

P130, ex 4-15

(a) 英 $\rightarrow$ 中

(b) the axial stress of each rod. $\sigma_{AB} = 200 \text{ MPa}$, $\sigma_{CD} = 177.8 \text{ MPa}$,

$\sigma_{EF} = 267 \text{ MPa}$.

(c) the deflection of each rod. $\delta_{AB} = 1.143 \text{ mm}$, $\delta_{CD} = 1.016 \text{ mm}$, $\delta_{EF} = 1.144 \text{ mm}$

(d) the vertical displacement of point F, $\delta_F = 1.144 \text{ mm}$

$\delta = \frac{FL}{EA}$
 $\delta = \frac{F \cdot L}{EA}$

$\Rightarrow$ 先找 F

$\Rightarrow$ 先由自由体图

$\Rightarrow$ AB, CD, EF 皆 = 力棒



$\sum M_A = 0; F_{CD} \cdot AC - P \cdot AE = 0$

$1 \cdot 2.5 F_{CD} - 20 \cdot 0.5 = 0$

$F_{CD} = 8 \text{ kN}$

(b)(c)

$\sigma_{AB} = \frac{F_{AB}}{A_{AB}} = \frac{12000}{60} = 200 \text{ MPa}$

$\sum F_y = 0, F_{AB} + F_{CD} - P = 0$

$\delta_{AB} = \frac{2000}{350 \times 10^3} \times 200 = 1.143 \text{ mm}$

$F_{AB} + 8 - 20 = 0, F_{AB} = 12 \text{ kN}$

$\sigma_{CD} = \frac{8000}{45} = 177.78 \text{ MPa}$

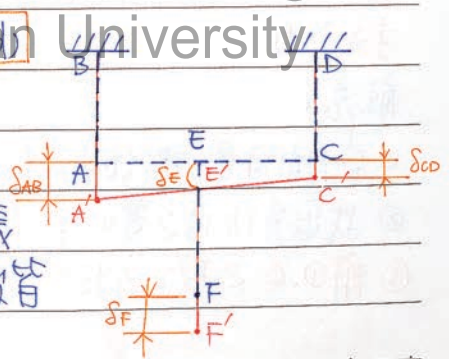
$\delta_{CD} = \frac{2000}{350 \times 10^3} \times 177.78 = 1.016 \text{ mm}$

$\sigma_{EF} = \frac{20000}{75} = 267 \text{ MPa}$

$\delta_{EF} = \frac{1500}{350 \times 10^3} \times 267 = 1.144 \text{ mm}$

$\therefore$ AB, CD, EF 桿皆受力, 一定會伸長

$\Rightarrow$ 但 AC 為 rigid bar, AC 受力前後皆為直線



斜率公式

$$\frac{\delta E - \delta_{CD}}{0.75} = \frac{\delta_{AB} - \delta_{CD}}{1.25}$$

$$\Rightarrow \delta E - 1.016 = \frac{0.175}{1.25} (1.143 - 1.016)$$

$$\delta_E = 1.0922 \text{ mm}$$

$$\delta_F = \delta_E + \delta_{EF} = 1.0922 + 1.143$$

Southern Taiwan University $= 22352 \text{ mm}$