Example 2.1.4

A rod of initial length $L_0 = 1$ m (at a room temperature of 20 ºC) is made of a 'sandwich' of three polymer layers (symmetric through the thickness) as shown in Figure 1. The rod is then subjected to a cruise-altitude temperature of -50 ºC. Calculate the unconstrained length of the rod at this temperature.
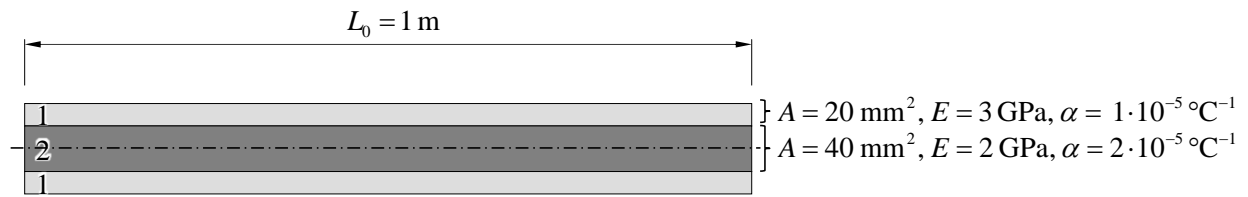

$L_0 = 1$ m

$A = 20 \text{ mm}^2, E = 3 \text{ GPa}, \alpha = 1 \cdot 10^{-5} \text{ °C}^{-1}$

$A = 40 \text{ mm}^2, E = 2 \text{ GPa}, \alpha = 2 \cdot 10^{-5} \text{ °C}^{-1}$

Figure 1: A rod made of a 'sandwich' of polymer layers (not to scale).