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 mm$^2$, 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:

$$
\sum F_x = 0; \quad F_A(1) - F_B(1) = 0 \quad F_A = F_B = F
$$

$$
+ \sum F_y = 0; \quad 2F + F_{sp} - 100(10^3) = 0 \quad [1]
$$

Compatibility:

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

$$
\frac{F(1)}{600(10^4)9.65(10^3) + 0.02} = \frac{F_{sp}}{2.0(10^4)}
$$

$$
0.1737F + 20(10^3) = 0.5 F_{sp} \quad [2]
$$

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

$$
F_A = F_B = F = 25581.7 \text{ N} = 25.6 \text{ kN} \quad \text{Ans}
$$

$$
F_{sp} = 48836.5 \text{ N}
$$

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

Compatibility:

$$
(\pm) \quad 0 = \delta_T - \delta_{sp}
$$

$$
0 = 12(10^{-6})(20 - 10)(0.3) + 21(10^{-6})(20 - 10)(0.3)
$$

$$
- \frac{F(0.3)}{200(10^{-4})(200)(10^3)} - \frac{F(0.3)}{450(10^{-4})(100)(10^3)}
$$

$$
F = 5988.2 \text{ N} = 6.99 \text{ kN} \quad \text{Ans}
$$