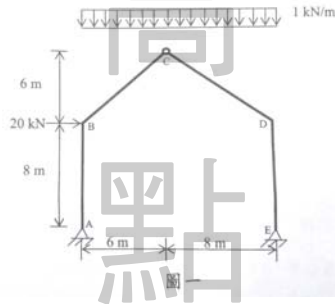


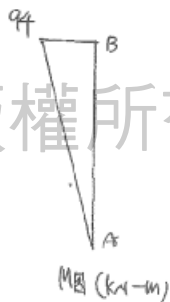
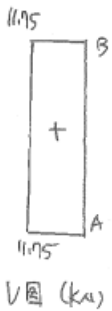
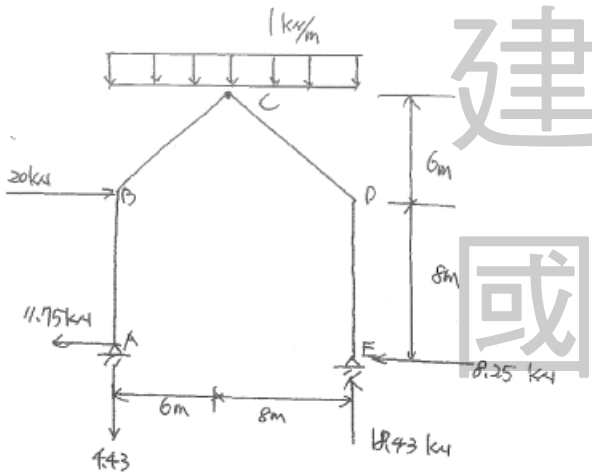
結構學

洪達老師 主解

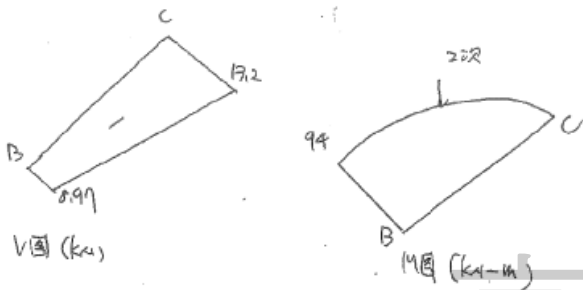
- 一、如圖一所示靜定剛架結構各桿件之E、I均相同。剛架結構A、E點為鉸支承，C點為鉸接。在B點施加水平載重20kN，桿件BC、CD並承受垂直均佈載重1kN/m。請計算A、E點支承反力為何？並繪桿件AB、BC之剪力圖與彎矩圖。(25分)



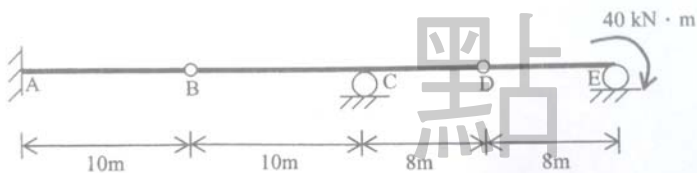
解：



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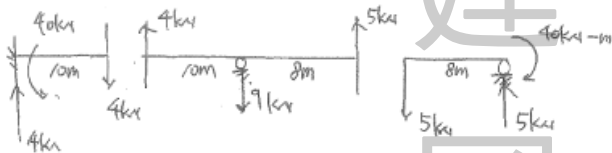


二、如圖二所示連續梁各桿件之E、I為固定值。A為固接支承，B、D為鉸接，C、E則為滾支承。在E點承受一順時鐘方向力矩40kN·m。請計算各支承反力並繪桿件A到E彎矩圖，並推導B、D點垂直位移與C、E點轉角為何？（方法不拘）（25分）

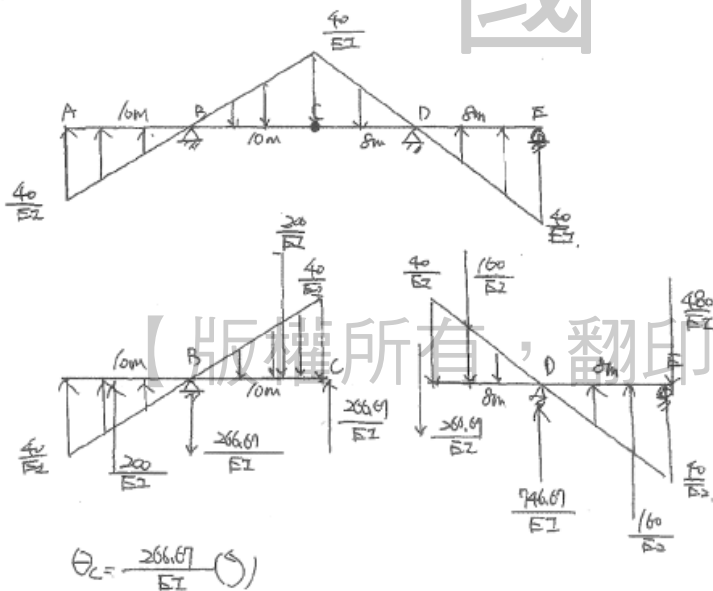


圖二

解：



⇒ 利用艾軒標法分析

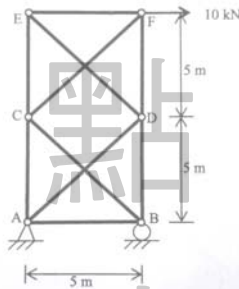


$$Q_E = \frac{486}{EI} \quad (2)$$

$$\Delta_B = M_B = \frac{(-200)}{EI} \times \left(\frac{2}{3} \times 10\right) = \frac{-1333.33}{EI} \quad (\downarrow)$$

$$\Delta_0 = M_D = \frac{480}{EI} \times 8 - \frac{160}{EI} \times \left(8 \times \frac{2}{3}\right) = \frac{2986.67}{EI} \quad (\uparrow)$$

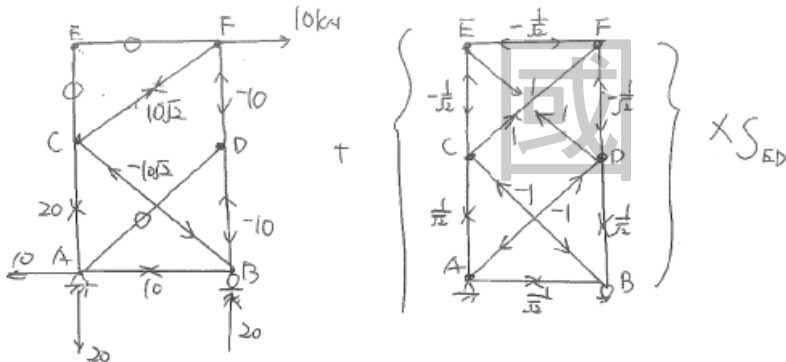
三、如圖三所示桁架結構各桿件之E、A均相同。在F點承受10kN水平力。請取ED桿件力為贅力，以應用力法（諧合變位法）推導ED桿件力，並求得各桿件之桿件力為何？（25分）



圖三

解：

以取 DE 桿內力 S_{DE} (程) 為贅力：



$$\Delta_{DE} + S_{DE} \delta_{DE} = 0$$

$$\Delta_{DE} = \frac{1}{AE} \left[(10\sqrt{2})(1)(5\sqrt{2}) + (-10)\left(\frac{1}{\sqrt{2}}\right)(5) + (-10\sqrt{2})(-1)(5\sqrt{2}) + (20)\left(\frac{1}{\sqrt{2}}\right)(5) \right]$$

$$= \frac{306.1}{AE}$$

$$\delta_{DE} = \frac{1}{AE} \left[(-\frac{1}{5}) \times 5 \times 6 + (1)^2 (\frac{5}{5}) \times 4 \right]$$

$$= \frac{4228}{AE}$$

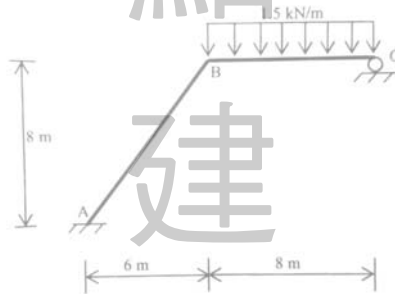
$$\therefore \frac{3061}{AE} + S_{DE} \left(\frac{4228}{AE} \right) = 0$$

$$\therefore S_{DE} = -7.07 \text{ (kN)}$$

$$\therefore \underline{S_{DE} = 7.07 \text{ (kN) (FE)}} \quad \times$$

高

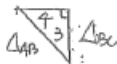
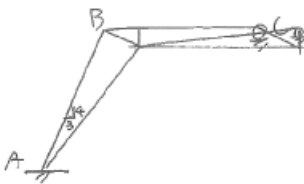
四、如圖四所示剛架結構各桿件之E、I均相同。A為固接支承，C為滾支承。不考慮桿件軸向變形，請以傾角位移法（Slope-deflection method）分析各桿件端點彎矩為何？（使用其他方法不予計分）（25分）



圖四

或

解：



$$\Delta_{BC} = \frac{3}{5} \Delta_{AB} \quad \text{令 } \Delta_{AB} = \Delta \quad \therefore \Delta_{BC} = \frac{3}{5} \Delta$$

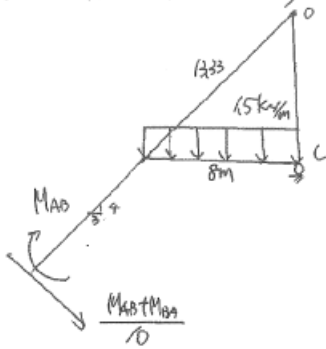
$$M_{AB} = \frac{2EI}{10} \left(\theta_B - 3 \frac{\Delta}{10} \right) = 40\theta_B - 12\Delta$$

$$M_{BA} = \frac{2EI}{10} \left(2\theta_B - 3 \frac{\Delta}{10} \right) = 80\theta_B - 12\Delta$$

$$M_{BC} = \frac{2EI}{18} \left(15\theta_B + 15 \frac{3}{8} \Delta \right) - \frac{3}{8} \frac{15 \times 8^2}{12} = 7.5\theta_B + 0.5625\Delta - 12$$

$$\sum M_B = 0$$

$$\therefore 15.5\theta_B - 0.6375\Delta = 12 \quad \text{--- (1)}$$



$$\sum Y_B = 0 \quad \uparrow$$

$$\therefore M_{AB} - \left(\frac{M_{AB} + M_{BC}}{10}\right) \times (10 + 3.33) - 15 \times 8 \times 4 = 0$$

$$\therefore 4\theta_B - 1.2\Delta - 28\theta_B + 5.6\Delta - 48 = 0$$

$$\therefore -24\theta_B + 4.4\Delta = 48 \quad \text{--- (2)}$$

由 (1) (2) 式得：

$$\theta_B = 1.577$$

$$\Delta = 19.5$$

$$\therefore M_{AB} = -17.1 = 17.1 \text{ (kN)} \quad (S)$$

$$M_{BC} = -17.8 = 17.8 \text{ (kN)} \quad (S)$$

$$M_{BC} = 17.8 \text{ (kN)} \quad (2)$$

高點建國

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