)(10^9)} - \frac{F(0.3)}{450(10^{-6})(100)(10^9)}$$

$F = 6988.2$ N $= 6.99$ kN **Ans**