DESIGN PROBLEMS

Thermal Expansion

19.D1 For these railroad tracks, each end is allowed to expand one-half of the joint space distance, or the track may expand a total of this distance (5.4 mm). Equation 19.3a is used to solve for T_f, where the value α_l for the 1025 steel [12.0 x 10^{-6} (°C)$^{-1}$] is found in Table 19.1. Thus, solving for T_f from Equation 19.3a leads to

$$T_f = \frac{\Delta l}{\alpha_l l_0} + T_0$$

$$= \frac{5.4 \text{ x } 10^{-3} \text{ m}}{\left[12.0 \text{ x } 10^{-6} \text{ (°C)}^{-1}\right](11.9 \text{ m})} + 4°\text{C}$$

$$= 37.8°\text{C} + 4°\text{C} = 41.8°\text{C} \ (107.3°\text{F})$$