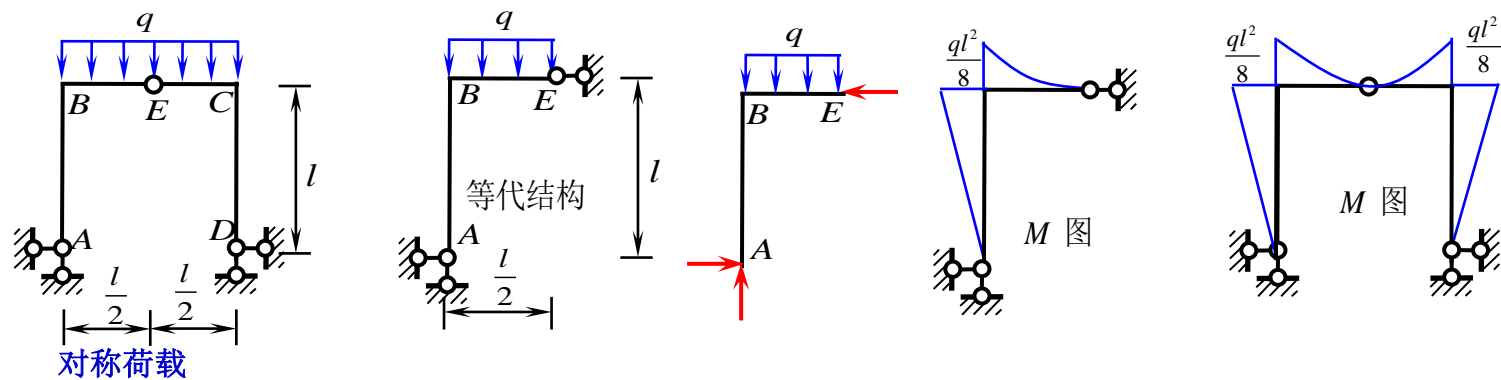
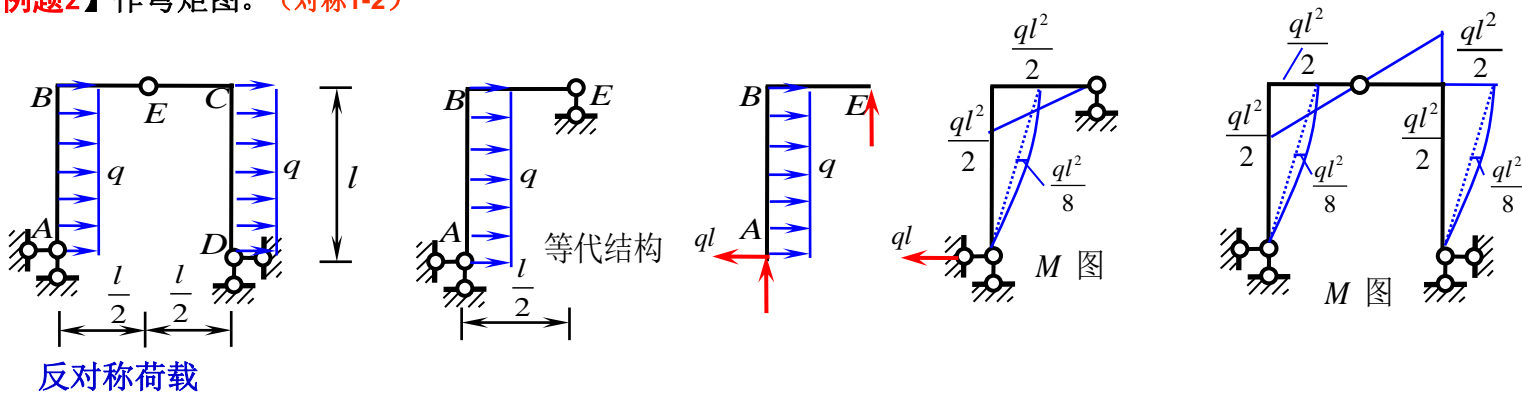


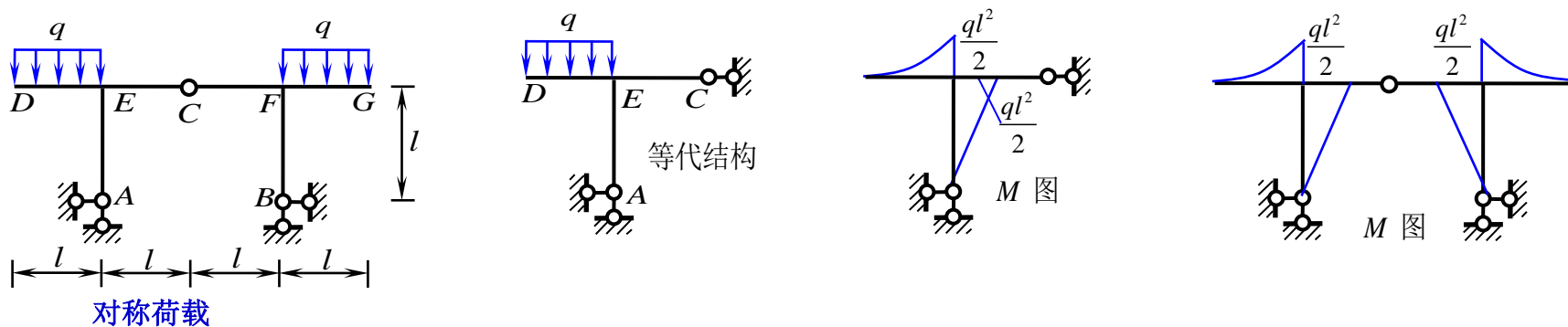
【例题1】作弯矩图。（对称1-1）



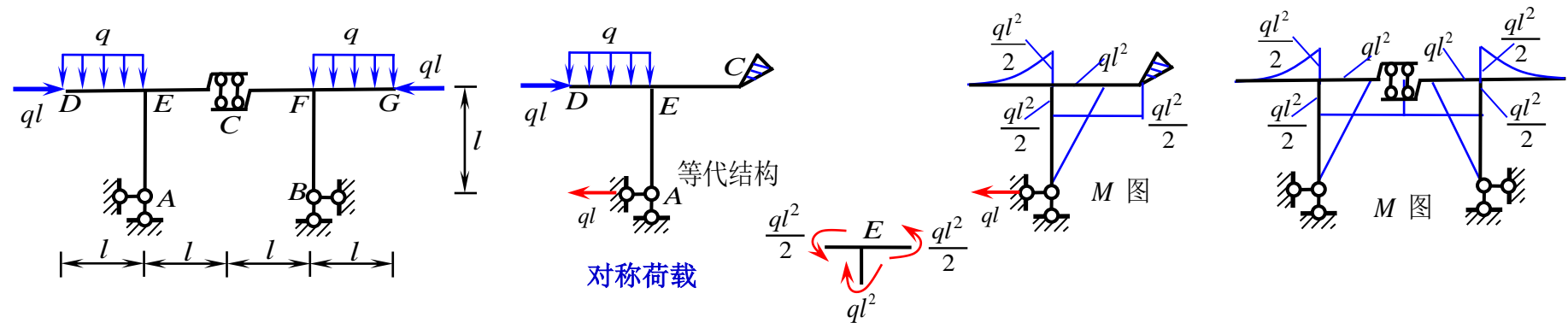
【例题2】作弯矩图。（对称1-2）



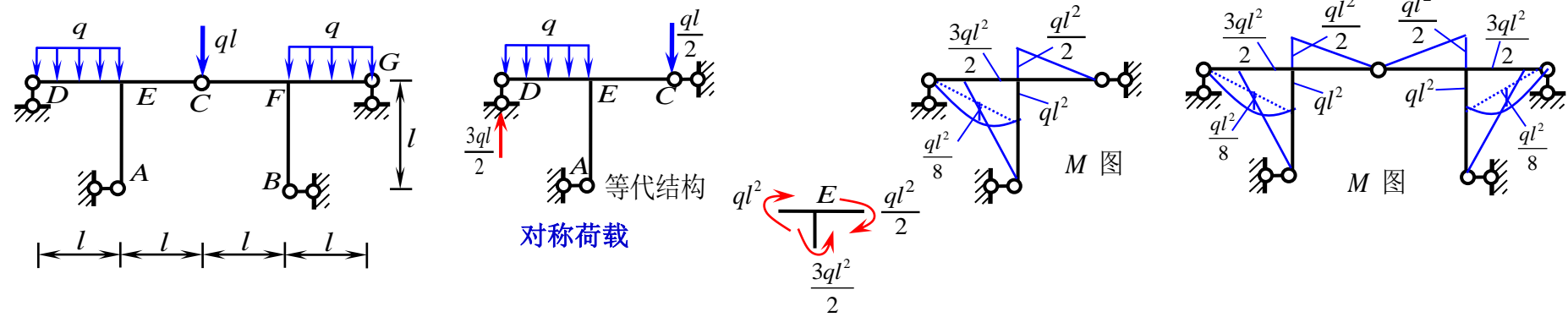
【例题3】作弯矩图。（对称1-2）



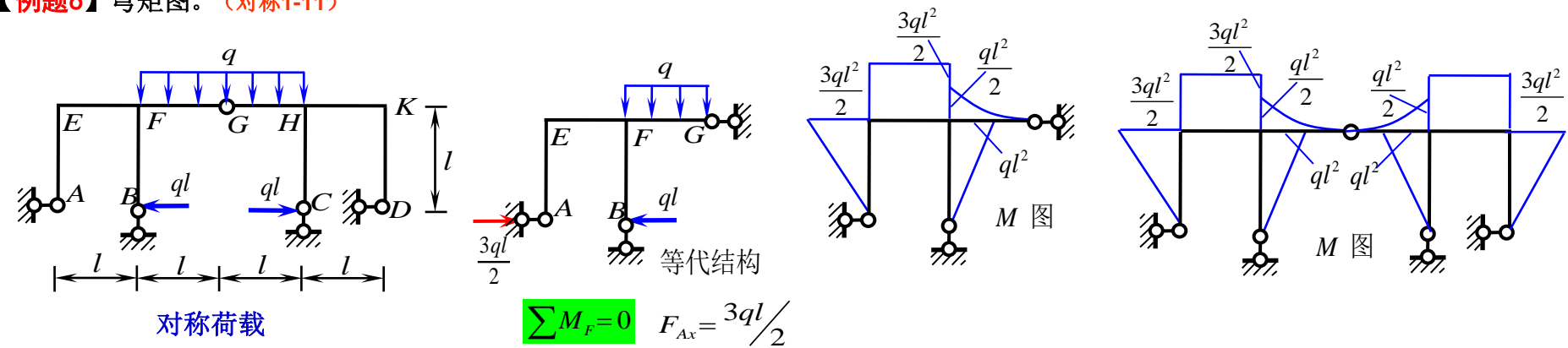
【例题4】弯矩图。（对称1-6）



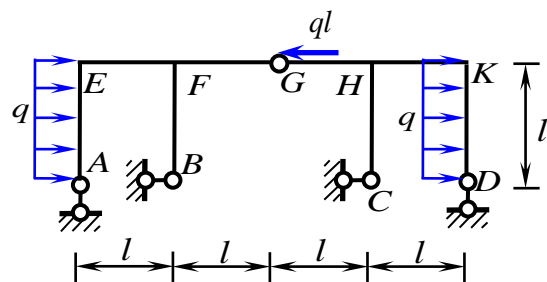
【例题5】弯矩图。（对称1-9）



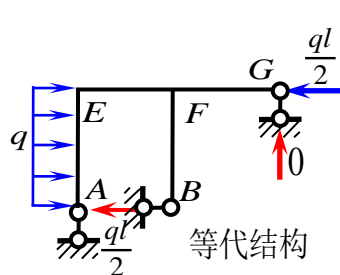
【例题6】弯矩图。（对称1-11）



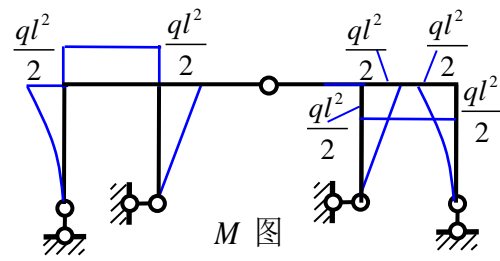
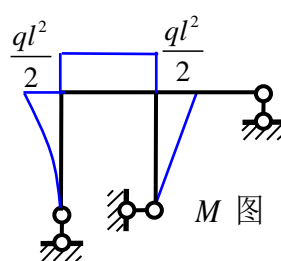
【例题7】弯矩图。（对称1-12）



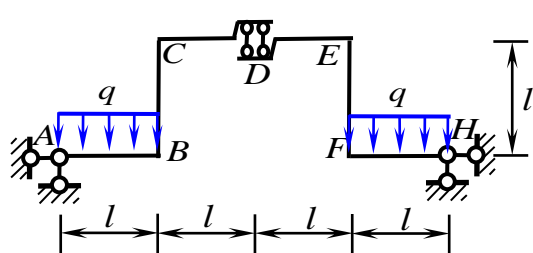
反对称荷载



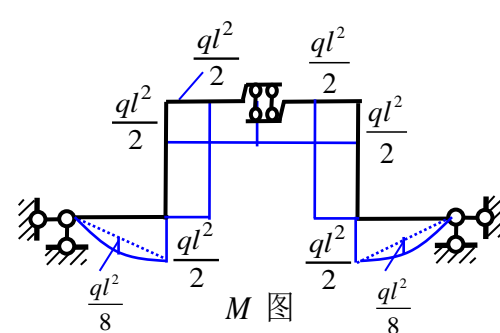
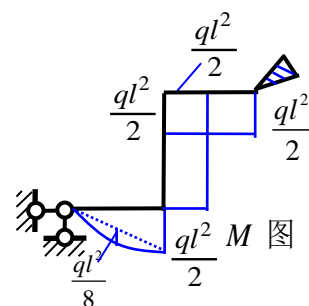
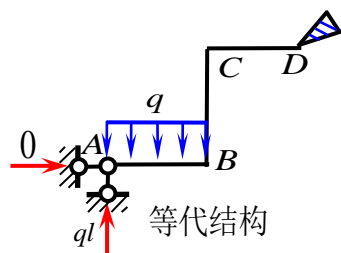
$$\sum M_A = 0 \quad F_{Gy} = 0$$



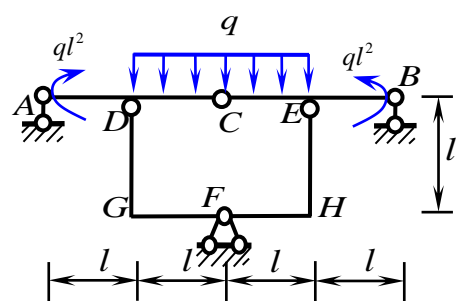
【例题8】弯矩图。（对称1-14）



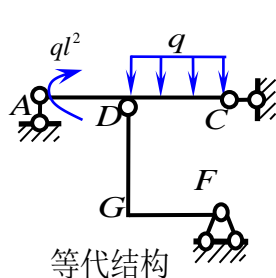
对称荷载



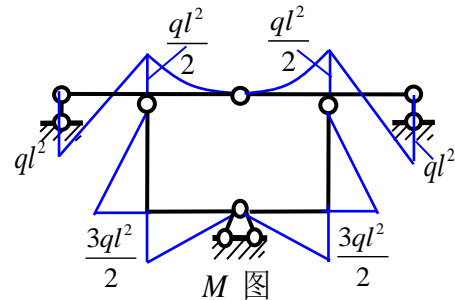
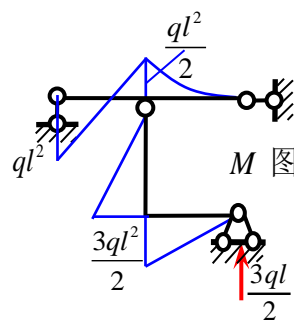
【例题9】弯矩图。（对称1-17）



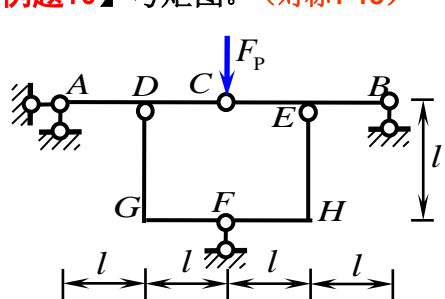
对称荷载



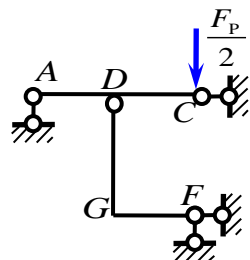
$$\sum M_D = 0 \quad F_{Ay} = \frac{3ql}{2}$$



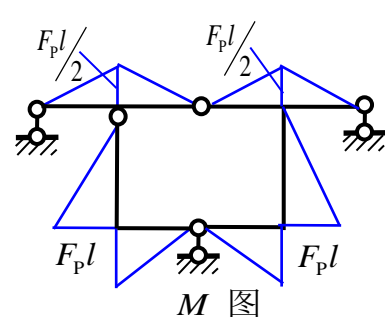
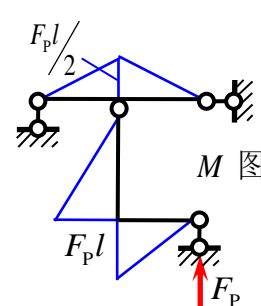
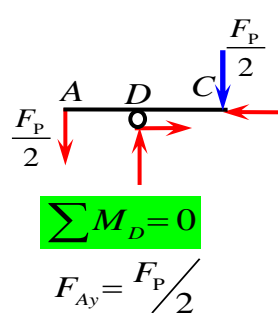
【例题10】弯矩图。(对称1-18)



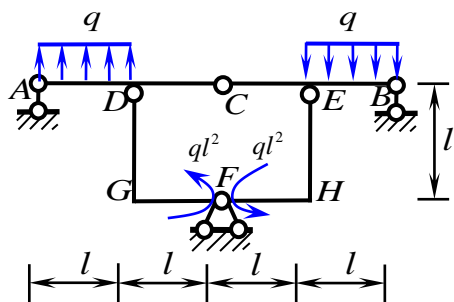
A支座水平反力为零，可以按照对称结构对称荷载计算



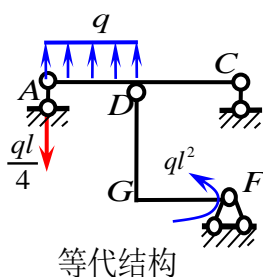
等代结构



【例题11】弯矩图。(对称1-19)

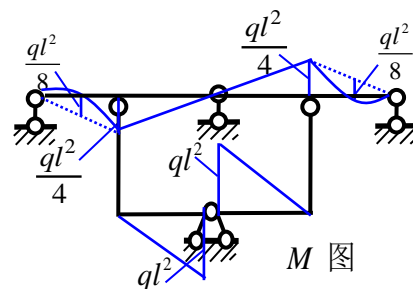
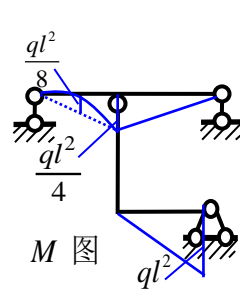


反对称荷载

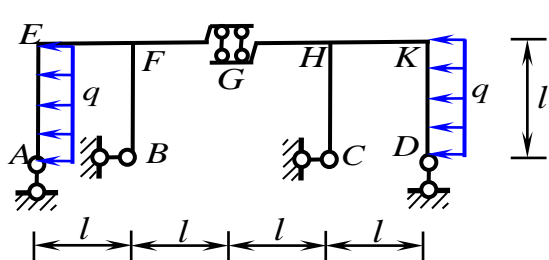


等代结构

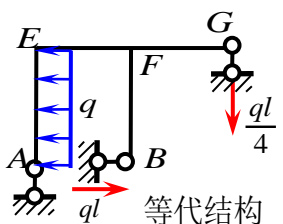
$$\sum M_F = 0 \quad F_{Ay} = ql/4$$



【例题12】弯矩图。(对称1-21)

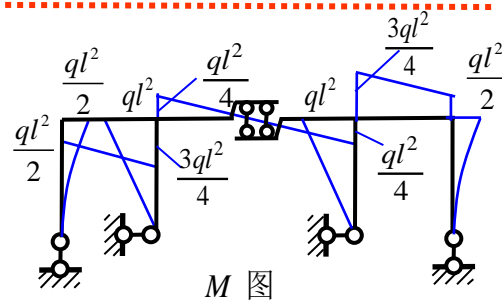
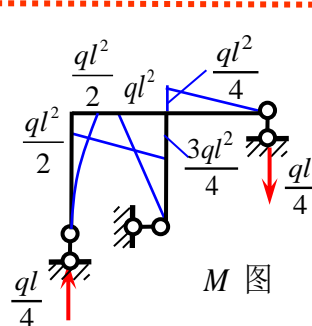


反对称荷载

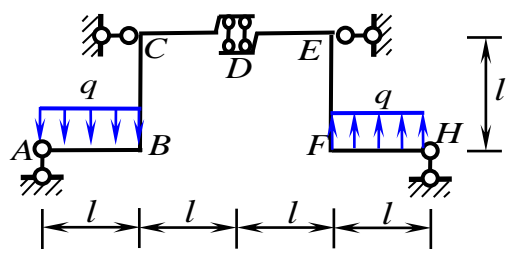


等代结构

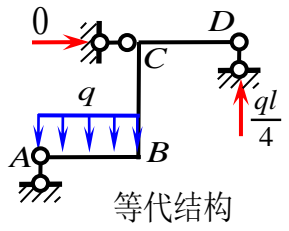
$$\sum M_A = 0 \quad F_{Gy} = ql/4$$



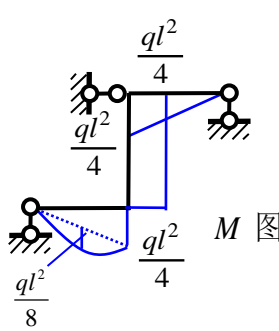
【例题13】弯矩图。（对称1-22）



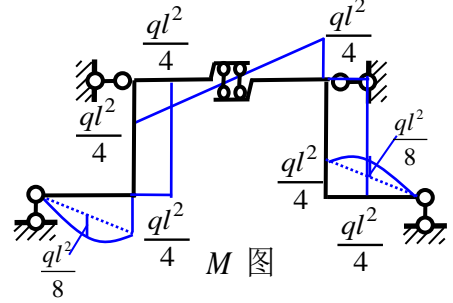
反对称荷载



等代结构

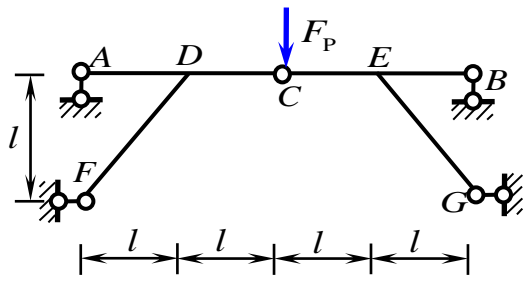


M 图

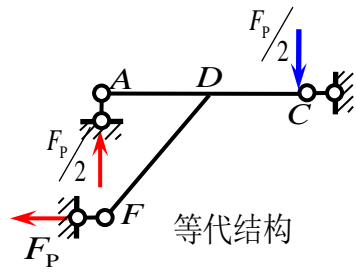


M 图

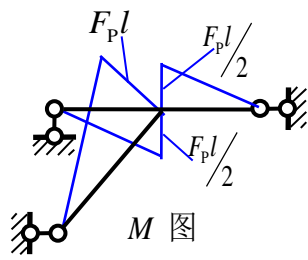
【例题14】弯矩图。（对称1-23）



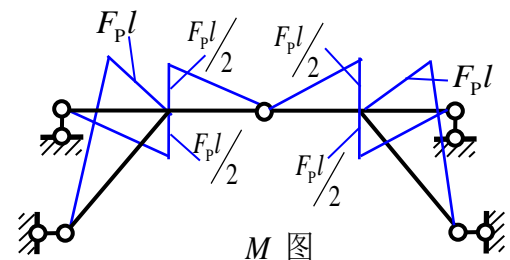
对称荷载



等代结构

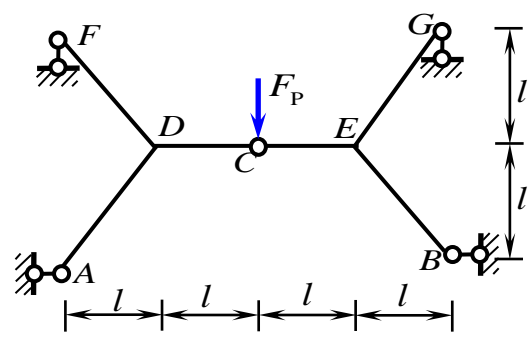


M 图

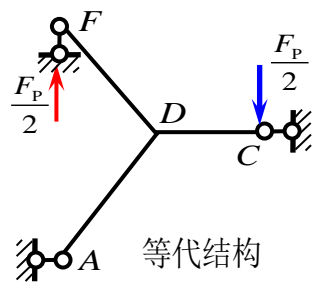


M 图

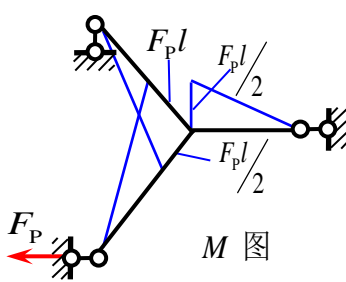
【例题15】弯矩图。（对称1-25）



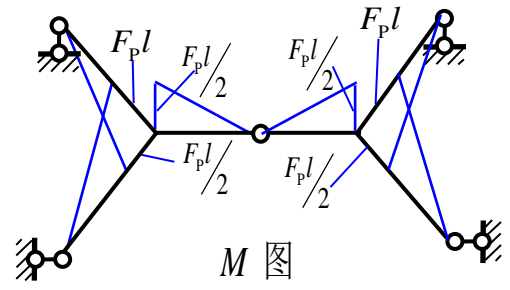
对称荷载



等代结构

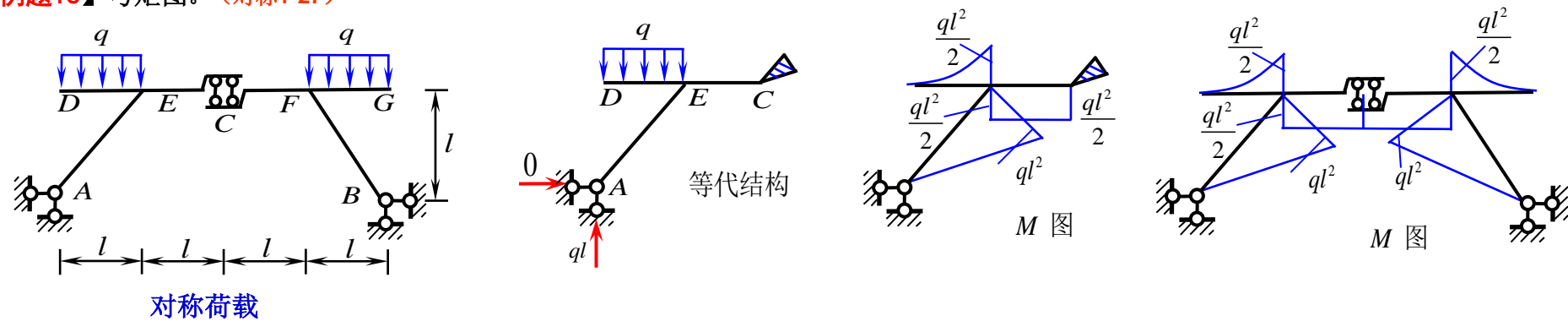


M 图

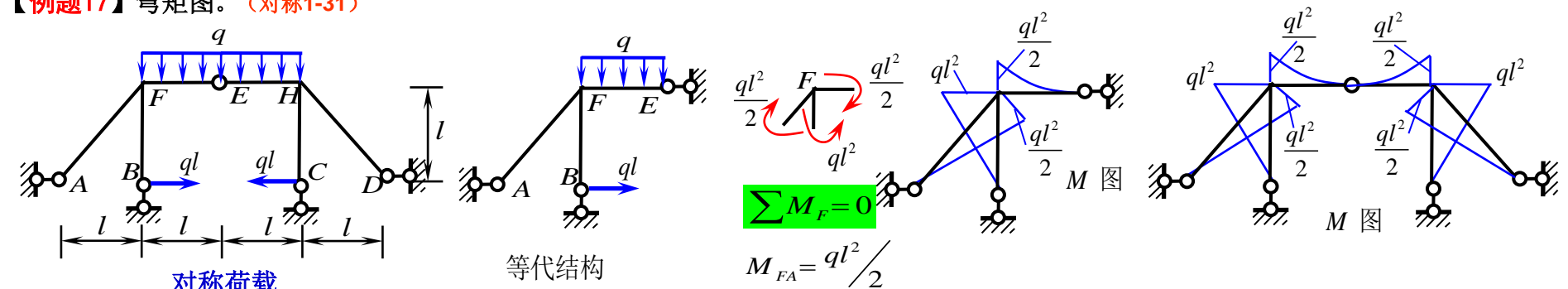


M 图

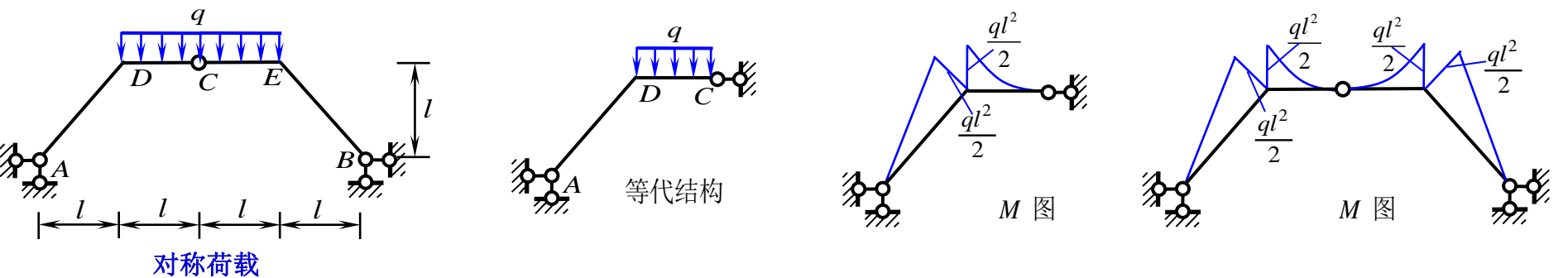
【例题16】弯矩图。（对称1-27）



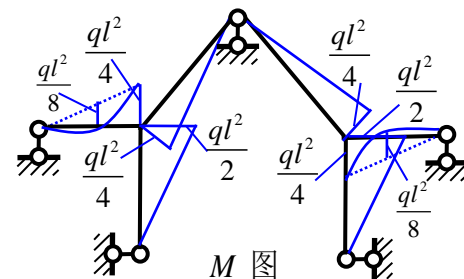
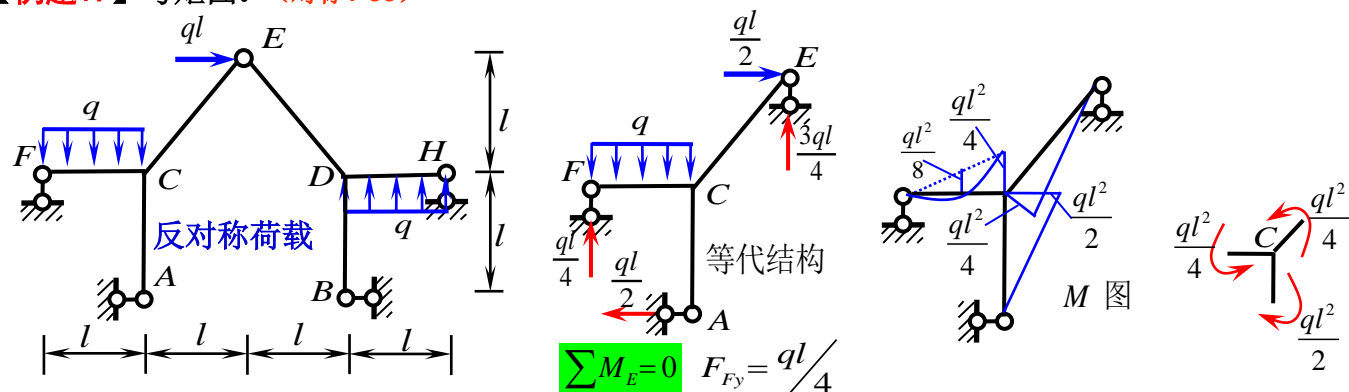
【例题17】弯矩图。（对称1-31）



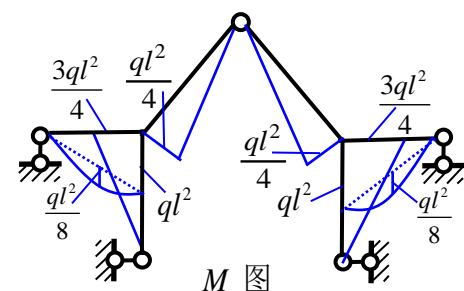
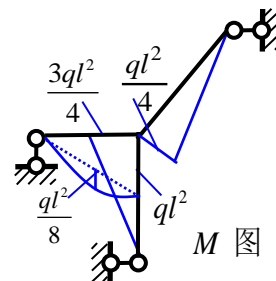
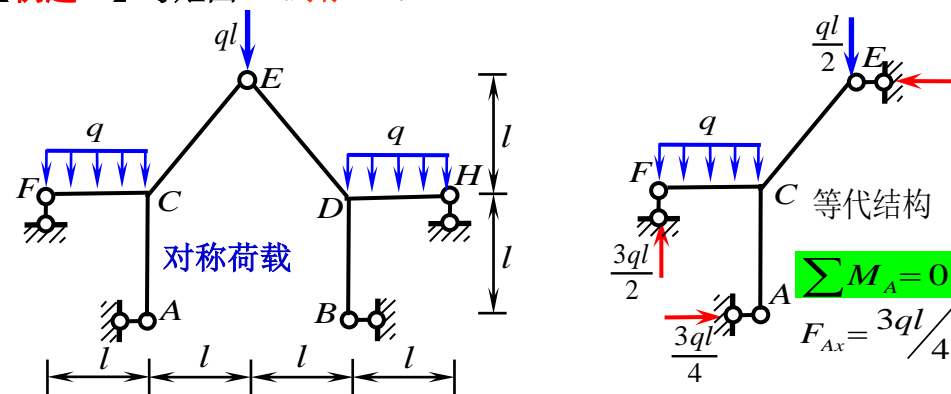
【例题18】弯矩图。（对称1-33）



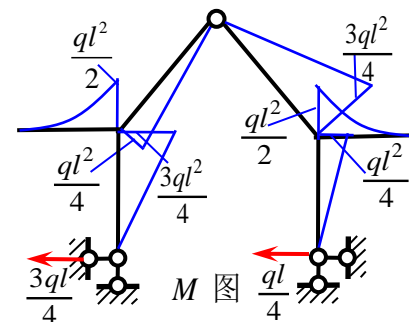
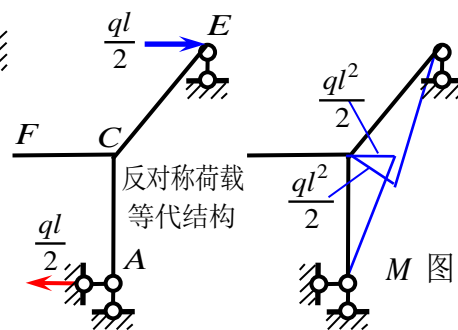
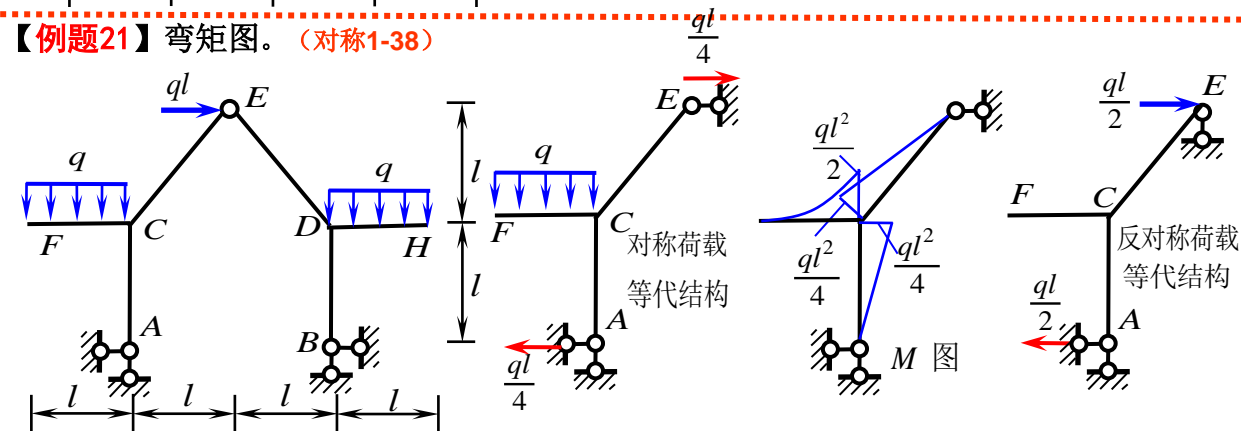
【例题19】弯矩图。（对称1-35）



【例题20】弯矩图。（对称1-36）



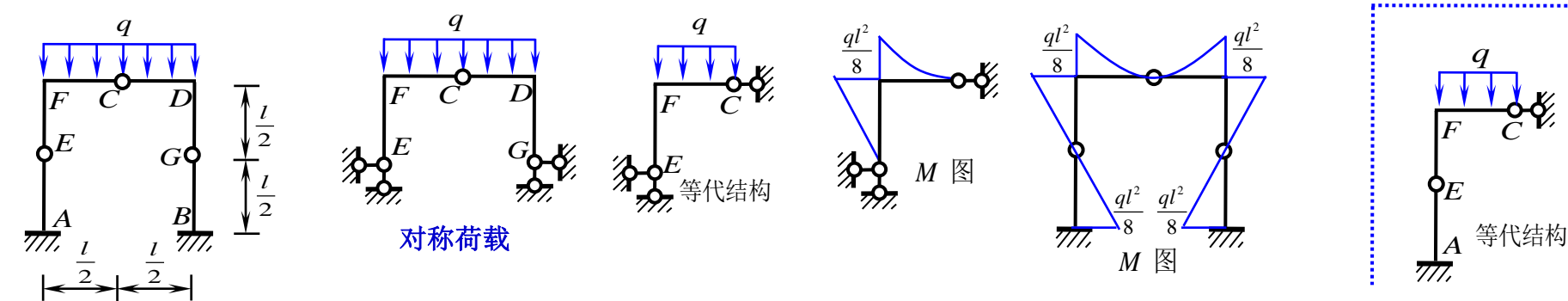
【例题21】弯矩图。（对称1-38）



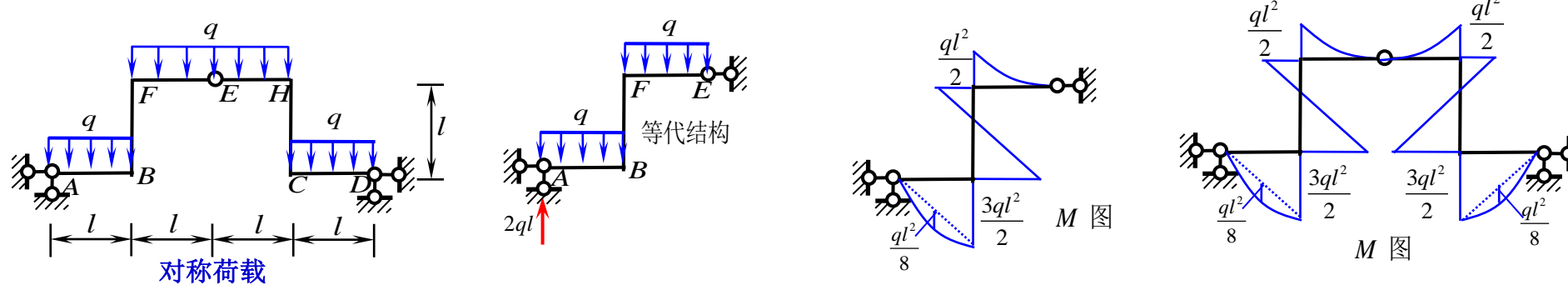
集中力为反对称荷载，
均布力为对称荷载



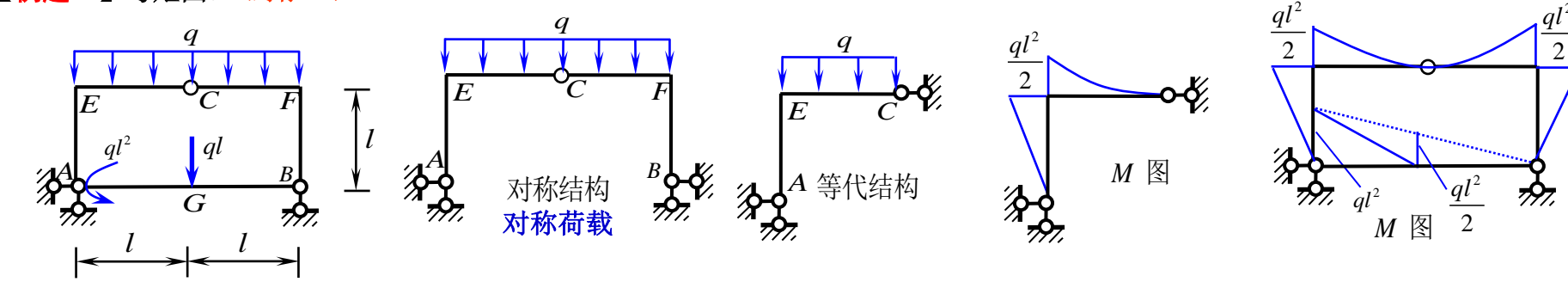
【例题22】弯矩图。（对称2-1）



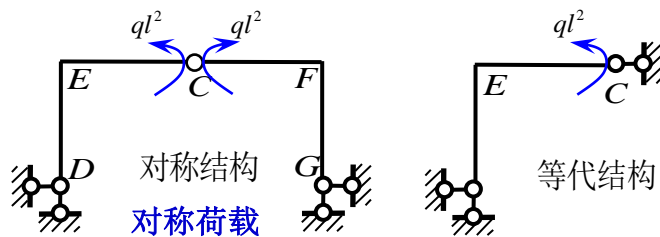
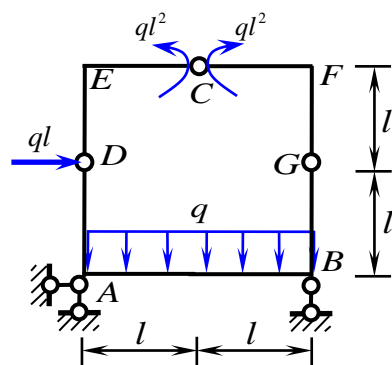
【例题23】弯矩图。（对称2-2）



【例题24】弯矩图。（对称2-4）

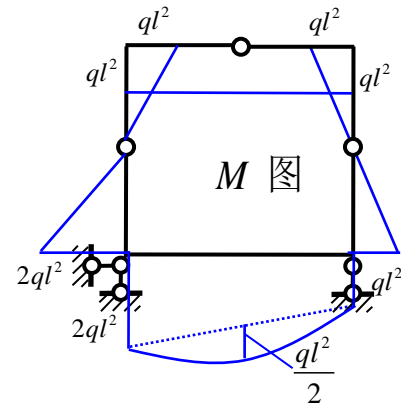
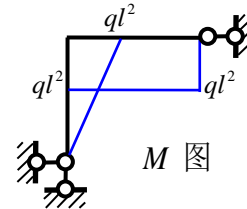


【例题25】弯矩图。（对称2-6）

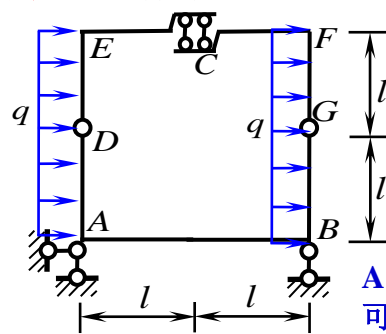


对称结构
对称荷载

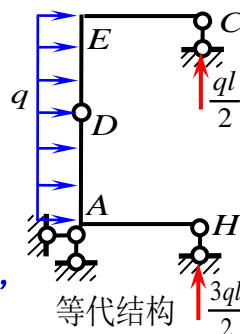
等代结构



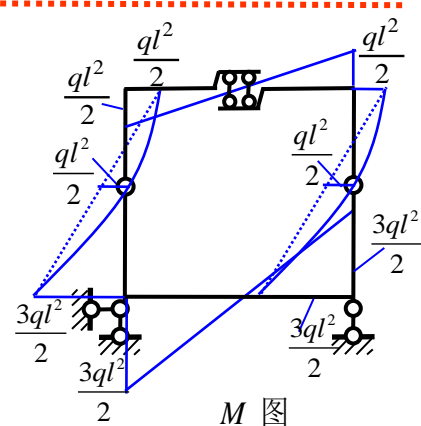
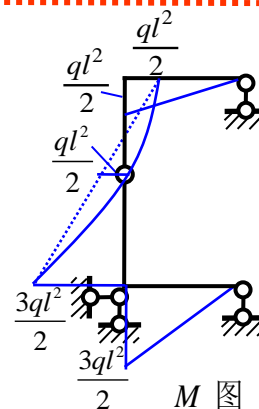
【例题26】弯矩图。（对称2-7）



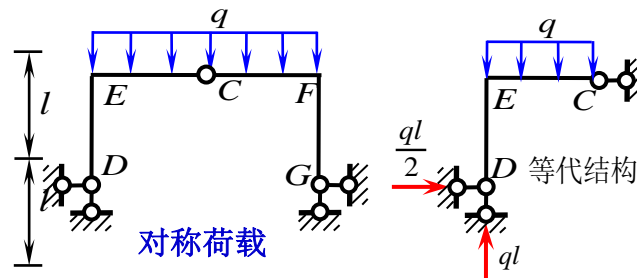
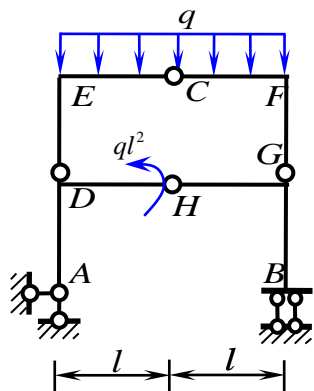
A处水平链杆支座不对称，
可以按照对称结构进行计算，荷载反对称



等代结构

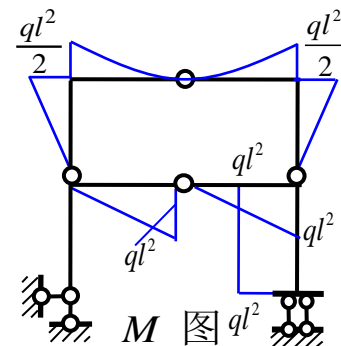
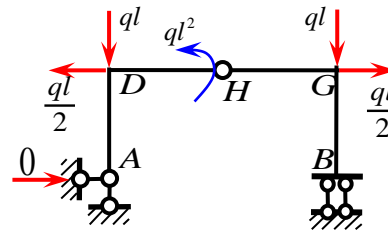


【例题27】弯矩图。（对称2-9）

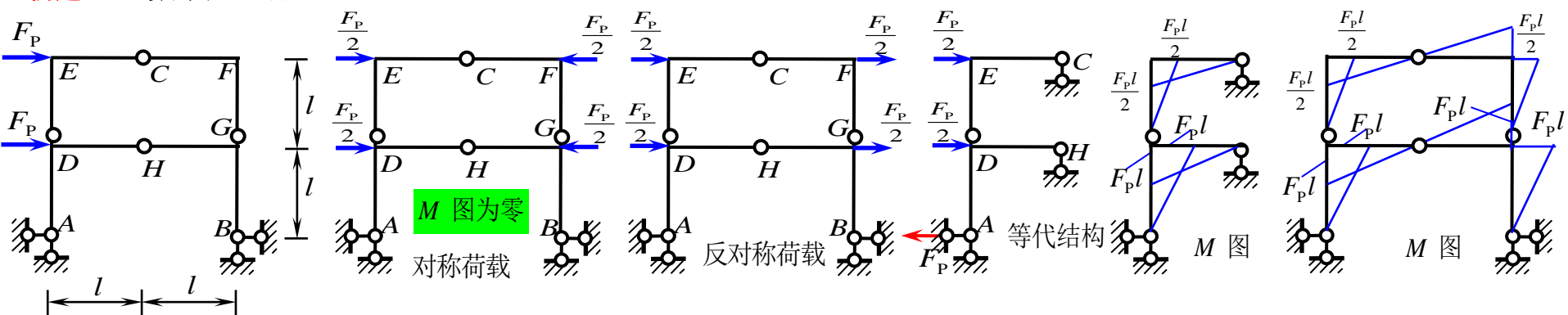


对称荷载

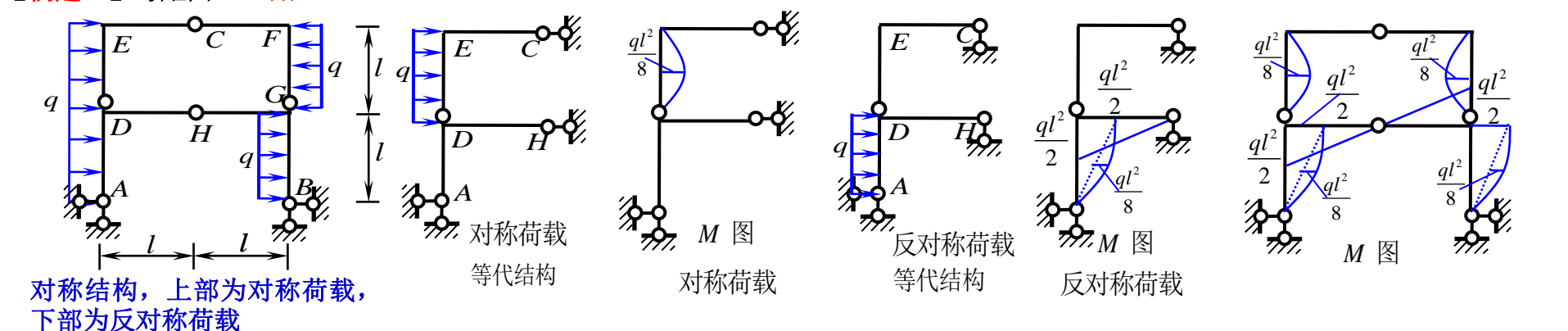
等代结构



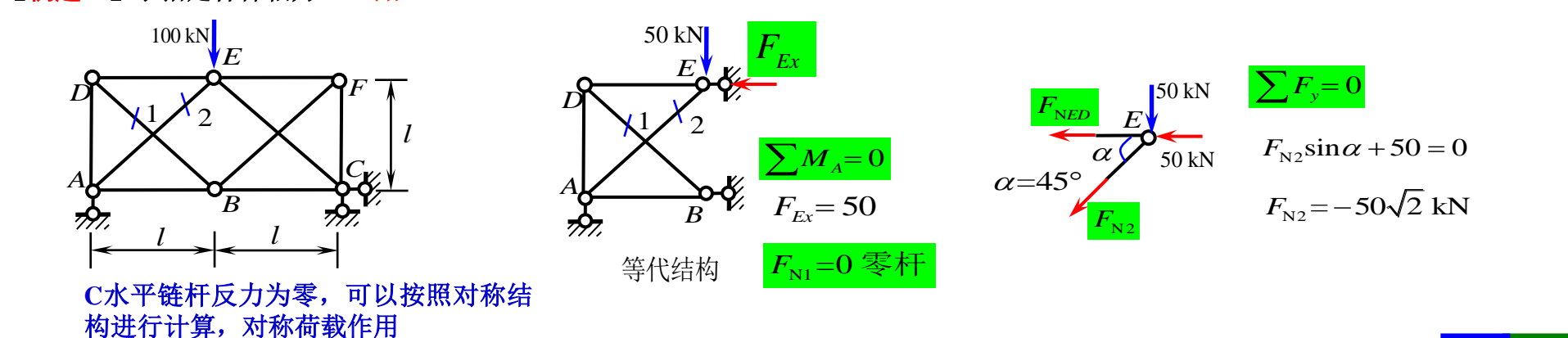
【例题28】弯矩图。(对称2-8)



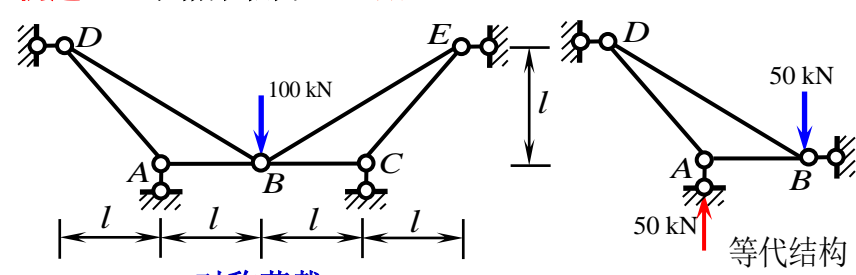
【例题29】弯矩图。(对称2-2)



【例题30】求指定杆件轴力。(对称2-21)



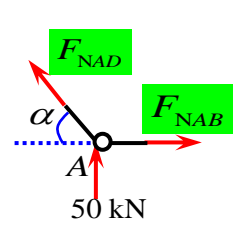
【例题31】求桁架轴力。（对称2-11）



对称荷载

$$\sum F_y = 0 \quad F_{Ay} = 50 \text{ kN}$$

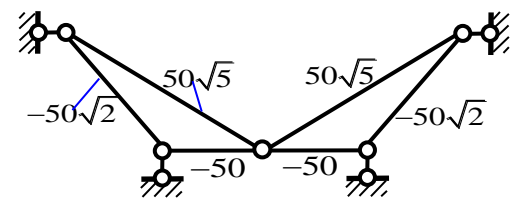
等代结构



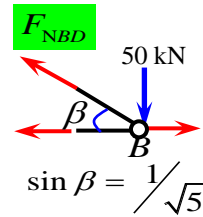
$$\alpha = 45^\circ \quad \sin \alpha = \frac{\sqrt{2}}{2}$$

$$\sum F_y = 0 \quad F_{NAD} = -50\sqrt{2}$$

$$\sum F_x = 0 \quad F_{NAB} = -50 \text{ kN}$$



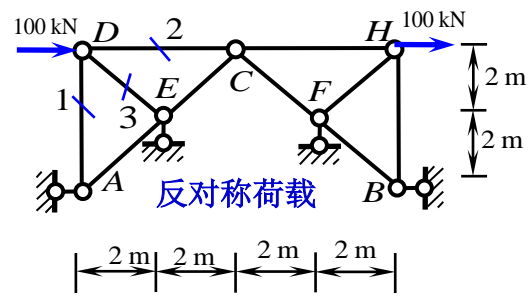
F_N 图 (kN)



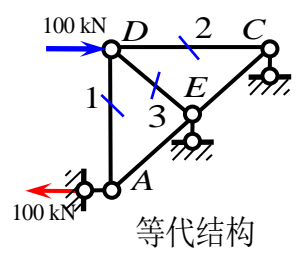
$$\sum F_y = 0$$

$$\sin \beta = \frac{1}{\sqrt{5}} \quad F_{NBD} = 50\sqrt{5}$$

【例题32】求指定杆件轴力。（对称2-13）

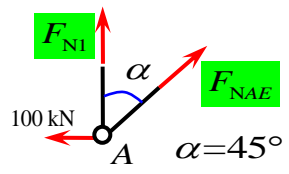


反对称荷载



等代结构

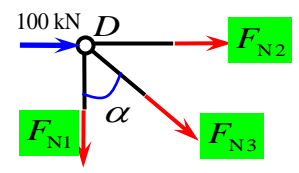
$$\sum F_x = 0 \quad F_{Ax} = 100 \text{ kN}$$



$$\alpha = 45^\circ$$

$$\sum F_x = 0 \quad F_{NAE} = 100\sqrt{2}$$

$$\sum F_y = 0 \quad F_{N1} = -100 \text{ kN}$$



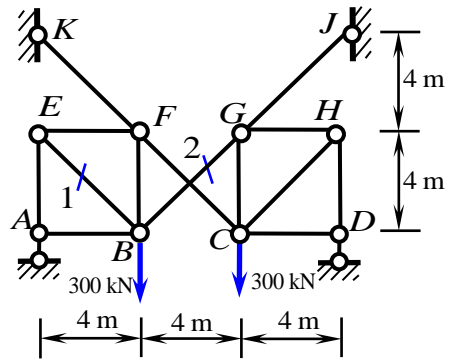
$$\sum F_y = 0$$

$$F_{N3} = 100\sqrt{2} \text{ kN}$$

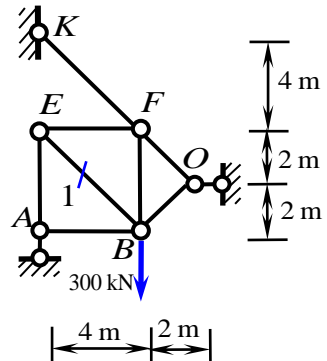
$$\sum F_x = 0$$

$$F_{N2} = -200 \text{ kN}$$

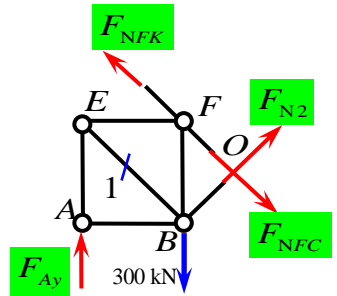
【例题33】求指定杆件轴力。（对称2-14）



对称荷载



等代结构



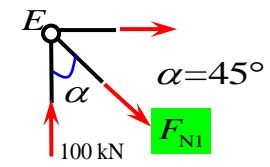
$$F_{NAB} = 0 \text{ 零杆}$$

$$\sum M_O = 0$$

$$F_{Ay} = 100$$

$$\sum M_F = 0$$

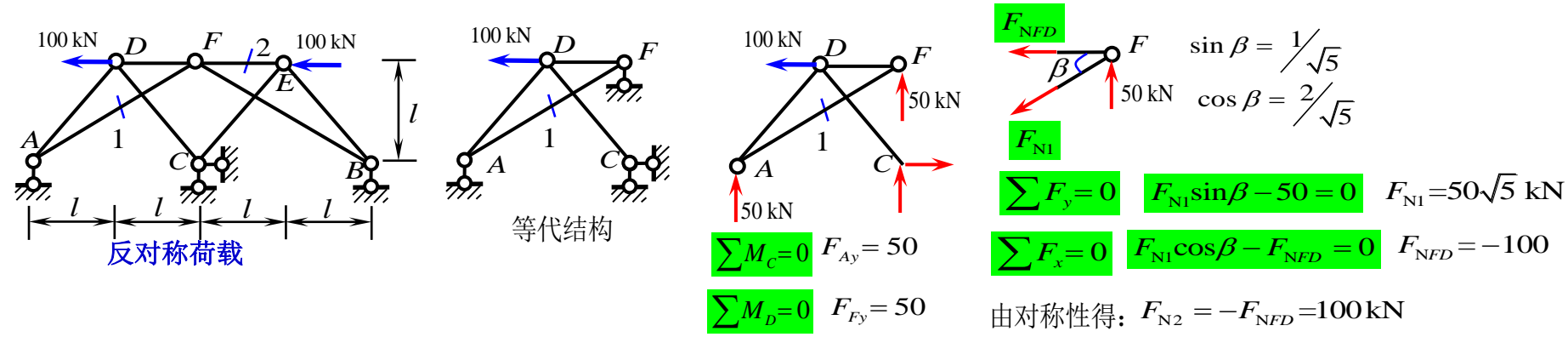
$$F_{N2} = 100\sqrt{2} \text{ kN}$$



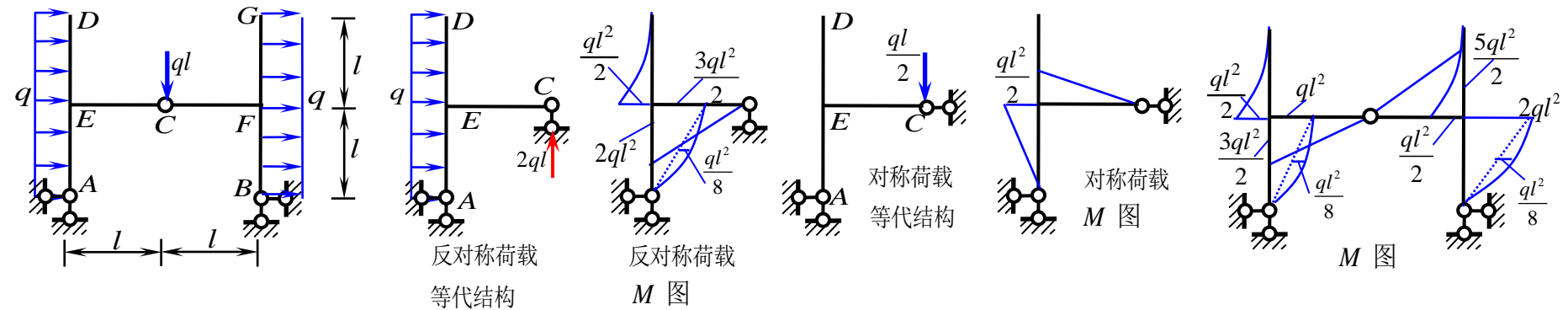
$$\sum F_y = 0$$

$$F_{N1} = 100\sqrt{2} \text{ kN}$$

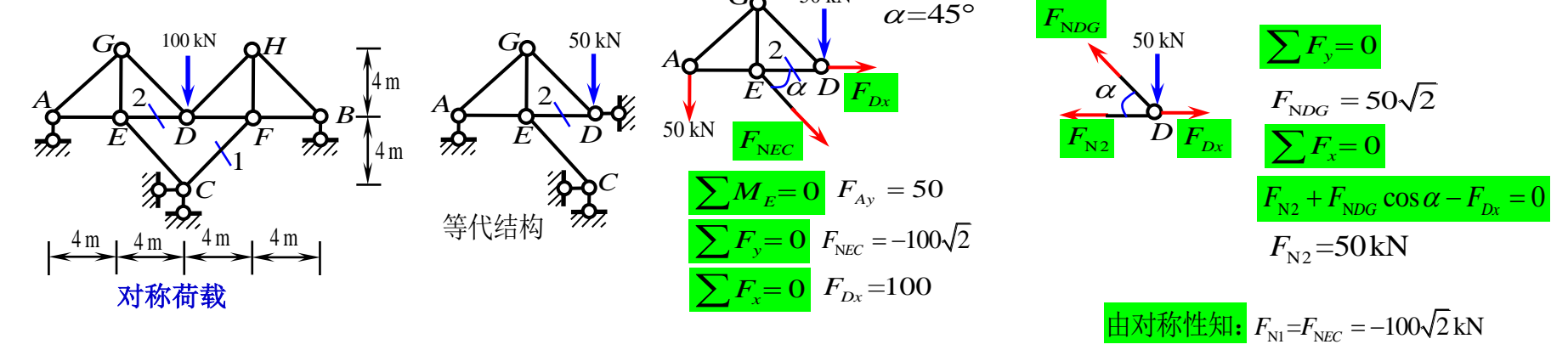
【例题34】求指定杆件轴力。（对称2-19）



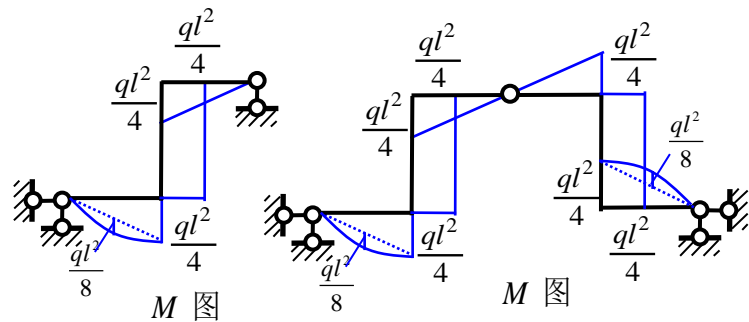
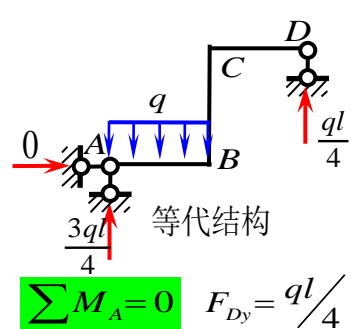
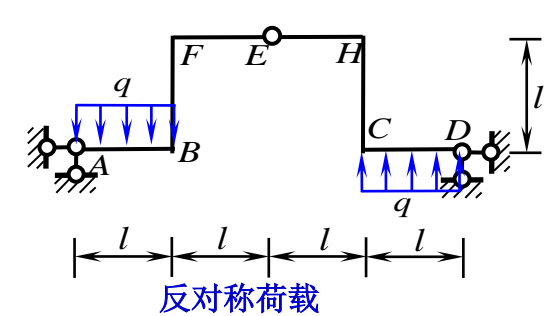
【例题35】弯矩图。（对称2-24）



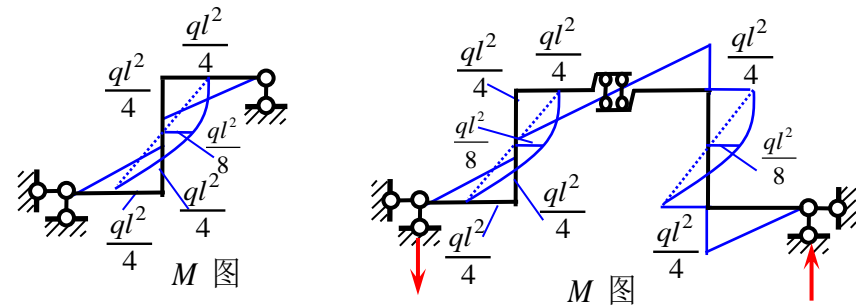
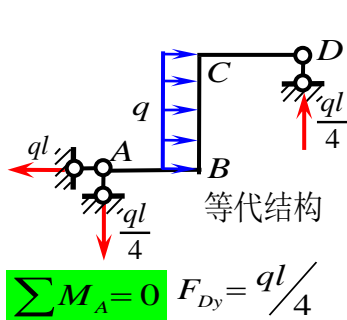
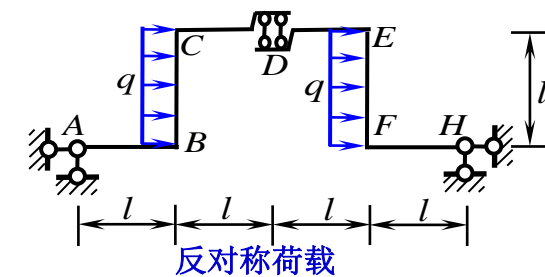
【例题36】求指定杆件轴力。（对称2-25）



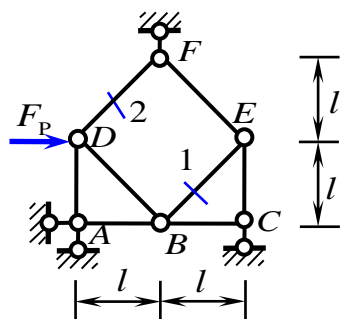
【例题37】弯矩图。（对称2-30）



【例题38】弯矩图。（对称2-32）



【例题39】求指定杆件轴力。（桁架1-3）



F_{NBD} F_{N1}

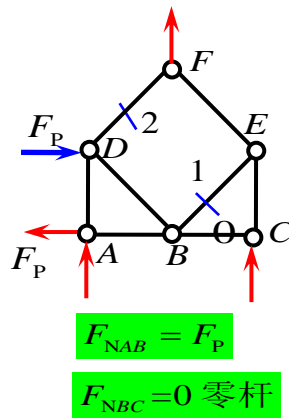
α α $\alpha = 45^\circ$

F_P F_P O

$F_{N1} - F_P \sin \alpha = 0$

$F_{N1} = \frac{\sqrt{2}F_P}{2}$

$F_{NBD} = \frac{-\sqrt{2}F_P}{2}$



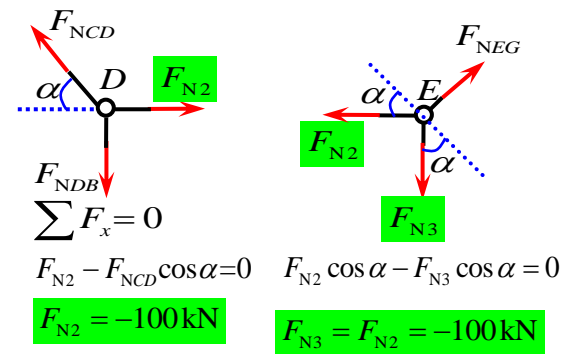
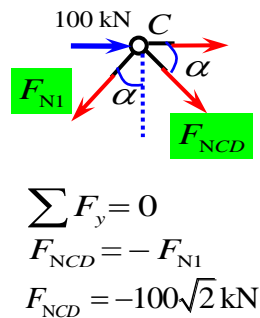
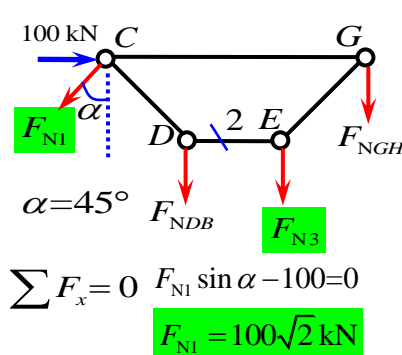
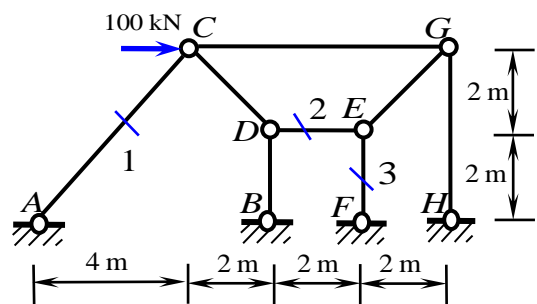
F_{N2} F_{NBD}

$\sum F_x = 0$

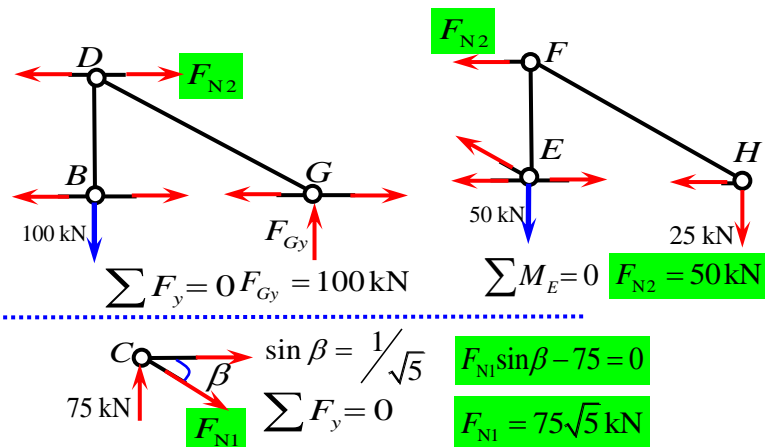
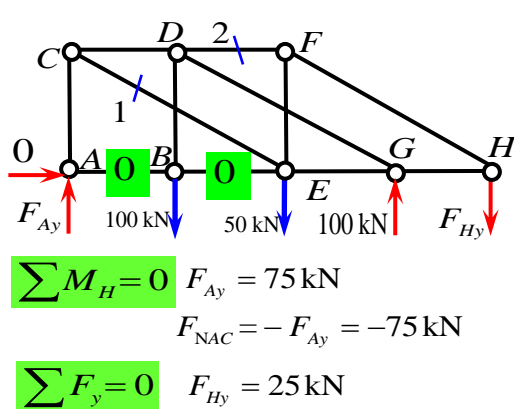
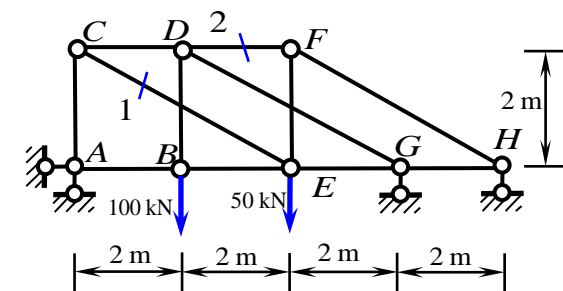
$F_{N2} \cos \alpha + F_{NBD} \cos \alpha + F_P = 0$

$F_{N2} = \frac{-\sqrt{2}F_P}{2}$

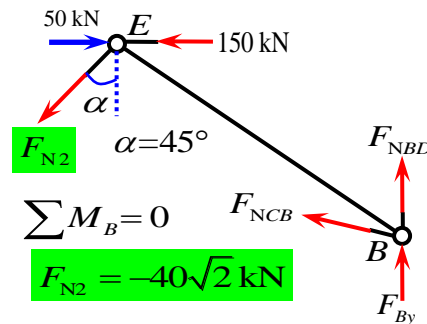
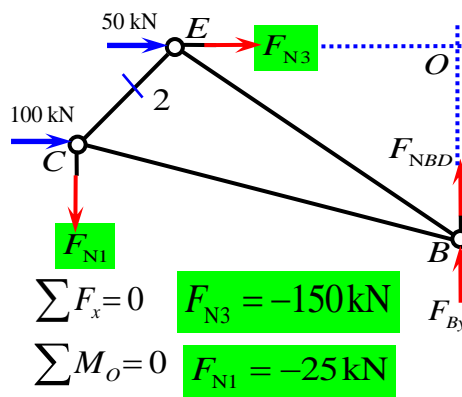
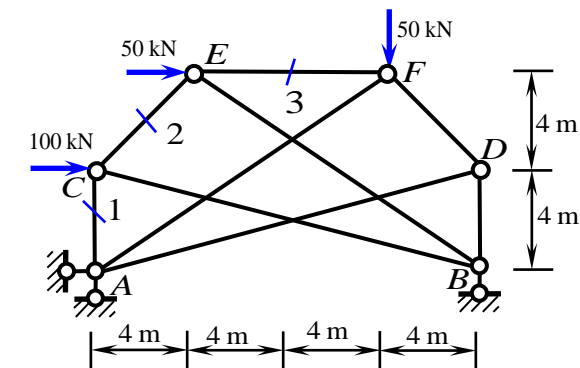
【例题40】求指定杆件轴力。（桁架1-4）



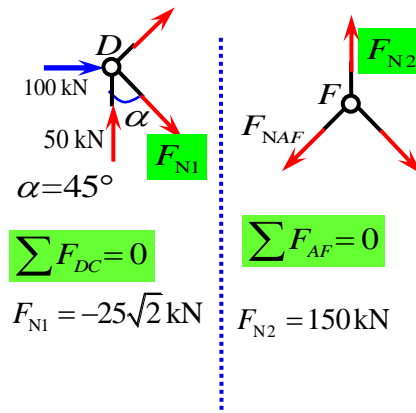
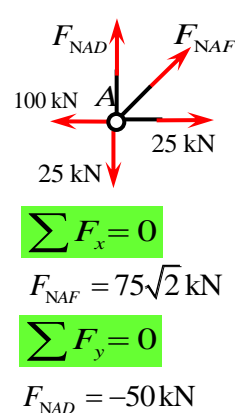
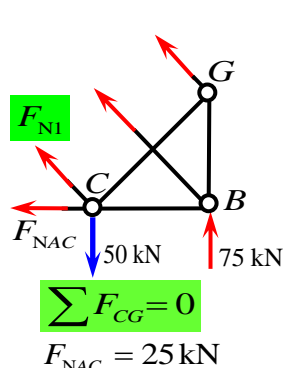
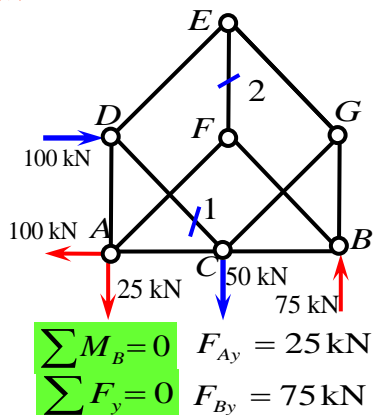
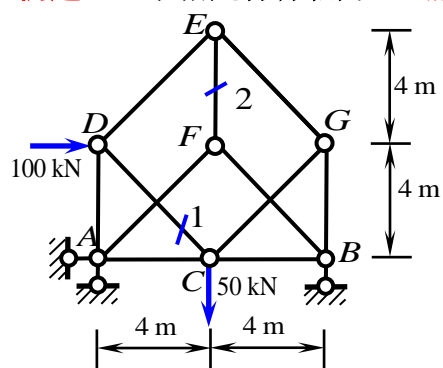
【例题41】求指定杆件轴力。（桁架1-5）



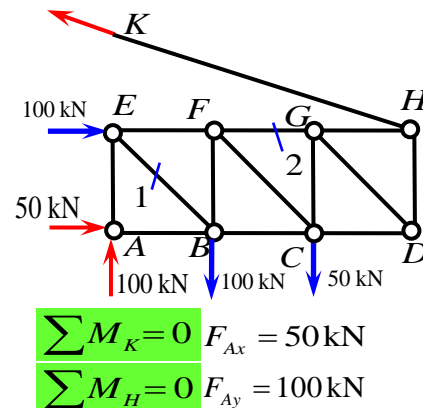
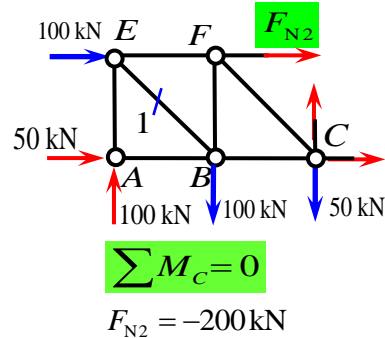
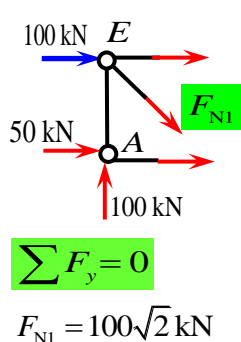
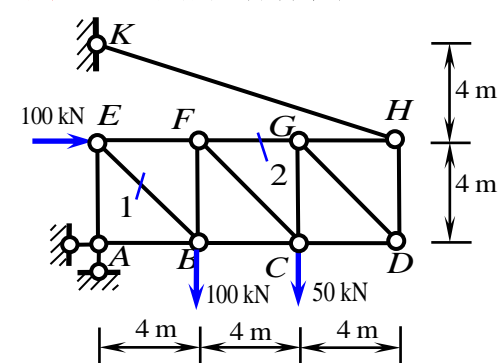
【例题42】求指定杆件轴力。（桁架1-6）



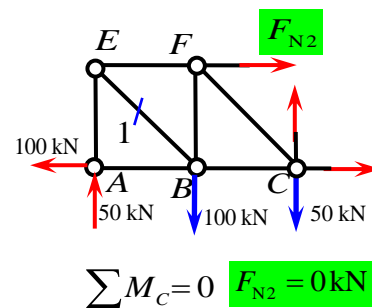
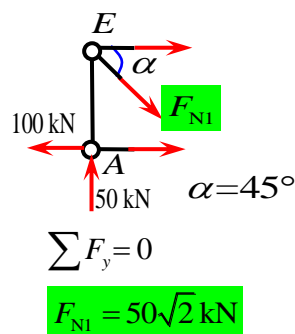
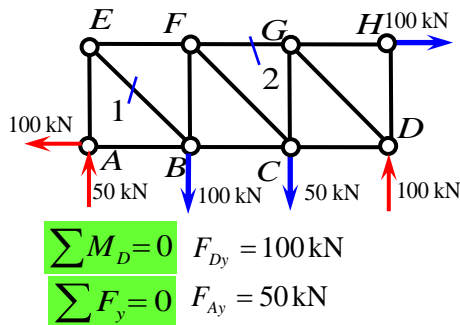
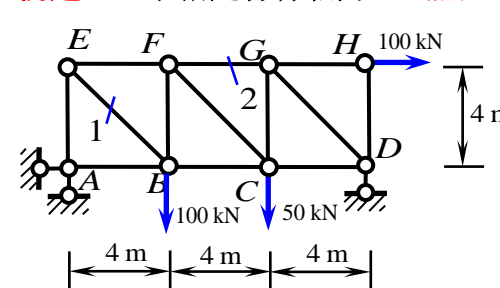
【例题43】求指定杆件轴力。（桁架1-7）



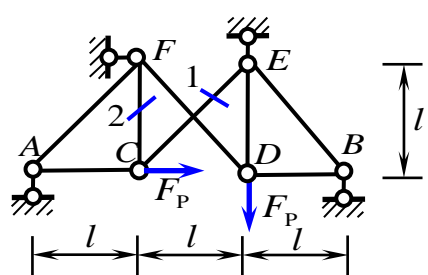
【例题44】求指定杆件轴力。（桁架1-8）



【例题45】求指定杆件轴力。（桁架1-21）



【例题46】求指定杆件轴力。（桁架2-1）



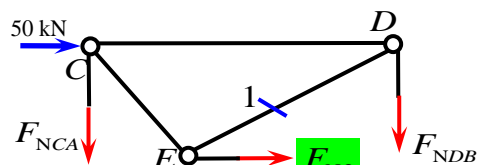
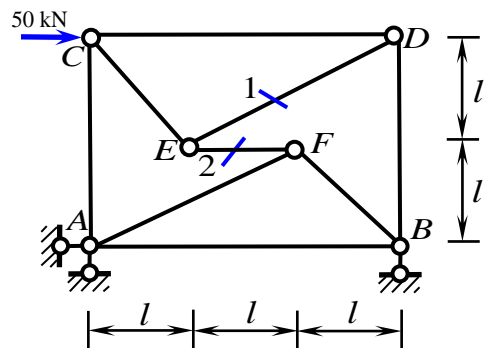
$\sum M_K = 0$
 $F_{Ay} \times 3l/2 - F_P \times l/2 - F_P \times l/2 = 0$
 $F_{Ay} = 2F_P/3$

$\sum M_F = 0 \quad F_{N1} \times \sqrt{2}l/2 - F_{Ay} \times l + F_P \times l = 0$

$F_{N1} = \frac{-\sqrt{2}F_P}{3}$

$\sum F_y = 0$
 $F_{N1} \sin \alpha + F_{N2} = 0$
 $\alpha = 45^\circ$
 $F_{N2} = \frac{F_P}{3}$

【例题47】求指定杆件轴力。（桁架2-2）

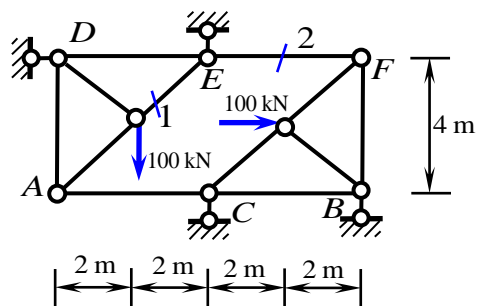


$\sum F_x = 0 \quad F_{N2} = -50 \text{ kN}$

$\sum M_C = 0 \quad F_{NDB} = \frac{-50 \text{ kN}}{3}$

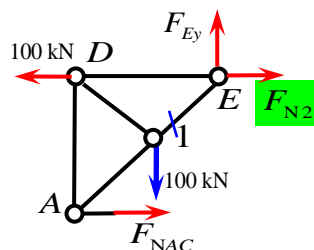
$\sum F_y = 0$
 $F_{N1} \sin \beta + F_{NDB} = 0$
 $\sin \beta = \frac{1}{\sqrt{5}}$
 $F_{N1} = \frac{50\sqrt{5} \text{ kN}}{3}$

【例题48】求指定杆件轴力。（桁架2-24）



整体隔离体

$\sum F_x = 0$
 $F_{Dx} = 100 \text{ kN}$

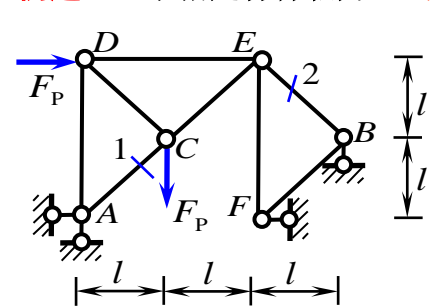


$\sum F_y = 0 \quad F_{Ey} = 100 \text{ kN}$

$\sum M_A = 0 \quad F_{N2} = 50 \text{ kN}$

$\sum F_y = 0 \quad F_{N1} = 100\sqrt{2} \text{ kN}$
 $\alpha = 45^\circ$

【例题49】 求指定杆件轴力。(桁架2-33)



$\sum M_A = 0 \quad F_{By} = F_P$
 $\sum F_x = 0 \quad F_{Ax} = F_P/2$

$\sum M_E = 0 \quad F_{Fx} = F_P/2$

Free-body diagram of a particle at point A. A vertical red arrow labeled F_{NAD} points upwards. A horizontal red arrow labeled $F_p/2$ points to the left. A red arrow labeled F_{N1} points up and to the right at an angle α from the vertical. A blue arc indicates the angle $\alpha = 45^\circ$. Below the diagram, the equation $\sum F_x = 0$ is shown. At the bottom, a green box contains the equation $F_{N1} = \frac{\sqrt{2} F_p}{2}$.

BE方向投影 $\sum F_{BE} = 0$

$$F_{N2} + F_P \cos \alpha = 0$$

$$F_{N2} = \frac{-\sqrt{2}F_P}{2}$$

【例题50】求指定杆件轴力。(桁架2-35)

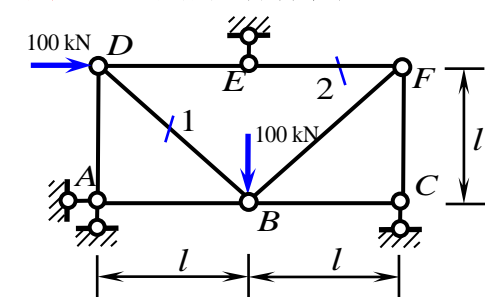


Diagram of a truss structure with nodes A, B, C, D, E. Node A is a pin support with a vertical reaction force of 100 kN (red arrow). Node C is a roller support with a vertical reaction force of 100 kN (red arrow). Node E is a roller support with a vertical reaction force of 0 kN (red arrow). A horizontal force of 100 kN (blue arrow) is applied at node D. A vertical force of 100 kN (blue arrow) is applied at node B. Members AD, DC, CB, AB, and BE are horizontal. Members DE and AC are diagonal. Members DB and EC are vertical. The truss is labeled with '1' and '2' on members DE and AC respectively. Below the diagram, the text $F_{Ey} = 0$ 零杆 (Zero member) is written. Below that, the equations $\sum M_A = 0 \quad F_{Cy} = 100 \text{ kN}$ and $\sum F_y = 0 \quad F_{Ay} = 0 \quad F_{NAD} = 0$ 零杆 (Zero member) are shown.

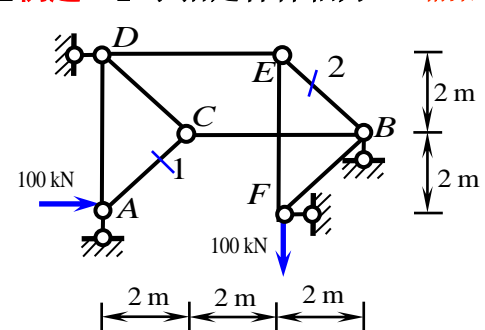
Free body diagram of joint D. A 100 kN force acts horizontally to the right. A reaction force F_{N1} acts vertically downwards. A reaction force F_{NDE} acts horizontally to the left. The angle between the horizontal and F_{NDE} is $\alpha = 45^\circ$.

$$\sum F_y = 0 \quad F_{N1} = 0$$

$$\sum F_x = 0 \quad F_{NDE} = -100 \text{ kN}$$

$\sum F_x = 0 \quad F_{N2} = F_{NDF}$
 $F_{N2} = -100 \text{ kN}$

【例题51】 求指定杆件轴力。(桁架2-29)



$\sum F_y = 0$
 $F_{By} = 100 \text{ kN}$

$\sum M_D = 0$
 $F_{NCB} = -200 \text{ kN}$

$\sum F_x = 0$
 $F_{N1} = -100\sqrt{2} \text{ kN}$

$$\sum F_{BE} = 0$$

$$F_{N2} + F_{NCB} \cos \alpha + 100 \cos \alpha = 0$$

$$F_{N2} = -50\sqrt{2} \text{ kN}$$

【例题40】求指定杆件轴力。（桁架1-21）

【例题41】求指定杆件轴力。（桁架1-21）

【例题42】求指定杆件轴力。（桁架1-21）

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