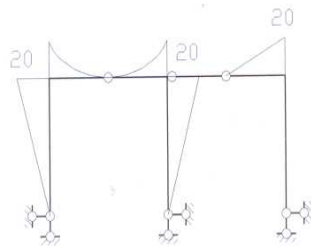


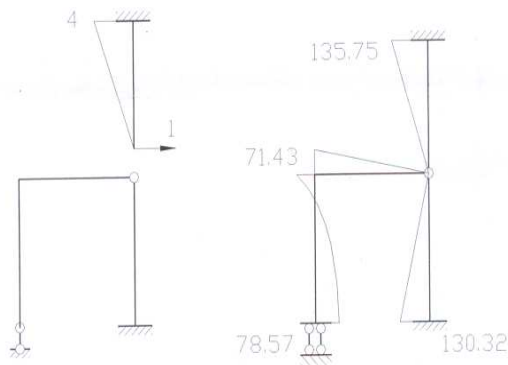
- 一、  
 (a) 有一个多余约束的几何不变体系。 5  
 (b) 瞬变体系。 5  
 (c) 没有多余约束的几何不变体系。 5

20



M图 (KN.m)

三、30

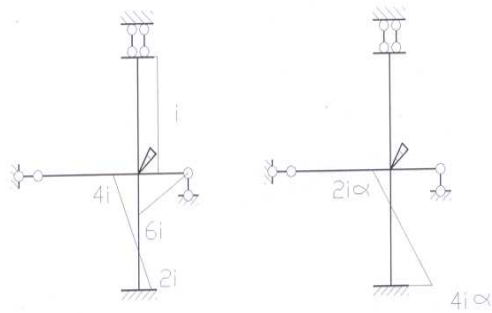


M1图

M图 (KN.m)

$$\Delta_{SH} = \frac{1}{EI} \times \frac{1}{2} \times 4 \times 4 \times \frac{2}{3} \times 135.75 = \frac{724}{EI} (\rightarrow)$$

四、30



M1图

令:  $\frac{EI}{a} = i$   
 位移法方程

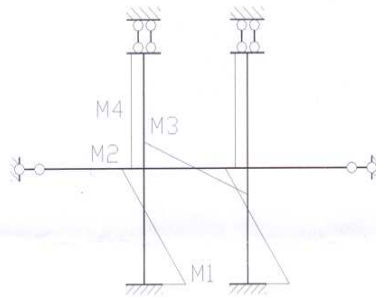
$$r_{11}Z_1 + R_{1\Delta} = 0$$

$$r_{11} = 11i, R_{1\Delta} = 2i\alpha$$

求得:

$$Z = -\frac{2\alpha}{11}$$

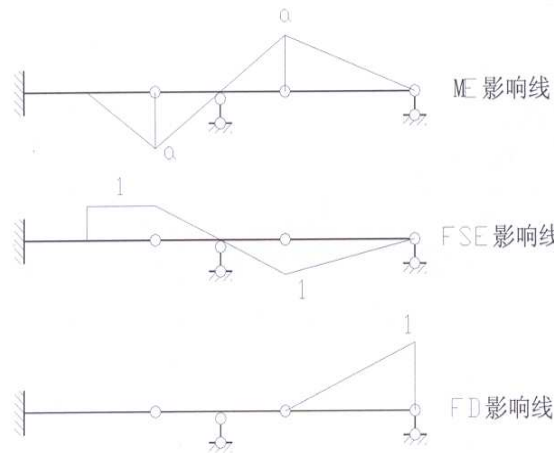
结构的最终弯矩图为:



图中:

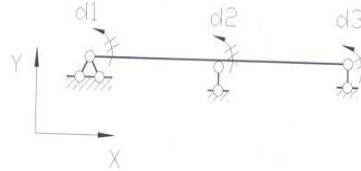
$$M_1 = \frac{40}{11}i\alpha, M_2 = \frac{14}{11}i\alpha, M_3 = \frac{12}{11}i\alpha, M_4 = \frac{2}{11}i\alpha$$

五、15



六、30  
 【解】:

令:  $\frac{EI}{6} = i$



1. 等效结点荷载

$$\{\lambda\}^{(1)} = [1 \quad 2]^T, \{F_F\}^{(1)} = [36 \quad -36]^T, \{\lambda\}^{(2)} = [2 \quad 3]^T, \{F_F\}^{(2)} = [6 \quad -6]^T$$

$$\{P\} = -[36 \quad -30 \quad -6]^T = [-36 \quad 30 \quad 6]^T$$

2. 结构刚度矩阵

$$[k]^{(1)} = \begin{bmatrix} 4i & 2i \\ 2i & 4i \end{bmatrix}, [k]^{(2)} = \begin{bmatrix} 4i & 2i \\ 2i & 4i \end{bmatrix}$$

$$[K] = \begin{bmatrix} 4i & 2i & 0 \\ 2i & 8i & 2i \\ 0 & 2i & 4i \end{bmatrix}$$

七、10

【解】:

1. 结构的自振频率

$$k = K + \frac{3EI}{a^3}$$

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{K + \frac{3EI}{a^3}}{m}} = 2\sqrt{\frac{EI}{ma^3}}$$

2. 动力系数

$$\mu = \frac{1}{1 - (\frac{\theta}{\omega})^2} = \frac{4}{3}$$

3. 最大动弯矩

$$M_{d\max} = \mu F \cdot a = \frac{4}{3} Fa$$

最大动弯矩发生在 A 处。