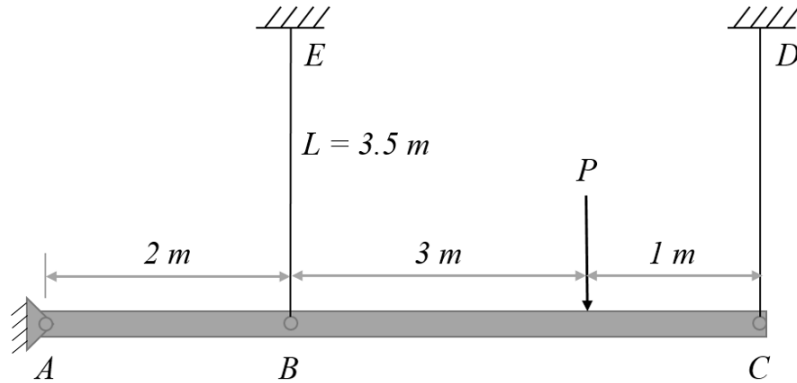
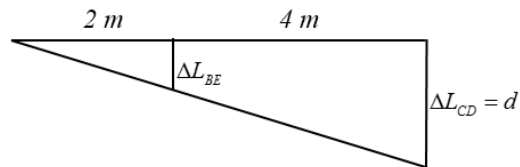


2-11. A random force  $P$  is applied to the beam that causes a downward displacement at  $C$ . The displacement follows the distribution  $d \sim N(12, 0.2^2)$  mm. Determine the distribution of the normal strain in wire  $BE$ .



### Solution

Solve for the change in length of wire  $BE$ .



$$\frac{\Delta L_{BE}}{L_{AB}} = \frac{\Delta L_{CD}}{L_{AC}} = \frac{d}{L_{AC}}$$

$$\Rightarrow \Delta L_{BE} = \frac{L_{AB}}{L_{BC}} d$$

Next, solve for the normal strain in wire  $BE$ .

$$\varepsilon_{BE} = \frac{\Delta L_{BE}}{L_{BE}} = \frac{L_{AB}}{L_{AC} L_{BE}} d$$

$$\mu_{\varepsilon_{BE}} = \frac{L_{AB}}{L_{AC} L_{BE}} \mu_d = \frac{2}{(6)(3.5)} (0.012) = 0.00114$$

$$\sigma_{\varepsilon_{BE}} = \sqrt{\left(\frac{L_{AB}}{L_{AC} L_{BE}}\right)^2} \sigma_d = \sqrt{\left(\frac{2}{(6)(3.5)}\right)^2} (2 \times 10^{-4}) = 1.90 \times 10^{-5}$$

Then

$$\varepsilon_{BE} \sim N\left(0.00114, (1.90 \times 10^{-5})^2\right)$$

**Ans.**