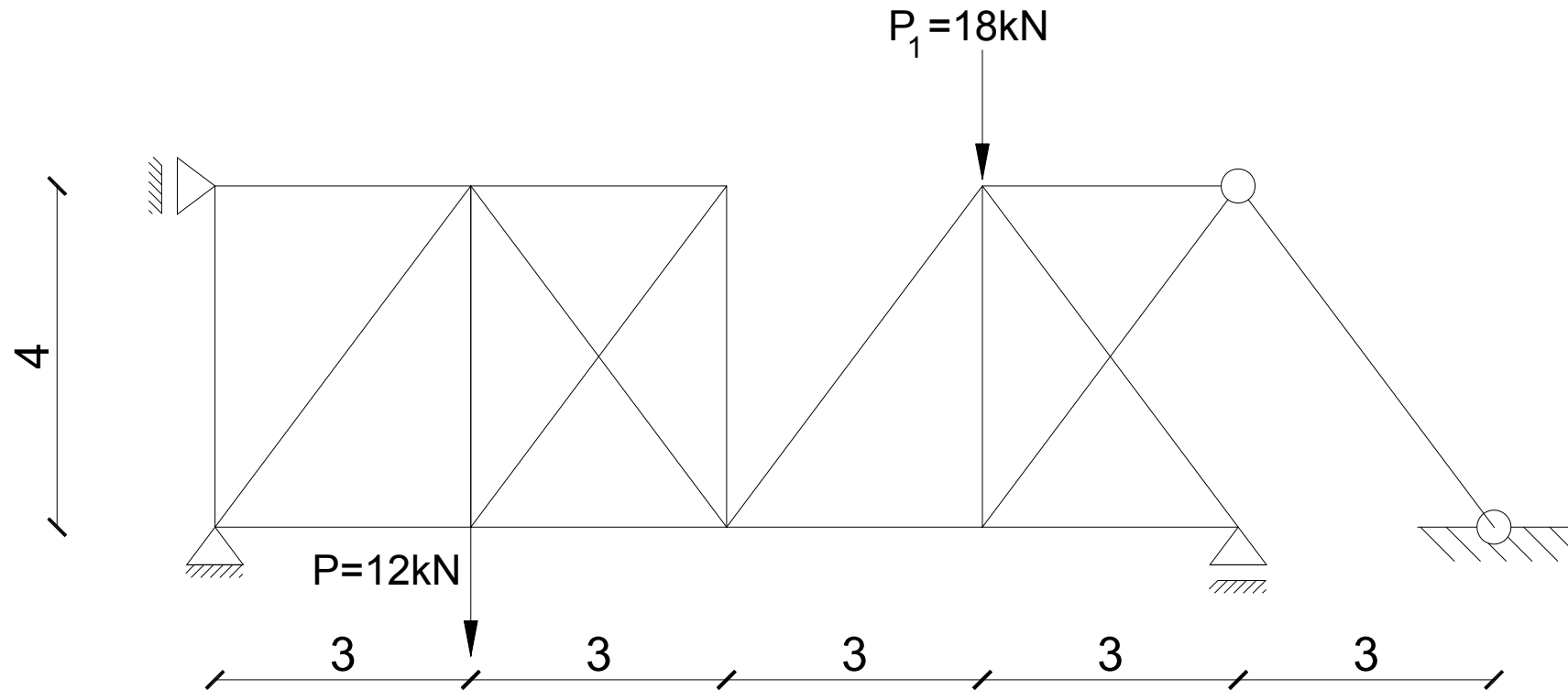
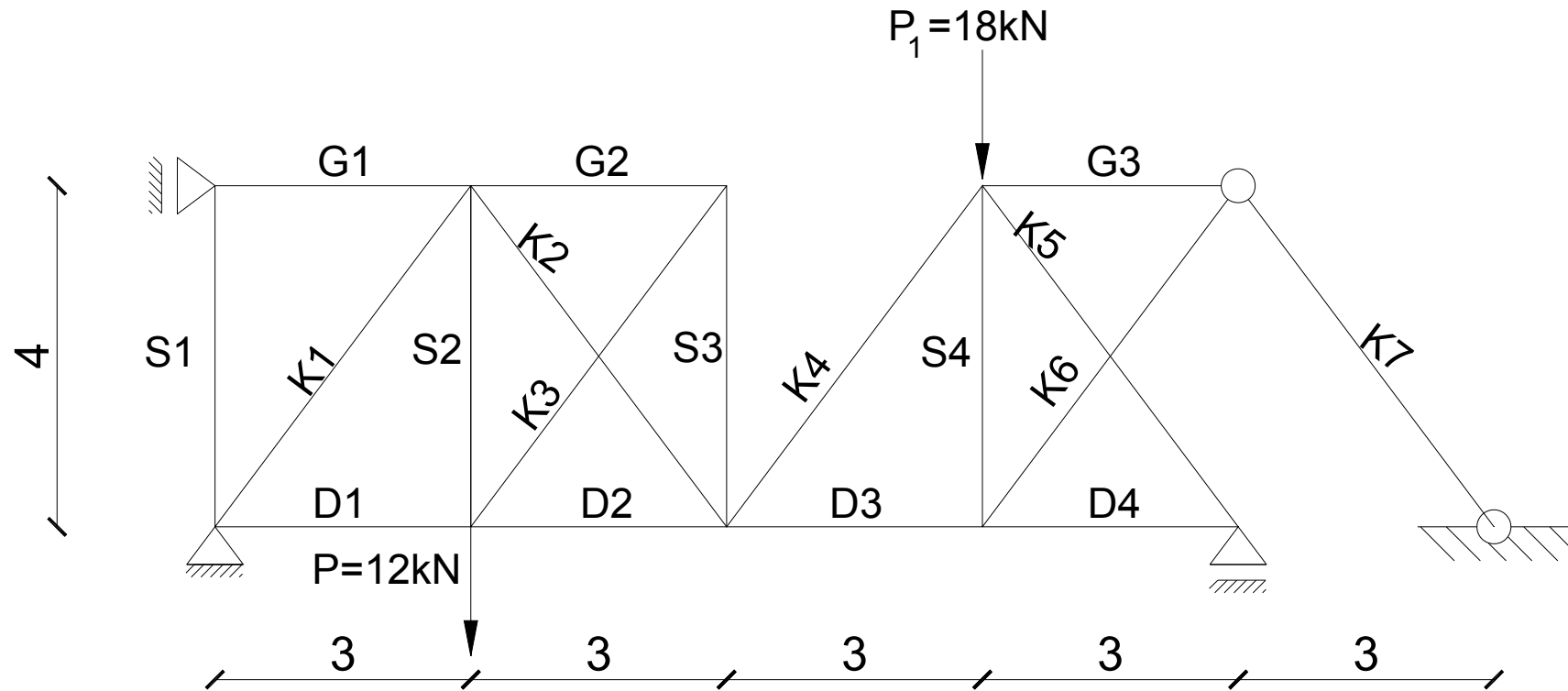


Zadanie: Narysować wykres sił normalnych w kratownicy.
Zadanie rozwiązać metodą sił.



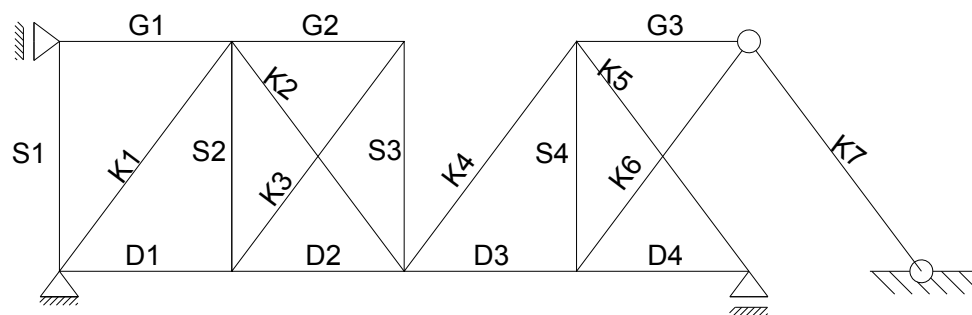
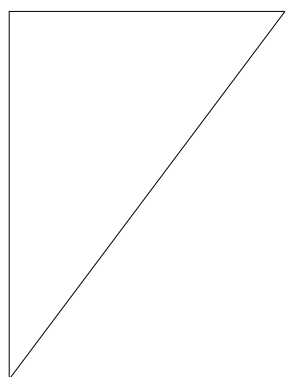
Stopień statycznej niewyznaczalności kratownicy



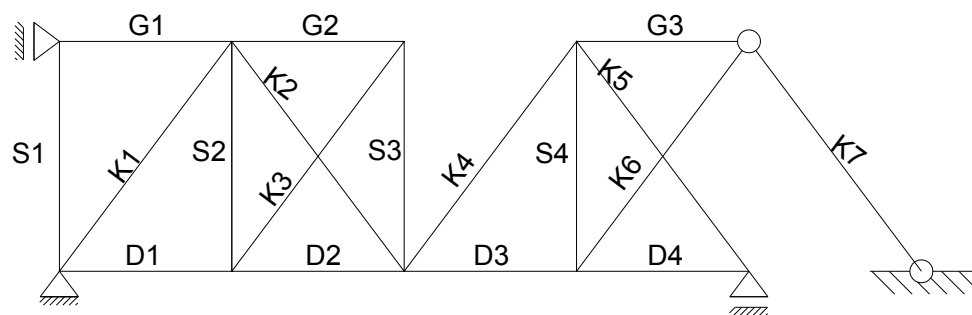
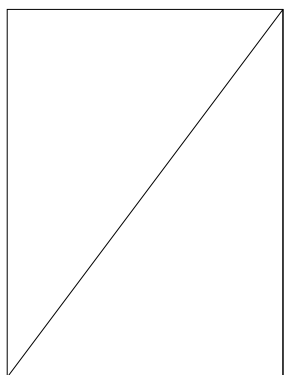
$$n_s = l_r + l_p - 2w = 6 + 18 - 2 \cdot 11 = 2$$

Układ dwukrotnie statycznie niewyznaczalny

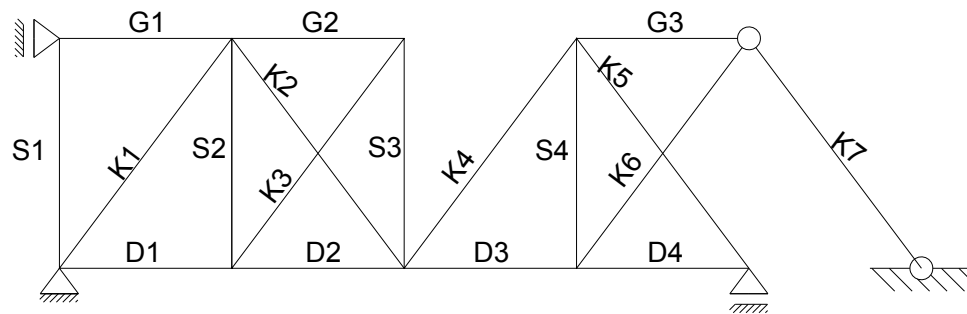
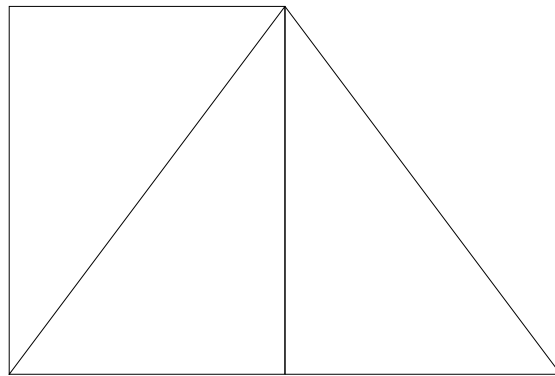
Dobór schematu podstawowego statycznie wyznaczalnego



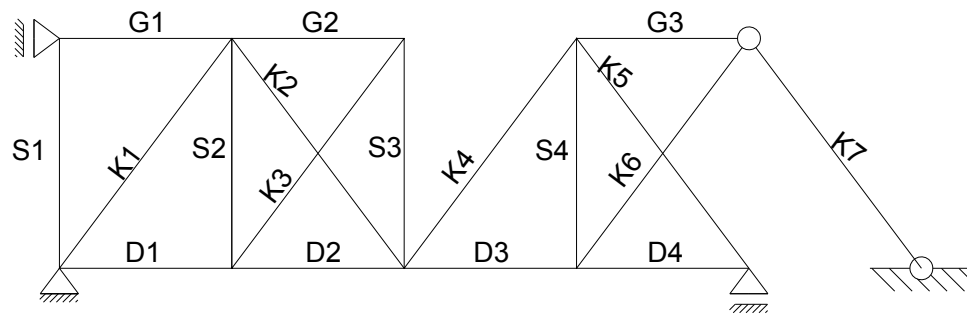
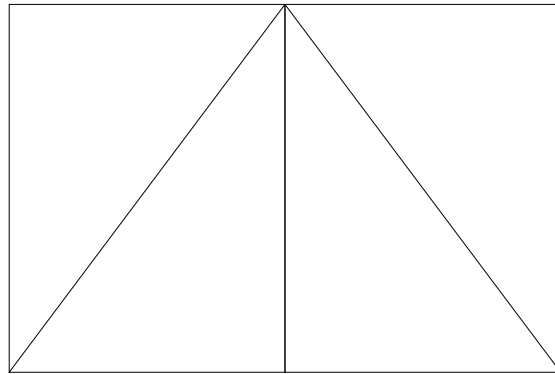
Dobór schematu podstawowego statycznie wyznaczalnego



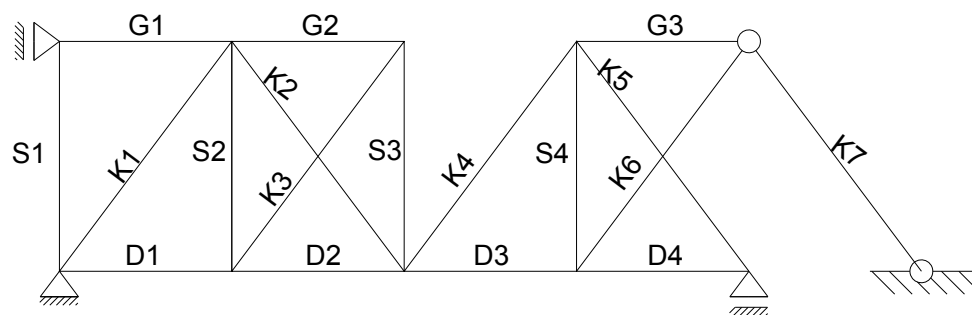
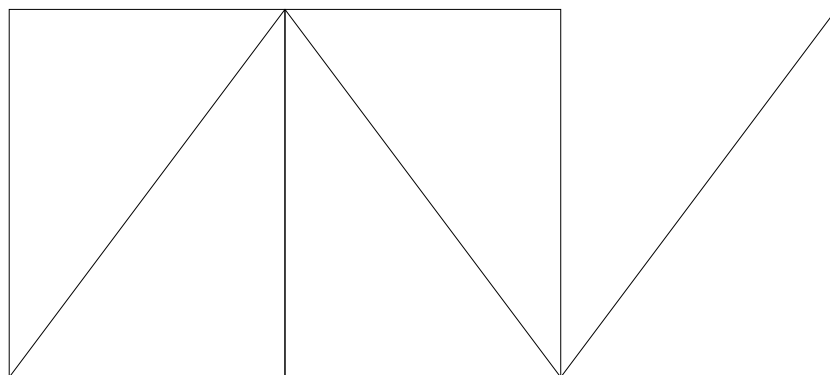
Dobór schematu podstawowego statycznie wyznaczalnego



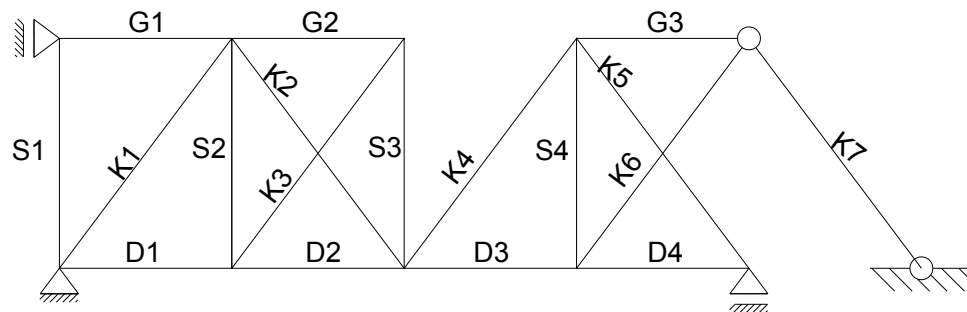
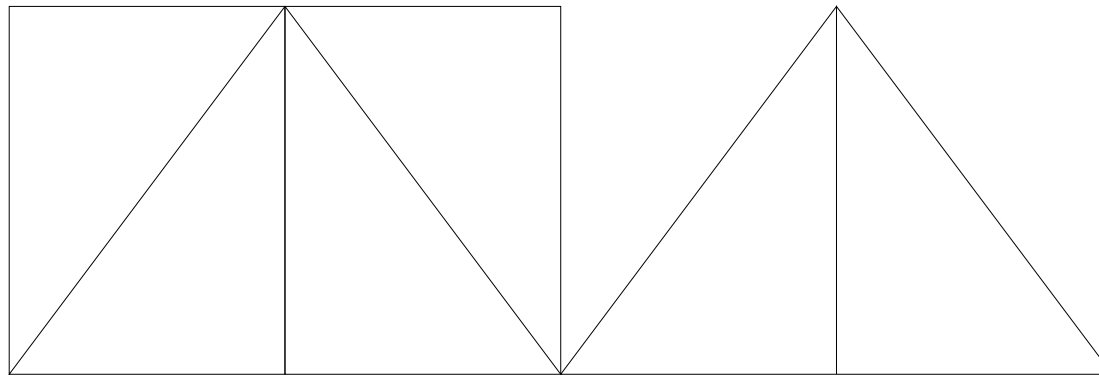
Dobór schematu podstawowego statycznie wyznaczalnego



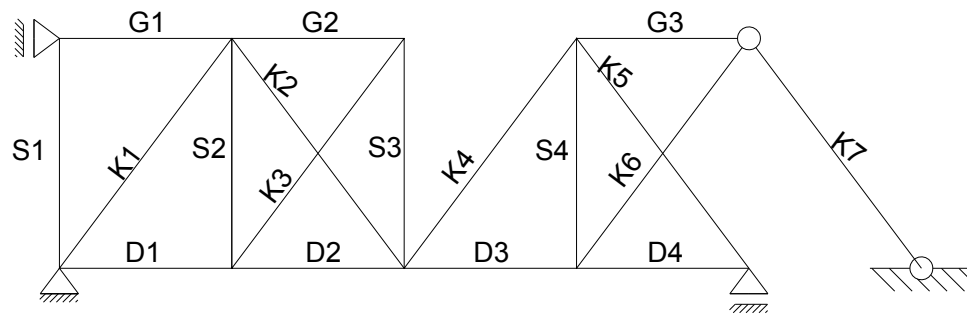
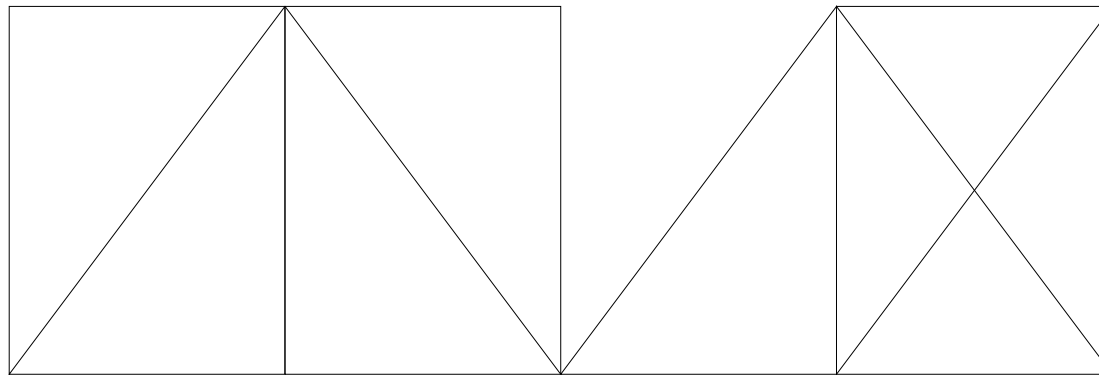
Dobór schematu podstawowego statycznie wyznaczalnego



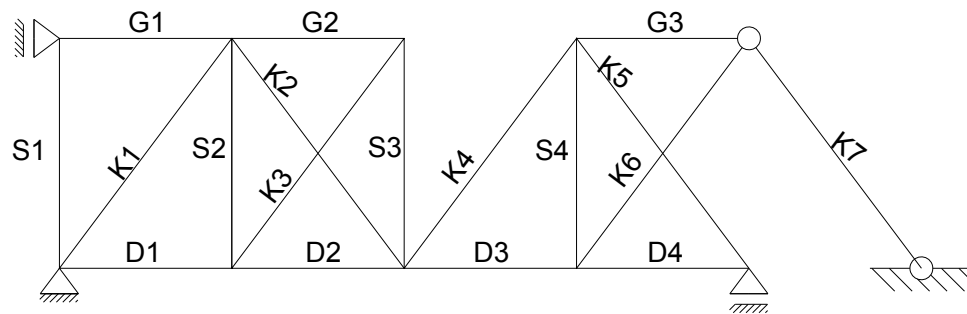
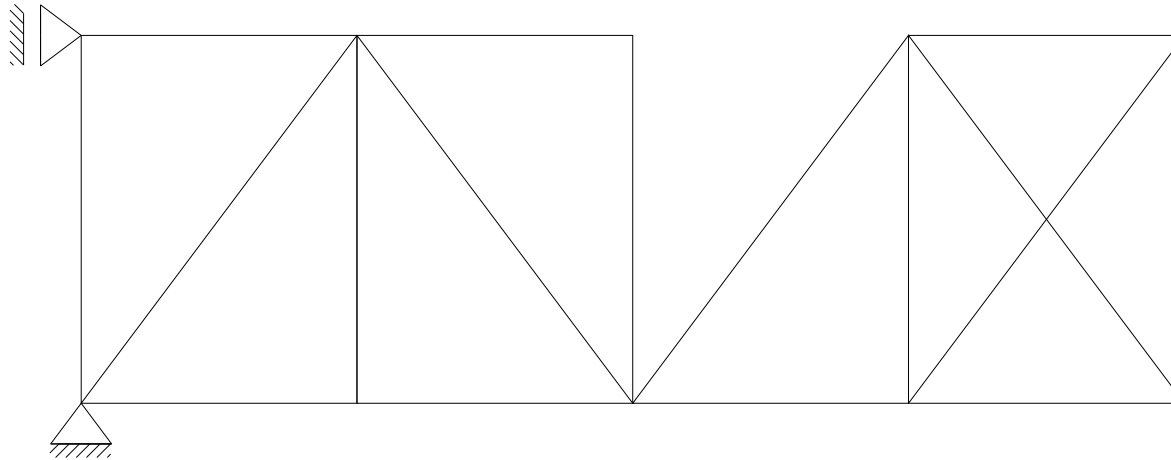
Dobór schematu podstawowego statycznie wyznaczalnego



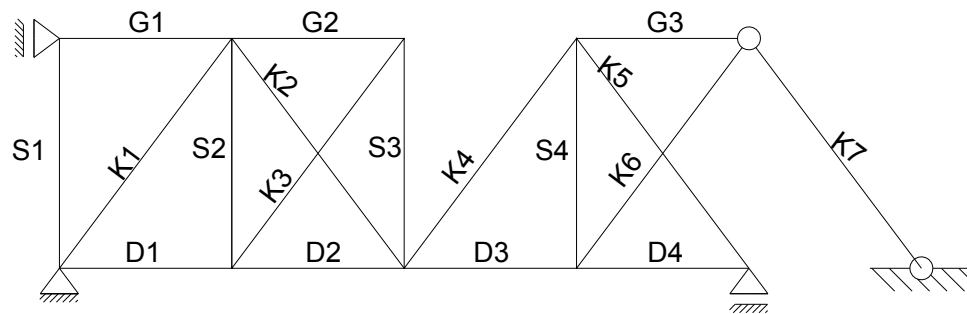
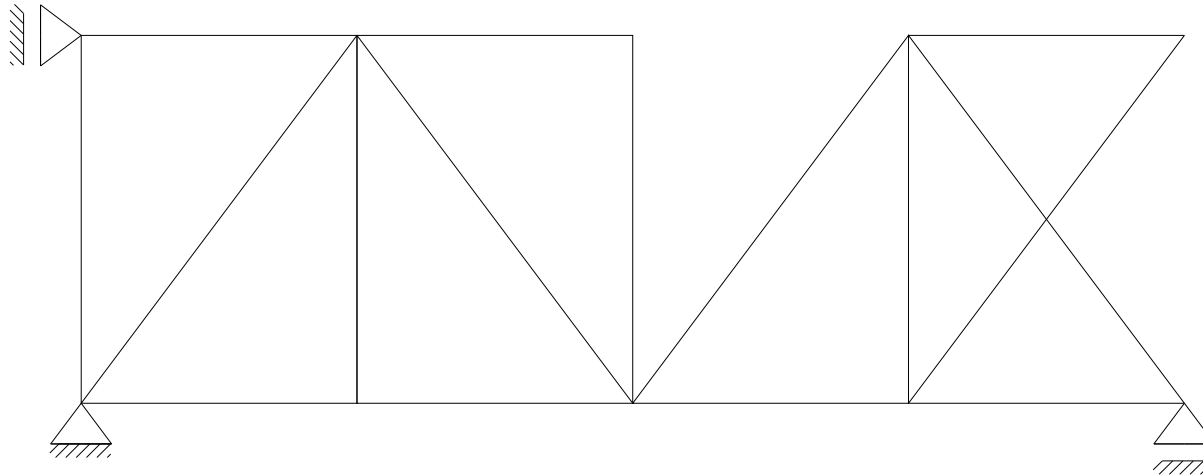
Dobór schematu podstawowego statycznie wyznaczalnego



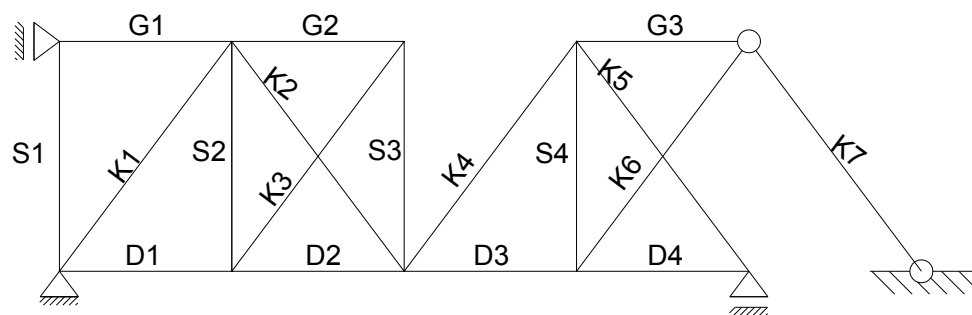
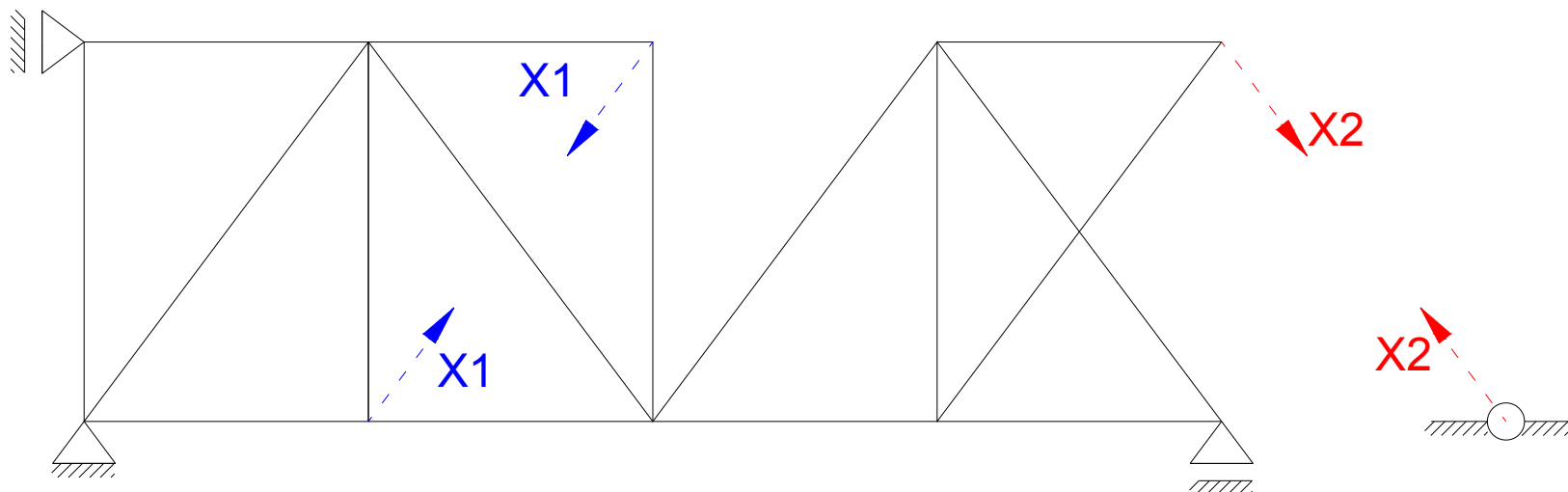
Dobór schematu podstawowego statycznie wyznaczalnego



Dobór schematu podstawowego statycznie wyznaczalnego

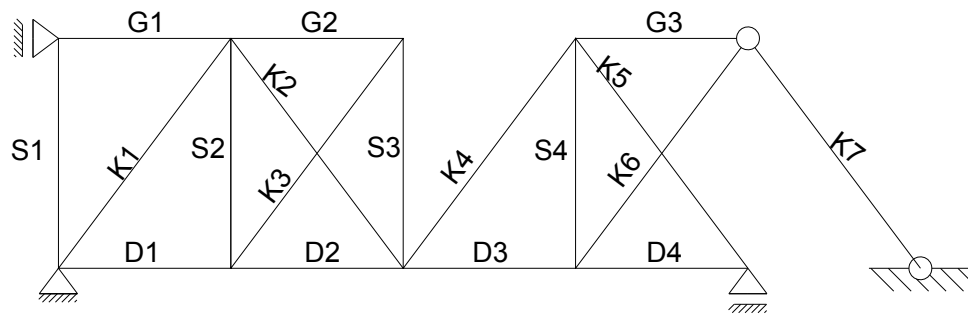
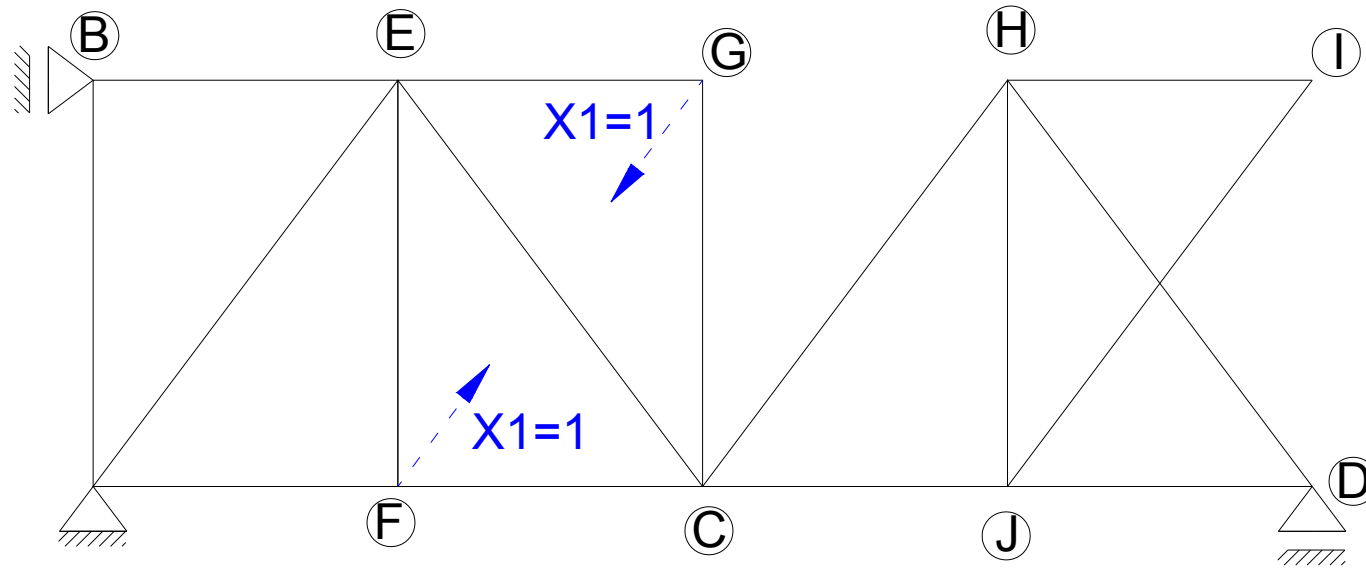


Dobór schematu podstawowego statycznie wyznaczalnego



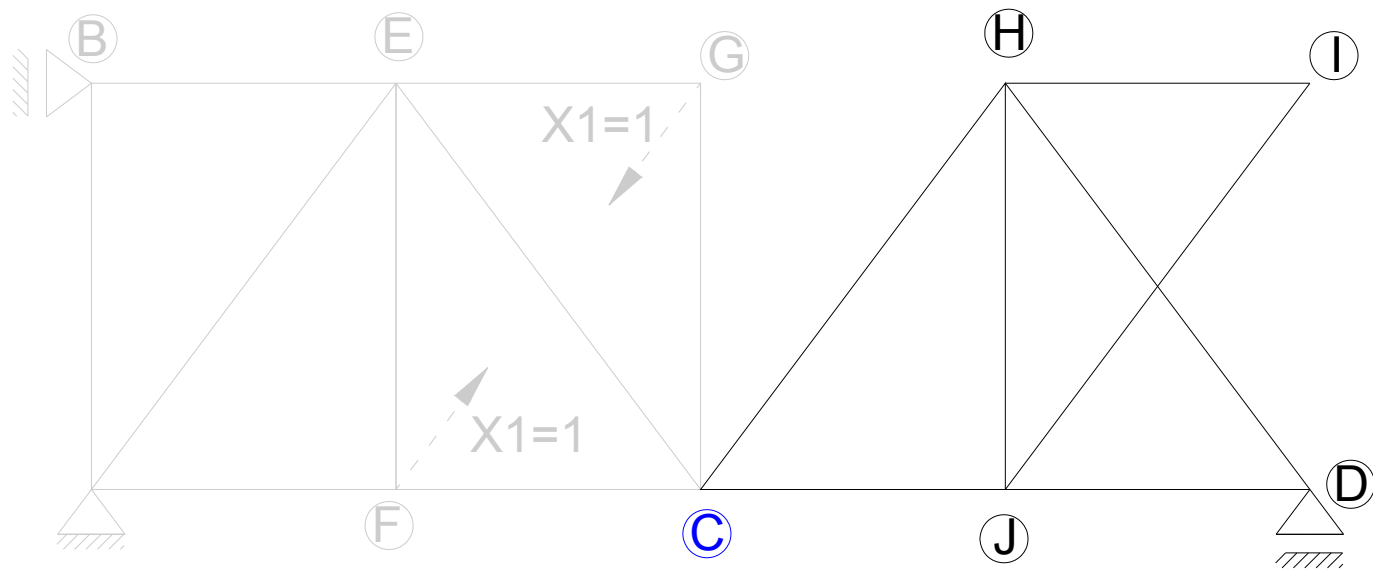
Wykresy jednostkowe

$X_1=1$

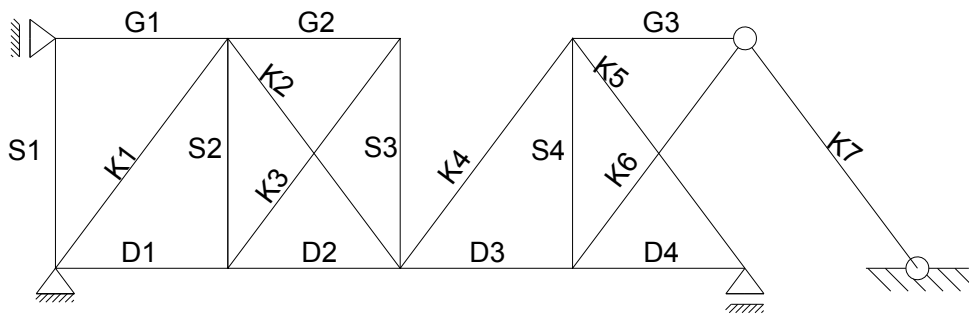
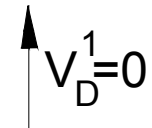


Wykresy jednostkowe

$X_1=1$



$$\sum M_C^L = V_D^1 \cdot 6 = 0 \rightarrow V_D^1 = 0$$

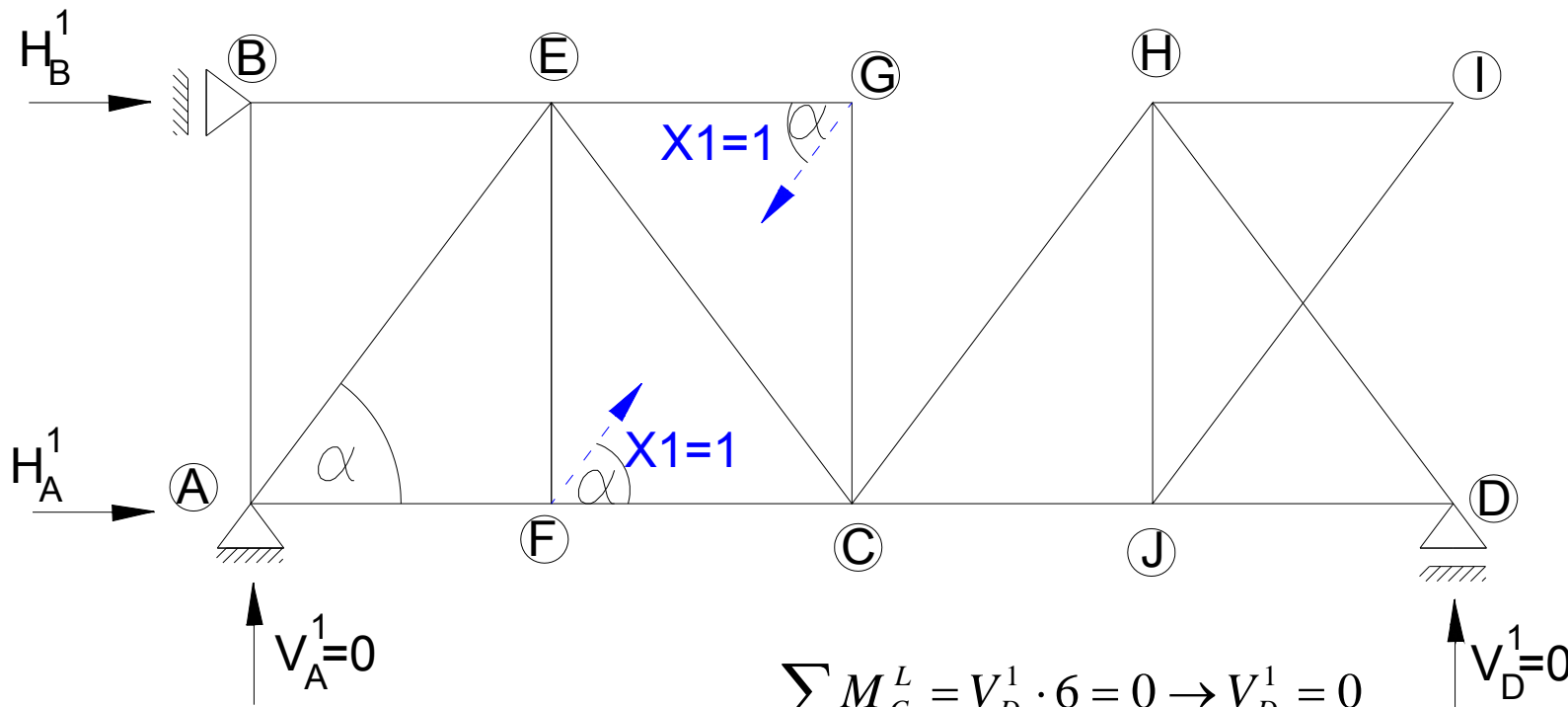


Wykresy jednostkowe

$X1=1$

$\sin \alpha = 4/5 = 0,8$

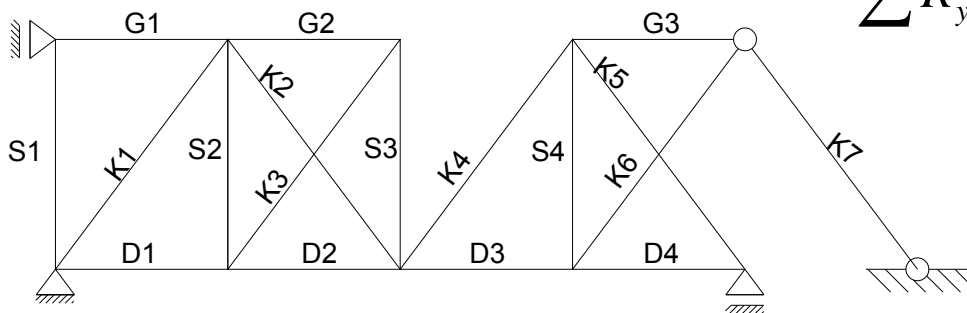
$\cos \alpha = 3/5 = 0,6$



$$\sum M_C^L = V_D^1 \cdot 6 = 0 \rightarrow V_D^1 = 0$$

$$\sum R_y = V_A^1 + X1 \cdot \sin \alpha - X1 \cdot \sin \alpha + V_D^1 = 0$$

↓
 $V_A^1 = 0$

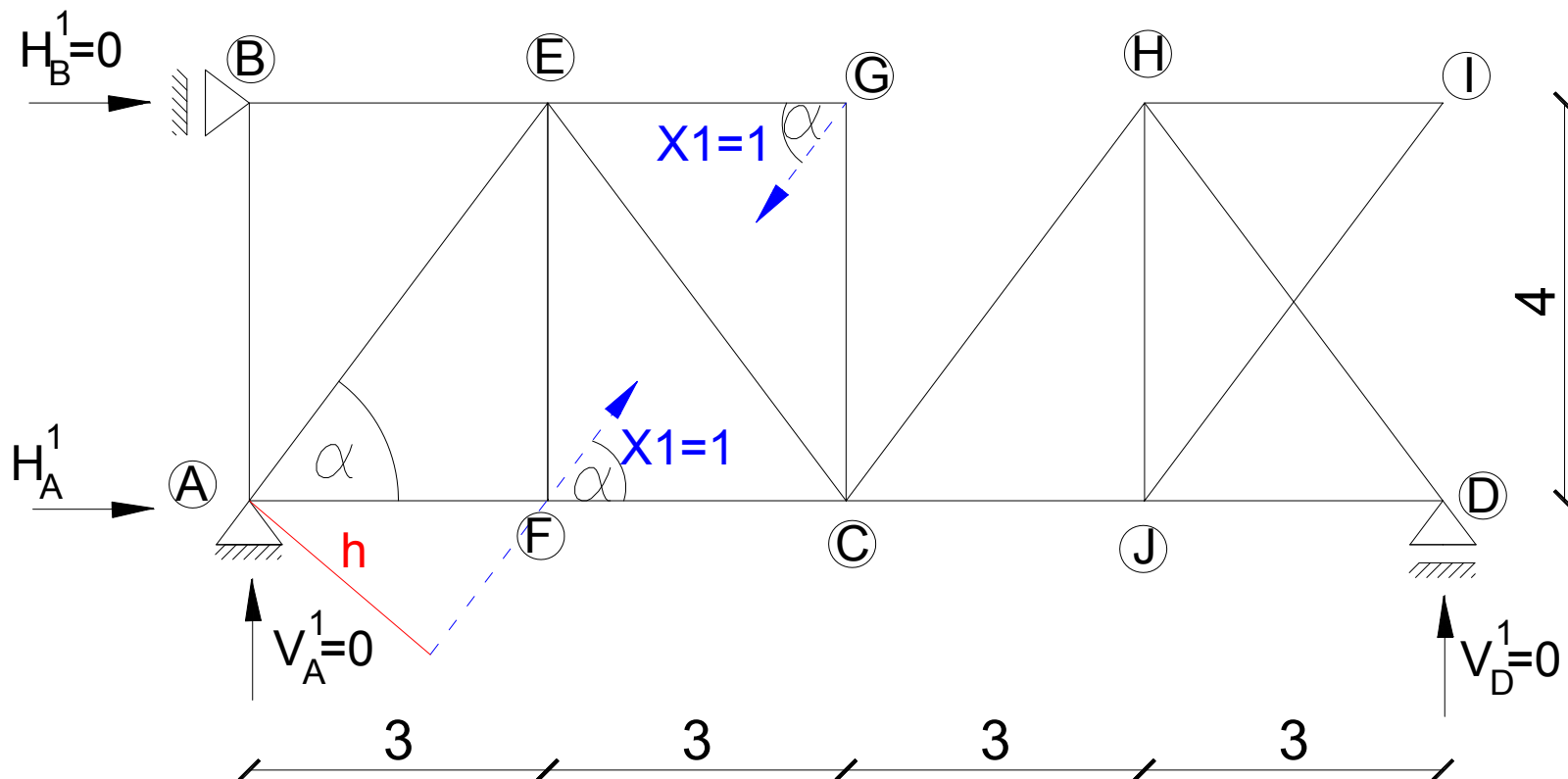


Wykresy jednostkowe

$X_1=1$

$\sin \alpha = 4/5 = 0,8$

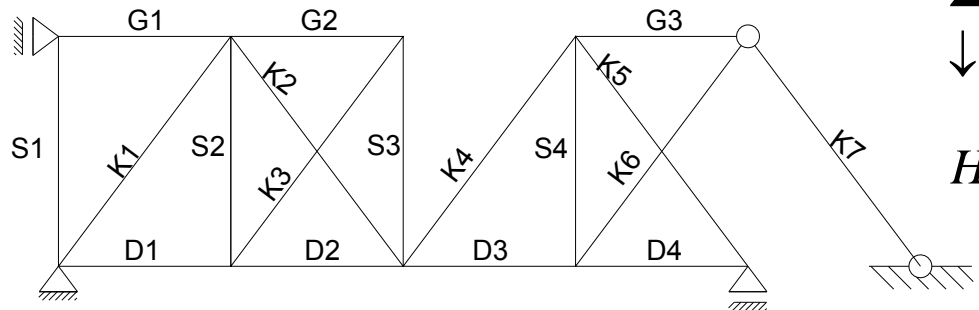
$\cos \alpha = 3/5 = 0,6$



$$\sum M_A = V_D^1 \cdot 12 + X_1 \cdot h - X_1 \cdot h - H_B^1 \cdot 4 = 0$$

$$\downarrow$$

$$H_B^1 = \frac{12}{4} V_D^1 = 0$$

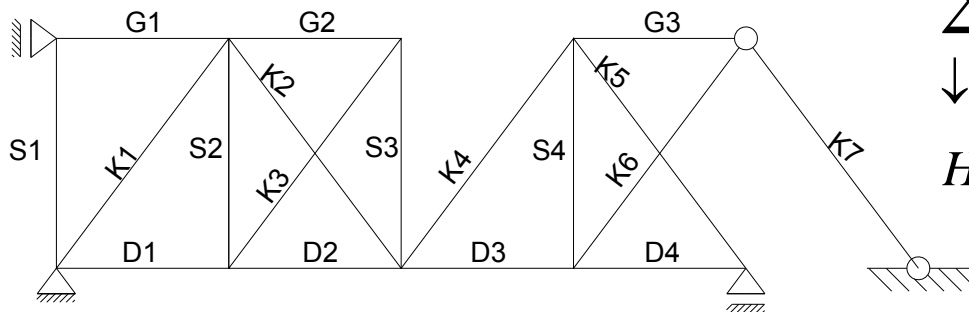
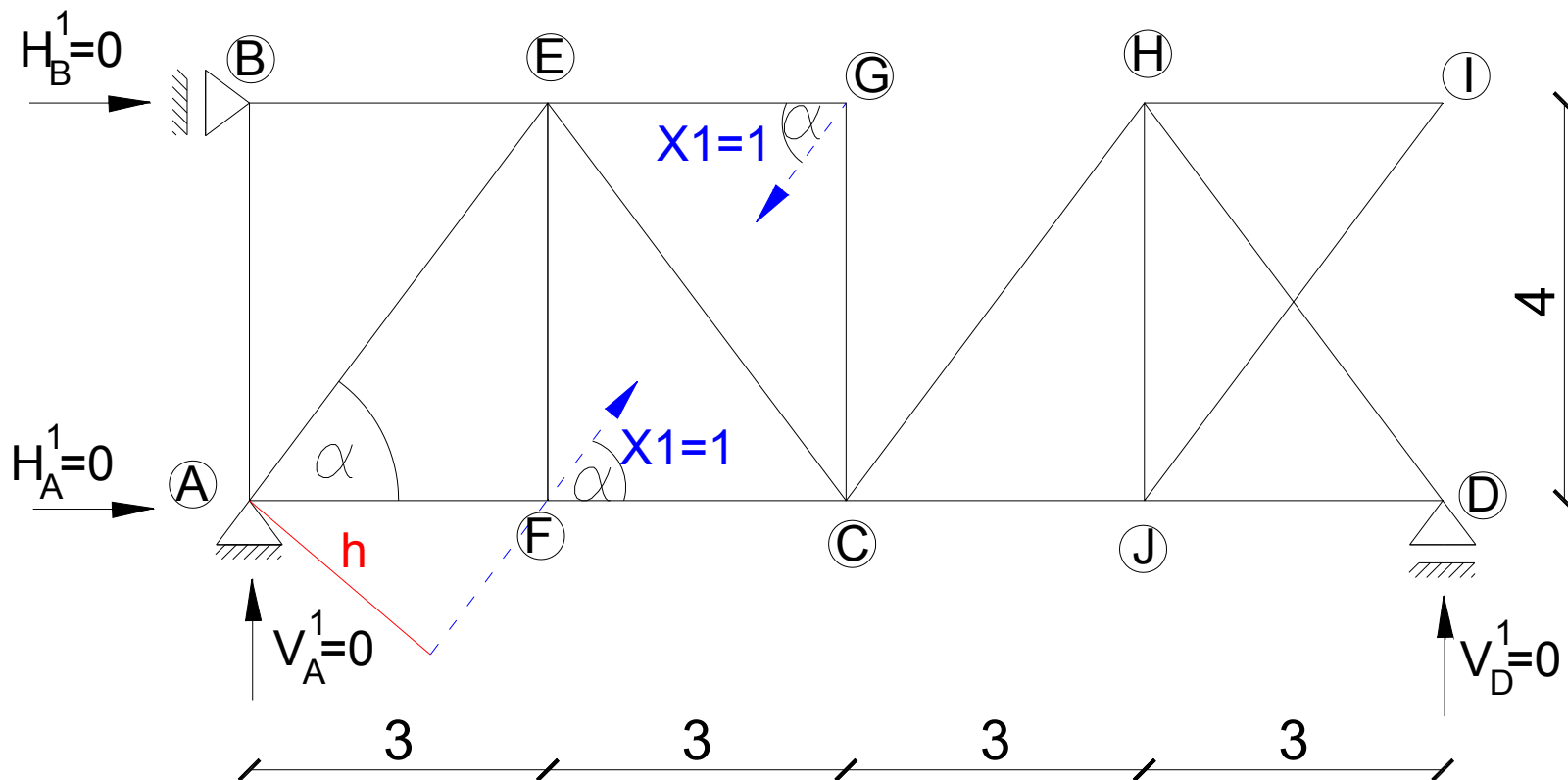


Wykresy jednostkowe

$X1=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_X = H_B^1 + X1 \cdot \cos \alpha - X1 \cdot \cos \alpha + H_A^1 = 0$$

↓

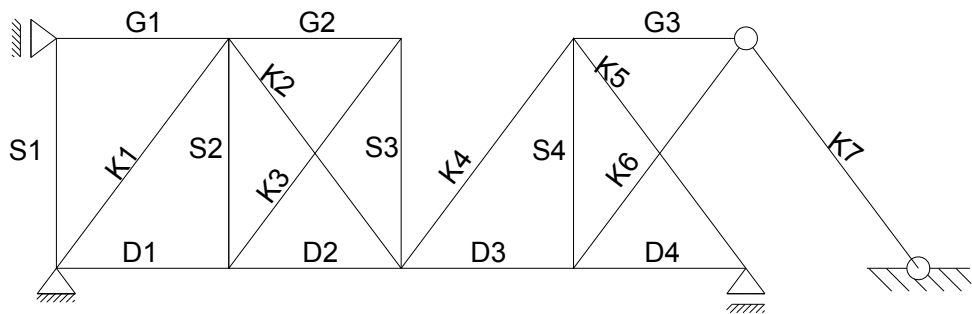
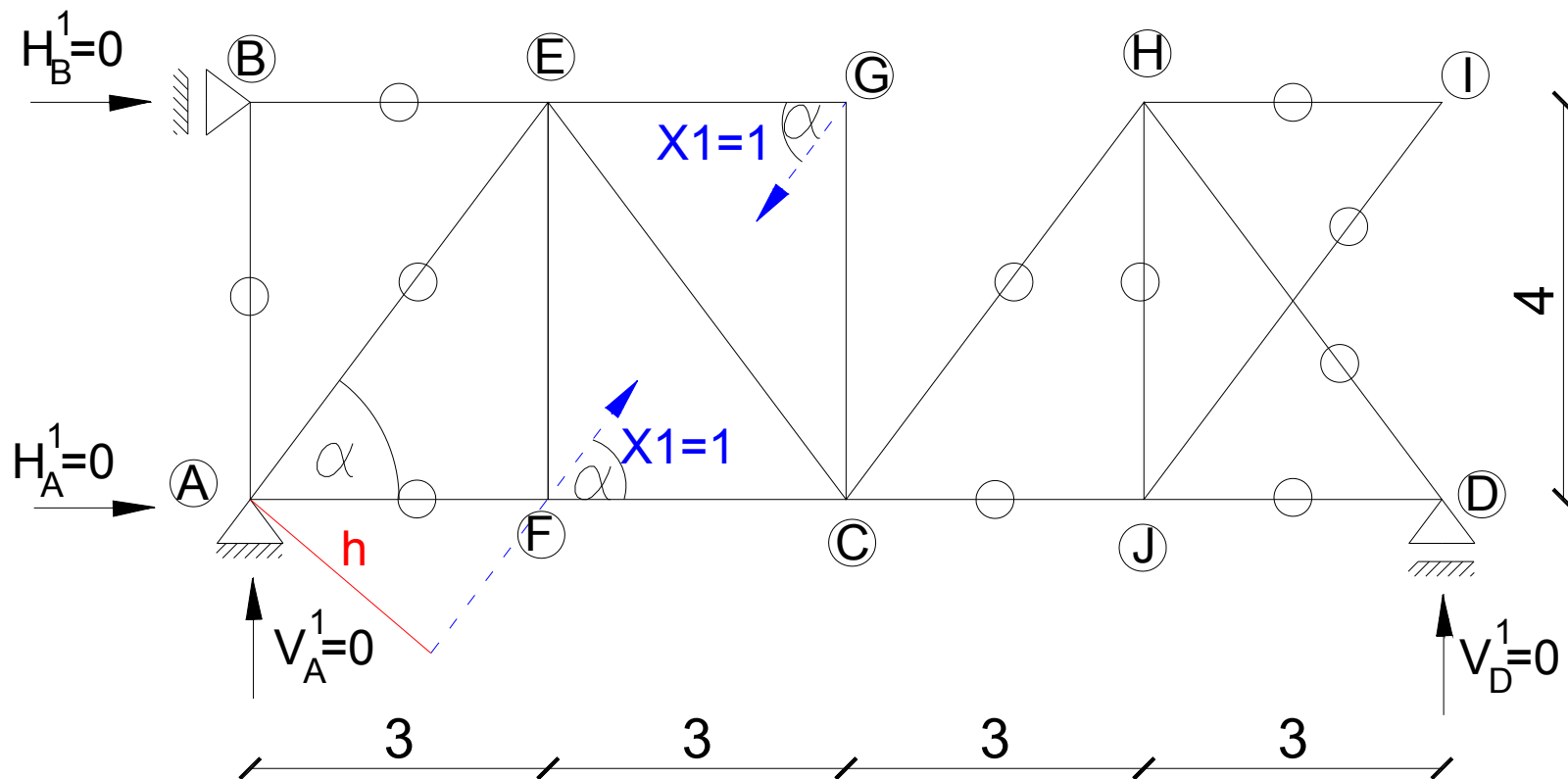
$$H_A^1 = H_B^1 = 0$$

Wykresy jednostkowe

$X_1=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$

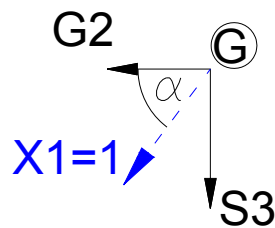
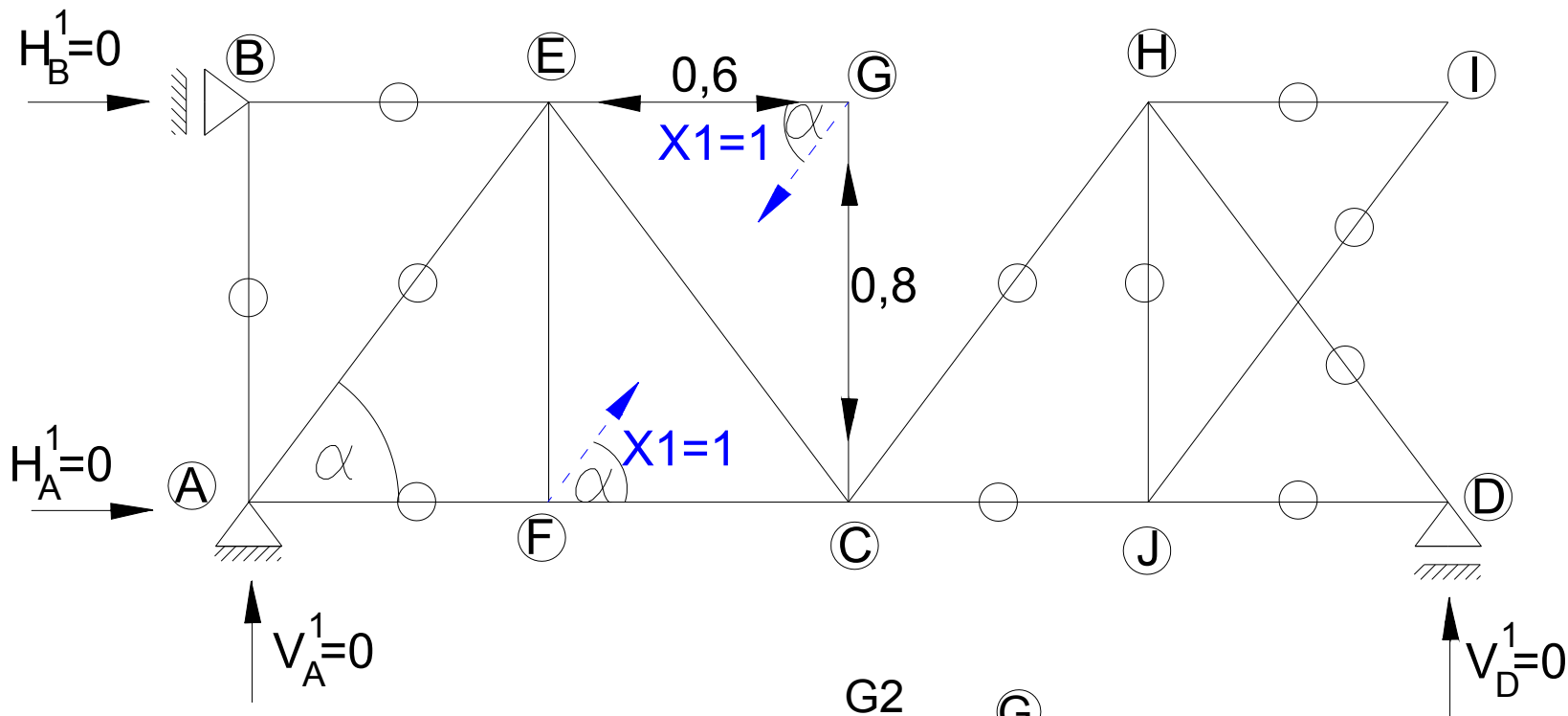


Wykresy jednostkowe

$X1=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -G2 - X1 \cdot \cos \alpha = 0$$

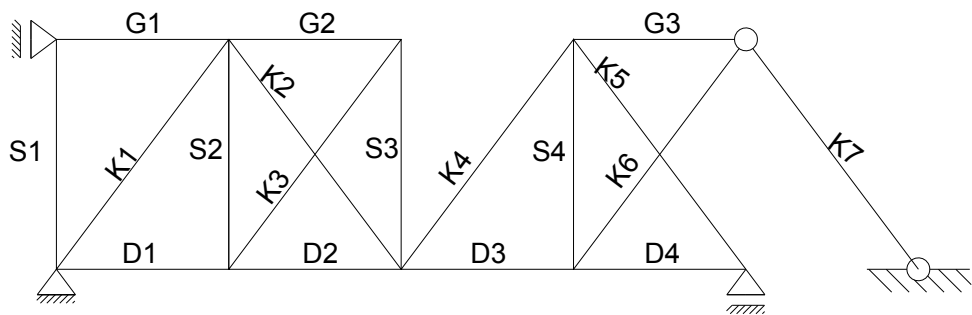
↓

$$G2 = -X1 \cdot \cos \alpha = -0,6$$

$$\sum R_y = -S3 - X1 \cdot \sin \alpha = 0$$

↓

$$S3 = -X1 \cdot \sin \alpha = -0,8$$

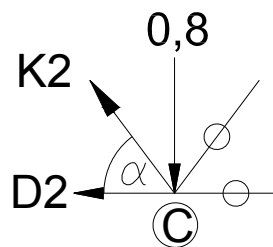
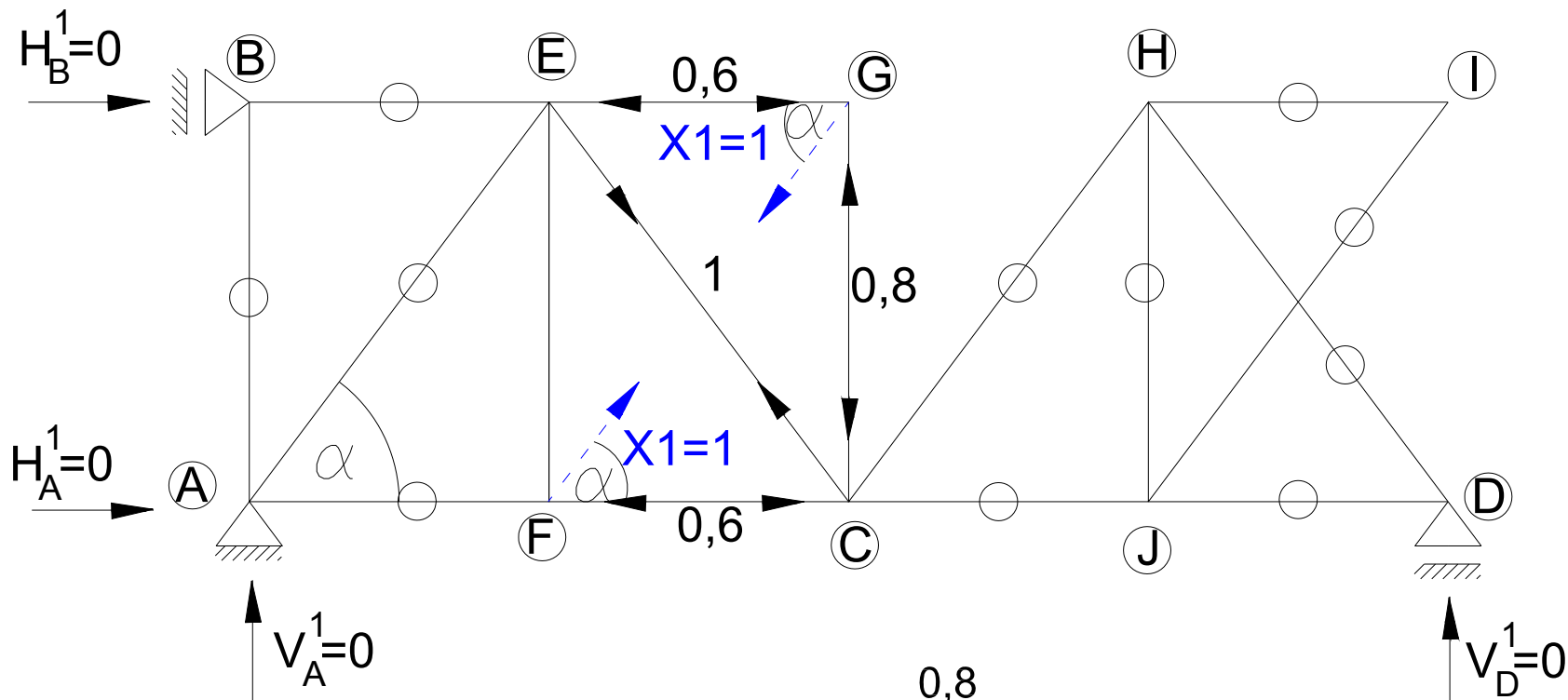


Wykresy jednostkowe

$X_1=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = K2 \cdot \sin \alpha - 0,8 = 0$$

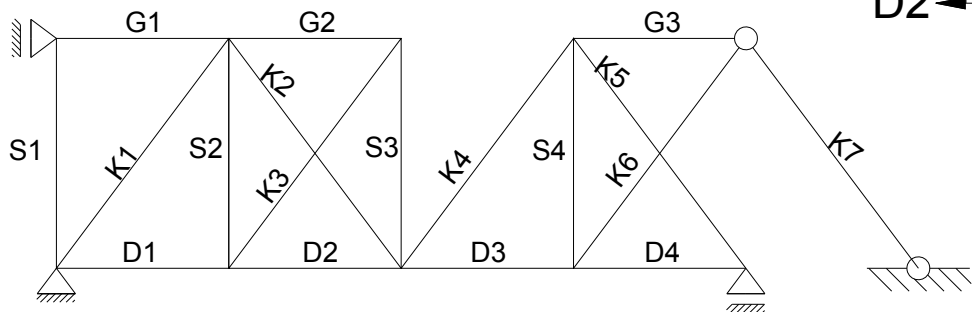
↓

$$K2 = \frac{0,8}{\sin \alpha} = \frac{0,8}{0,8} = 1$$

$$\sum R_x = -D2 - K2 \cdot \cos \alpha = 0$$

↓

$$D2 = -K2 \cdot \cos \alpha = -1 \cdot 0,6 = -0,6$$

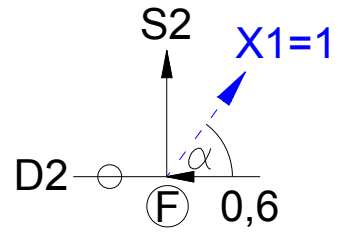
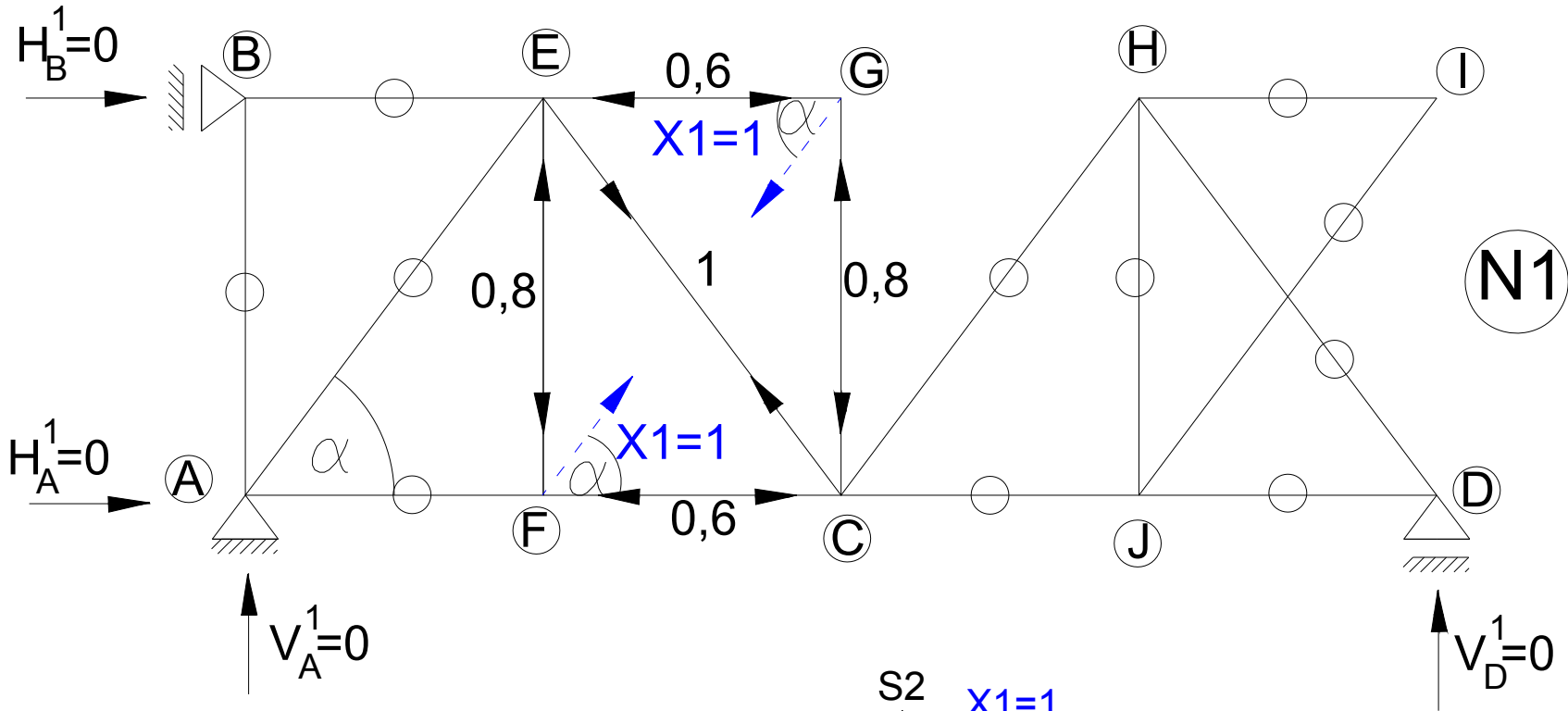


Wykresy jednostkowe

$X1=1$

$\sin \alpha = 4/5 = 0,8$

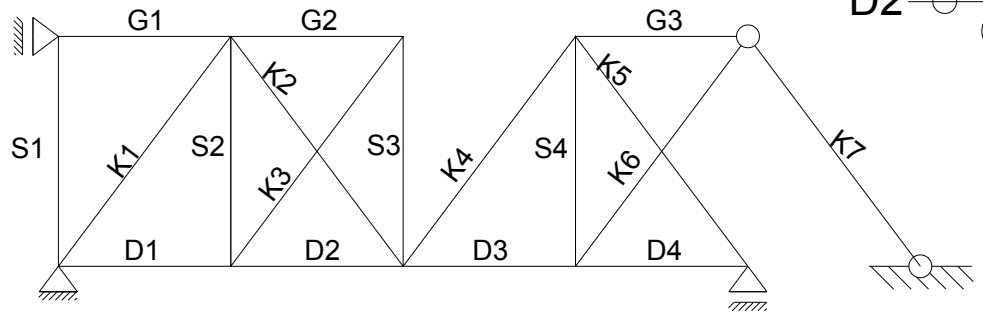
$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = X1 \cdot \sin \alpha + S2 = 0$$

↓

$$S2 = -X1 \cdot \sin \alpha = -1 \cdot 0,8 = -0,8$$

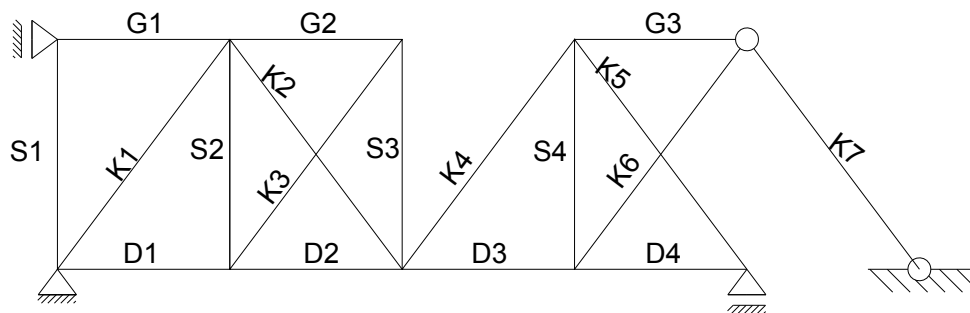
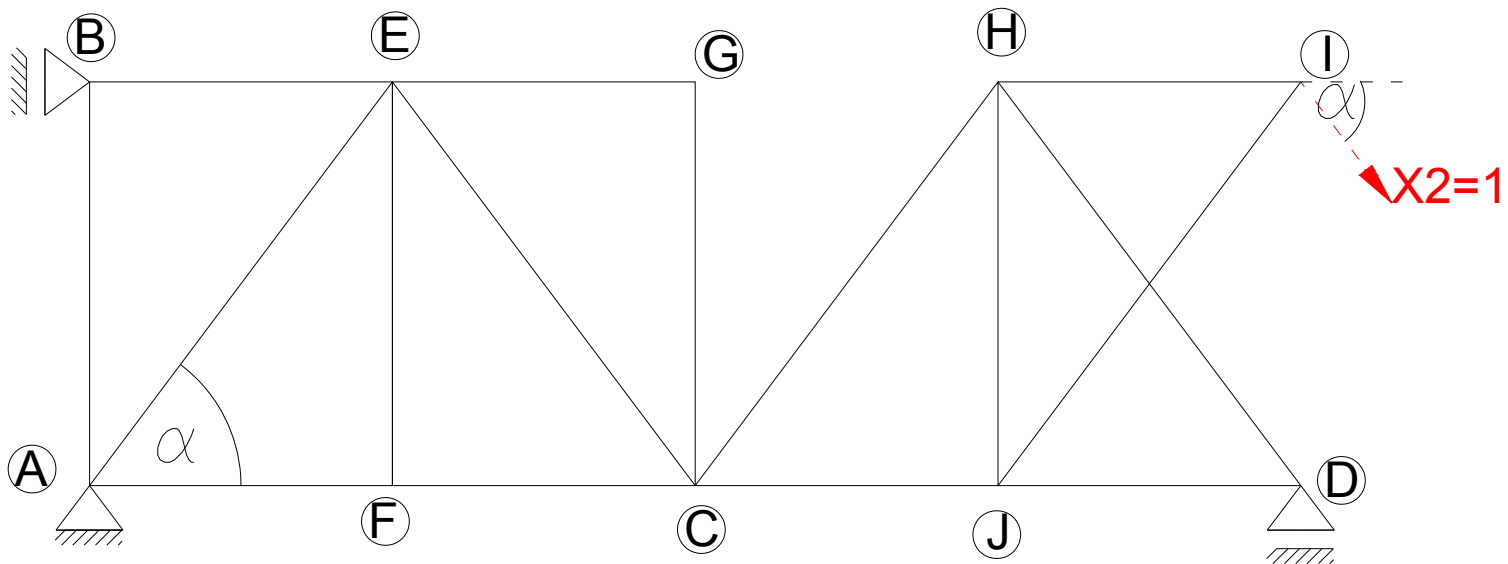


Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$

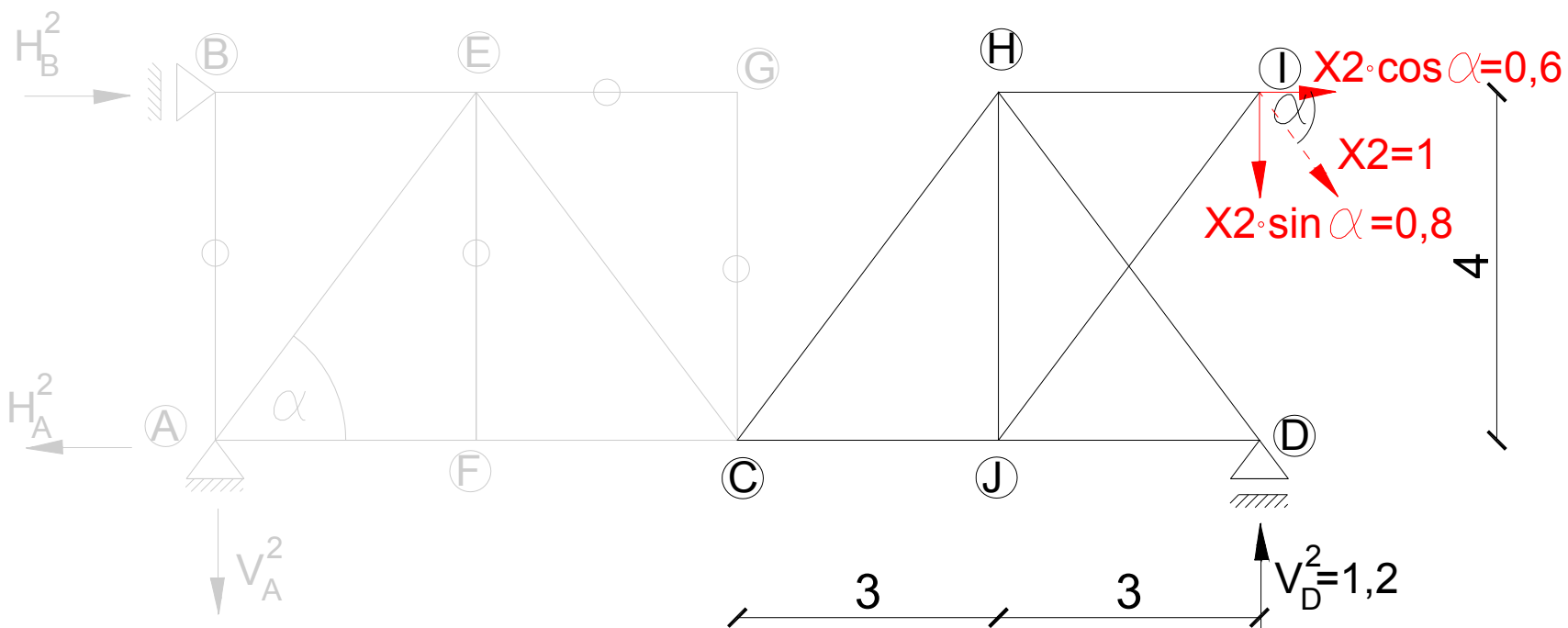


Wykresy jednostkowe

X2=1

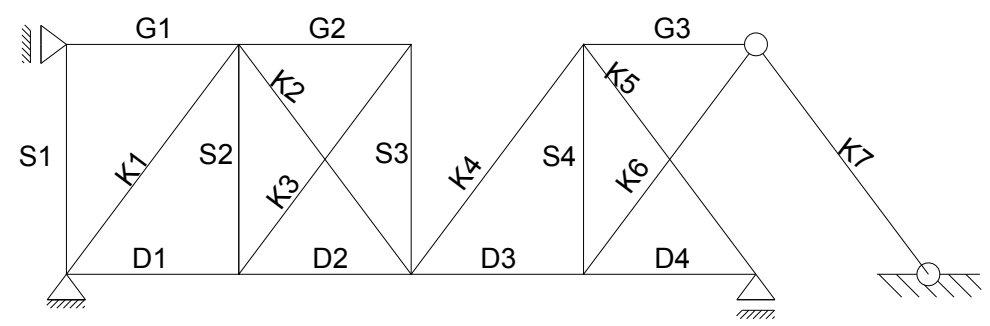
$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum M_C^P = 0,6 \cdot 4 + 0,8 \cdot 6 - V_D^2 \cdot 6 = 0$$

$$V_D^2 = \frac{2,4 + 4,8}{6} = 1,2$$

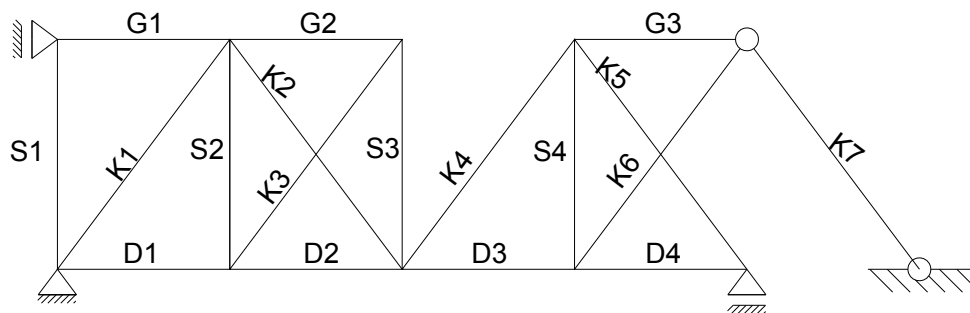
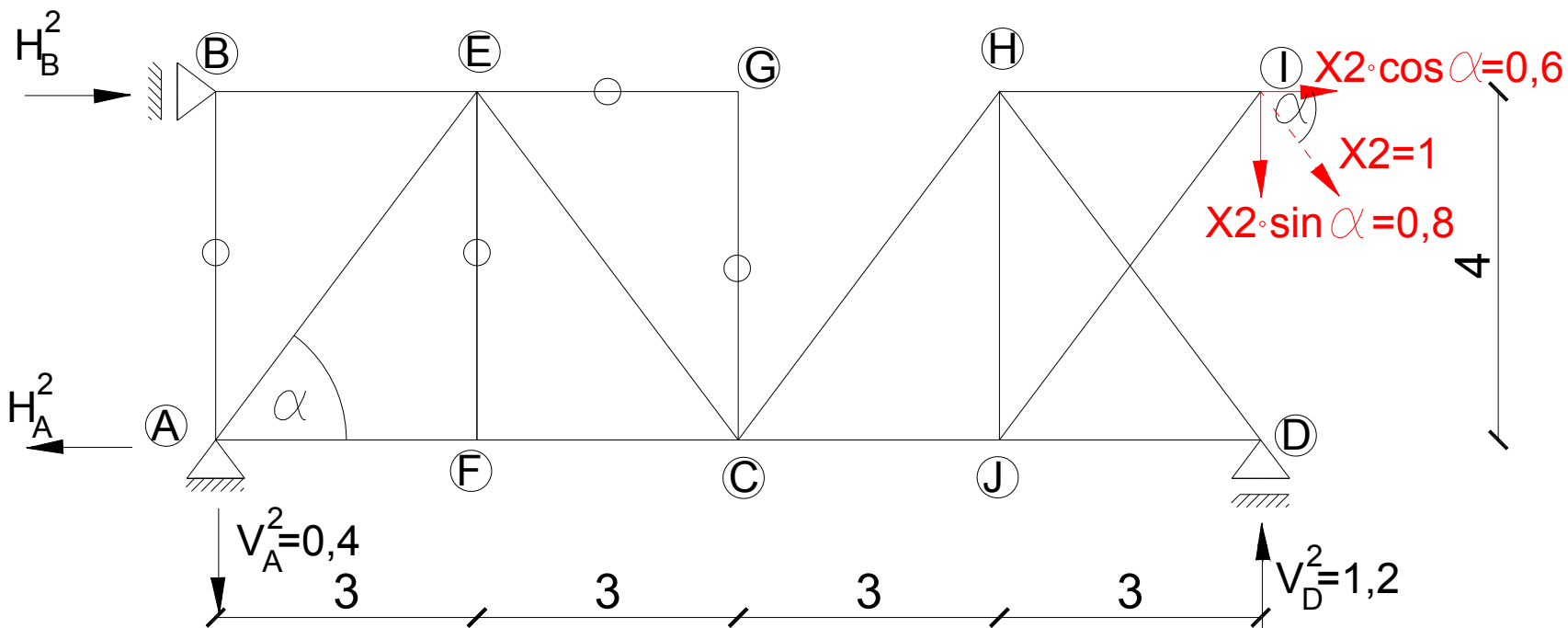


Wykresy jednostkowe

$$X_2 = 1$$

$$\sin \alpha = 4/5 = 0,8$$

$$\cos \alpha = 3/5 = 0,6$$



$$\sum R_y = -V_A^2 - 0,8 + 1,2 = 0$$

↓

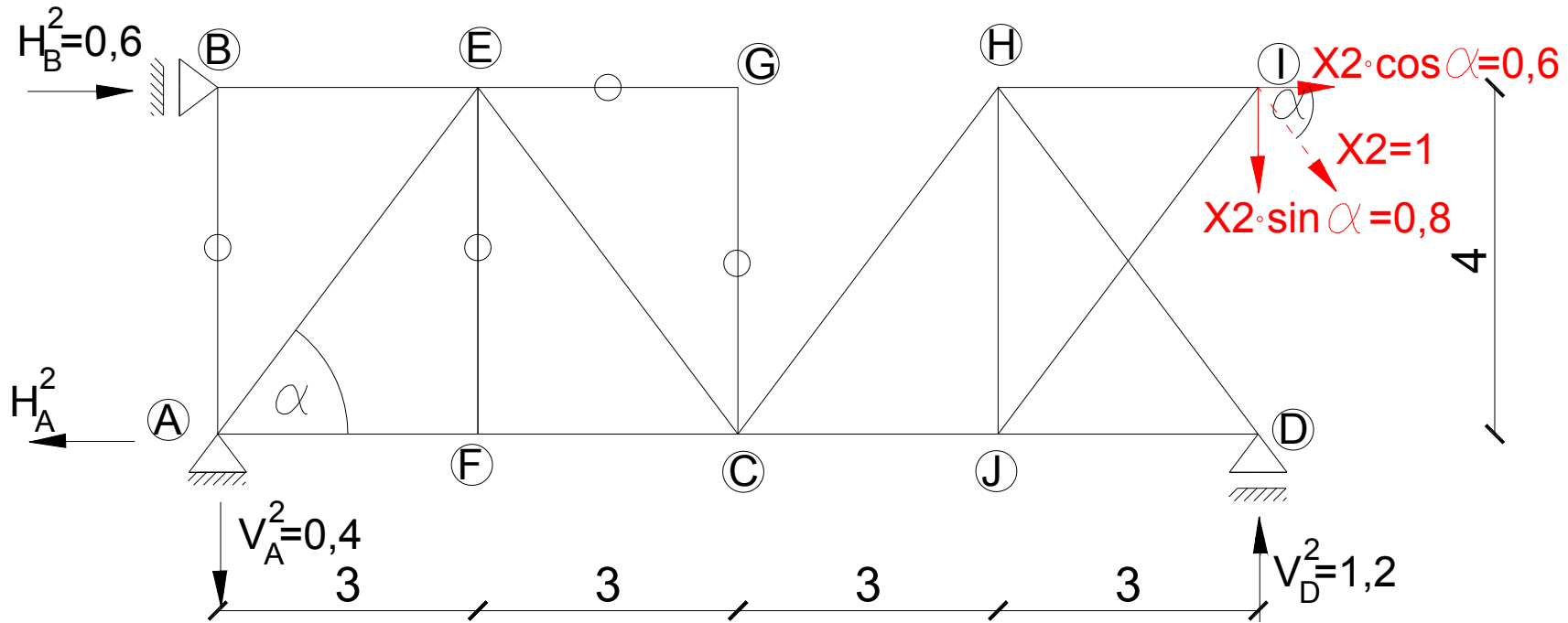
$$V_A^2 = 1,2 - 0,8 = 0,4$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

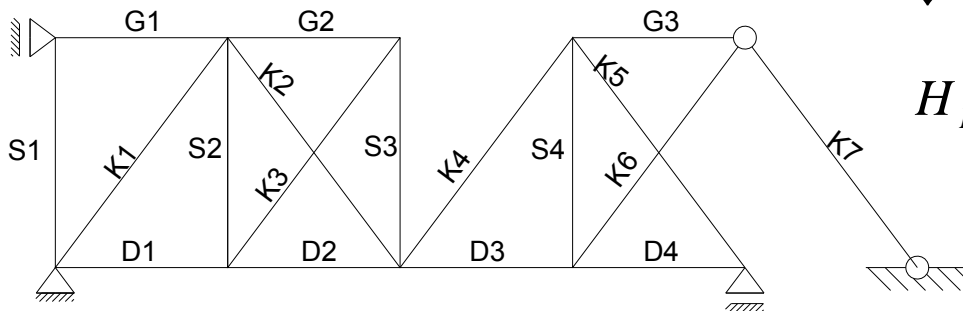
$\cos \alpha = 3/5 = 0,6$



$$\sum M_A = H_B^2 \cdot 4 + 0,8 \cdot 12 + 0,6 \cdot 4 - 1,2 \cdot 12 = 0$$

↓

$$H_B^2 = \frac{-0,8 \cdot 12 - 0,6 \cdot 4 + 1,2 \cdot 12}{4} = 0,6$$

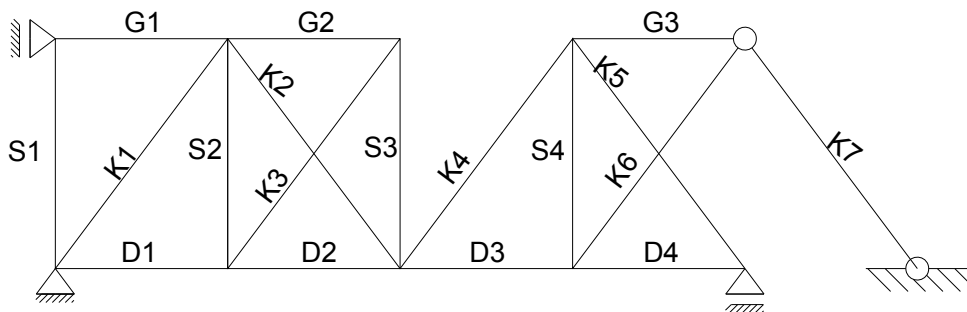
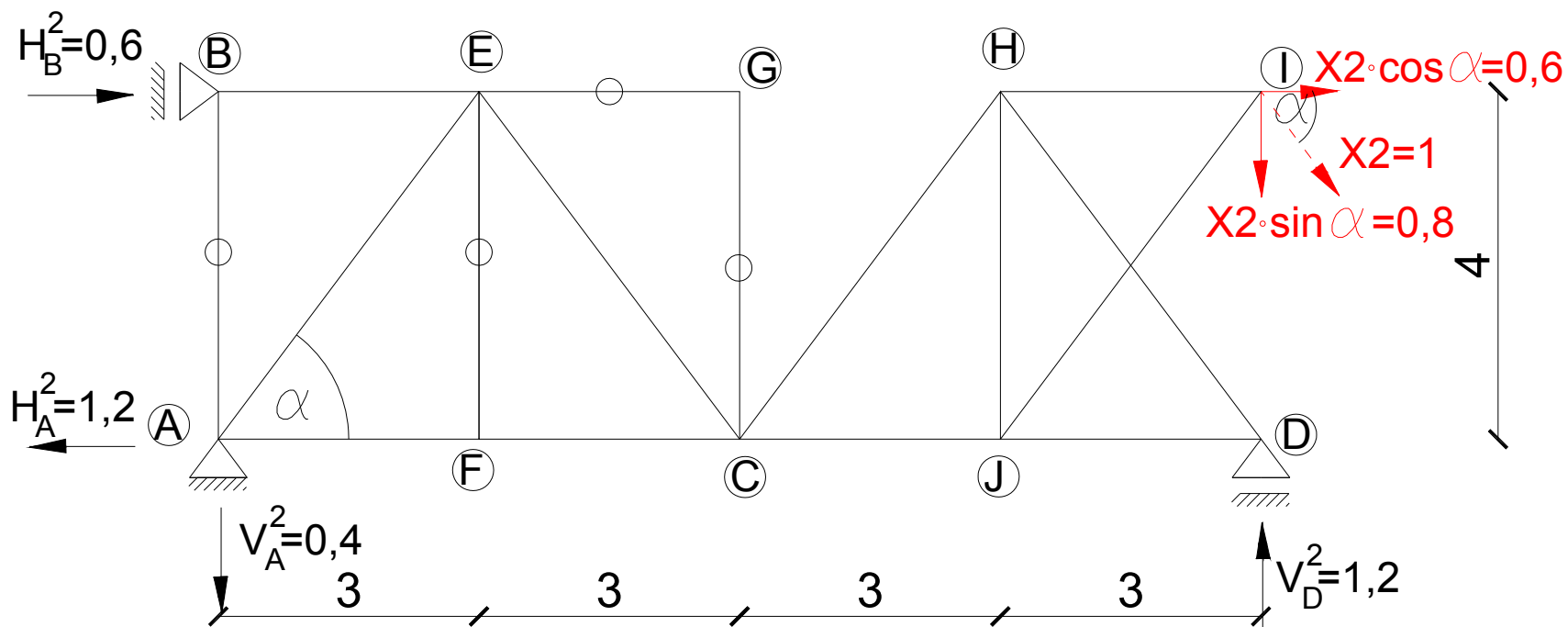


Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = 0,6 + 0,6 - H_A^2 = 0$$

↓

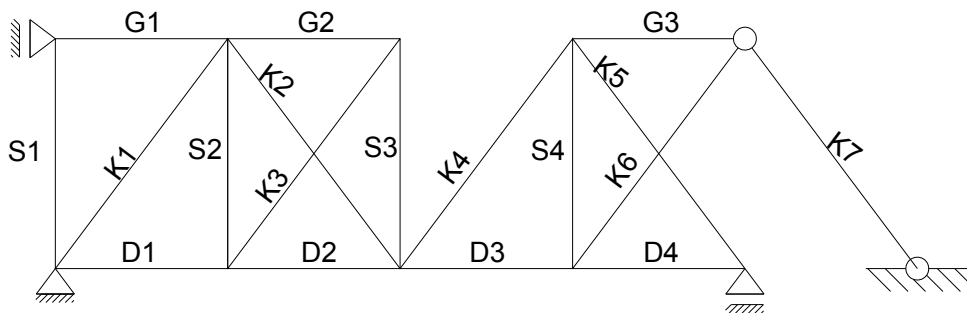
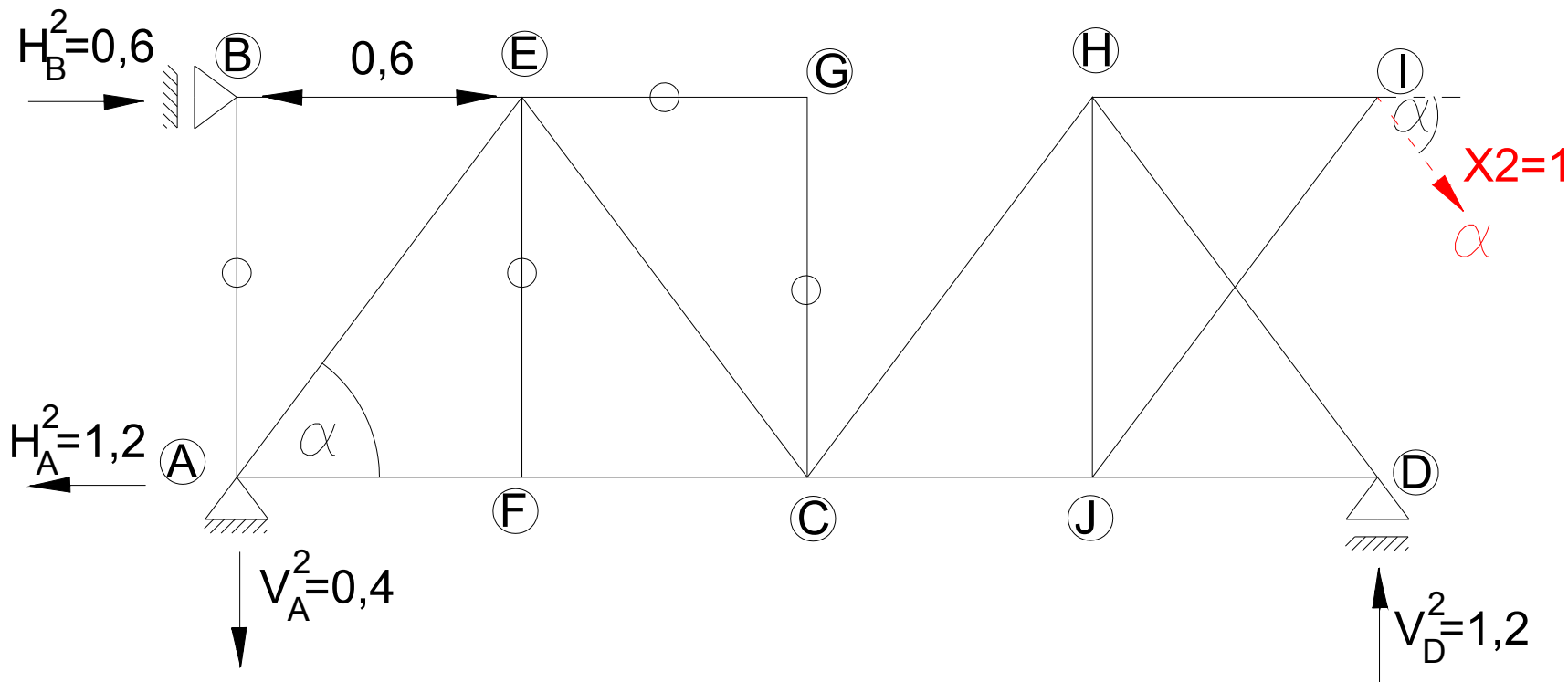
$$H_A^2 = 1,2$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



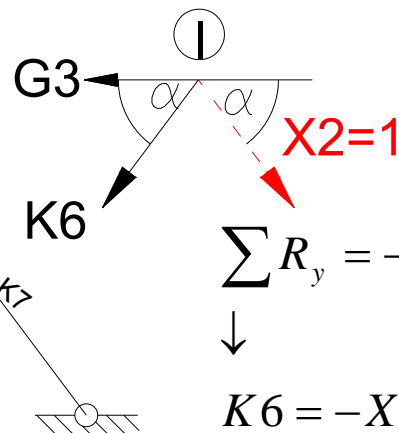
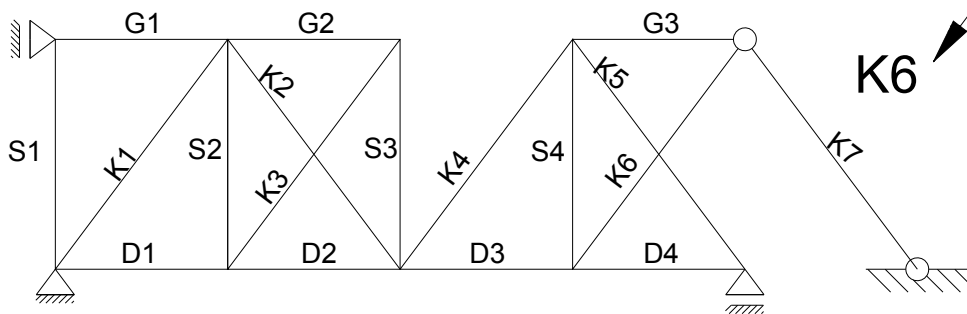
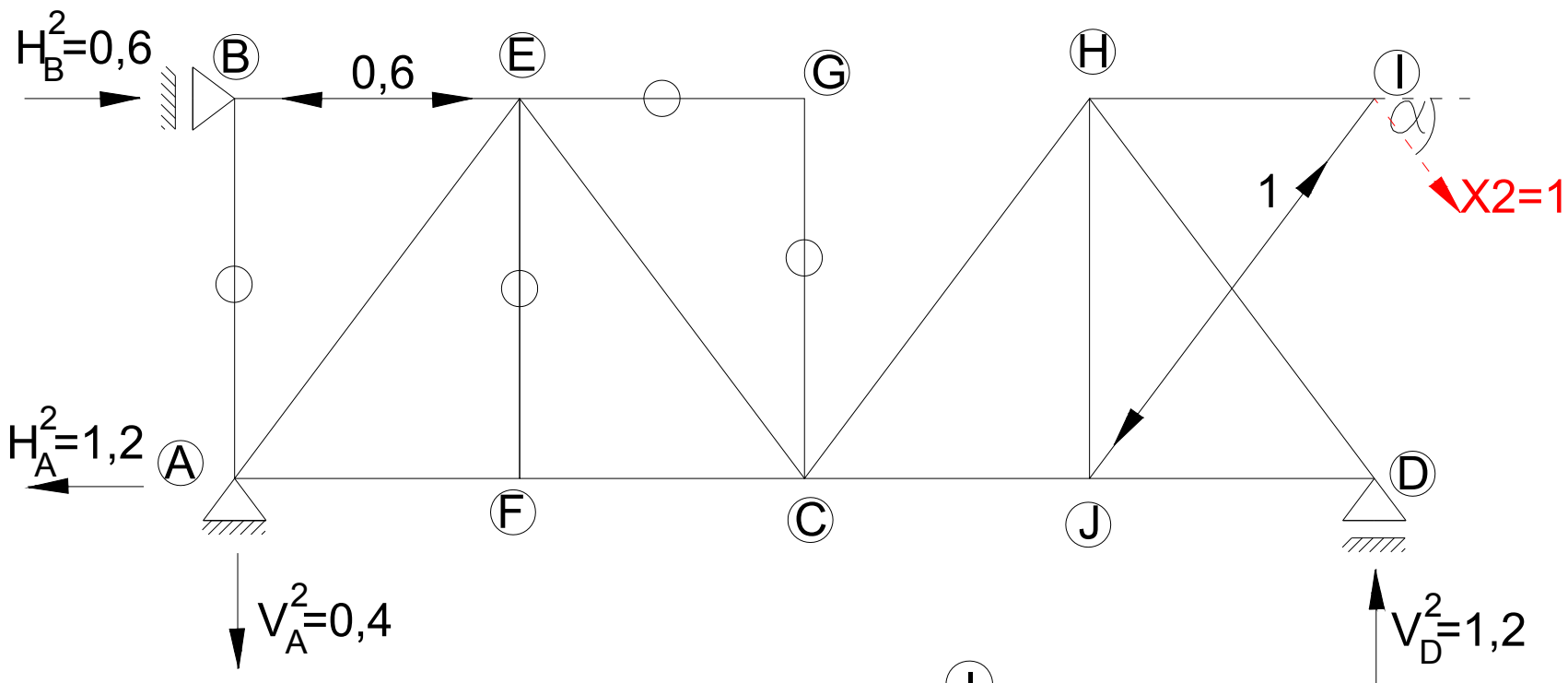
dr inż. Hanna Weber

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = -K_6 \cdot \sin \alpha - X_2 \cdot \sin \alpha = 0$$

↓

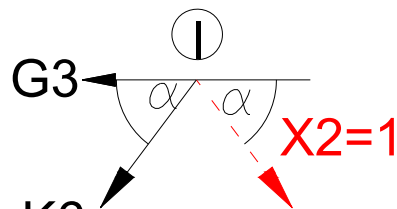
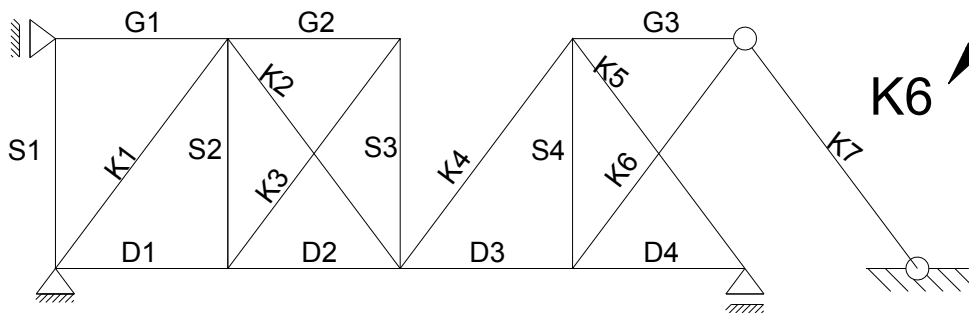
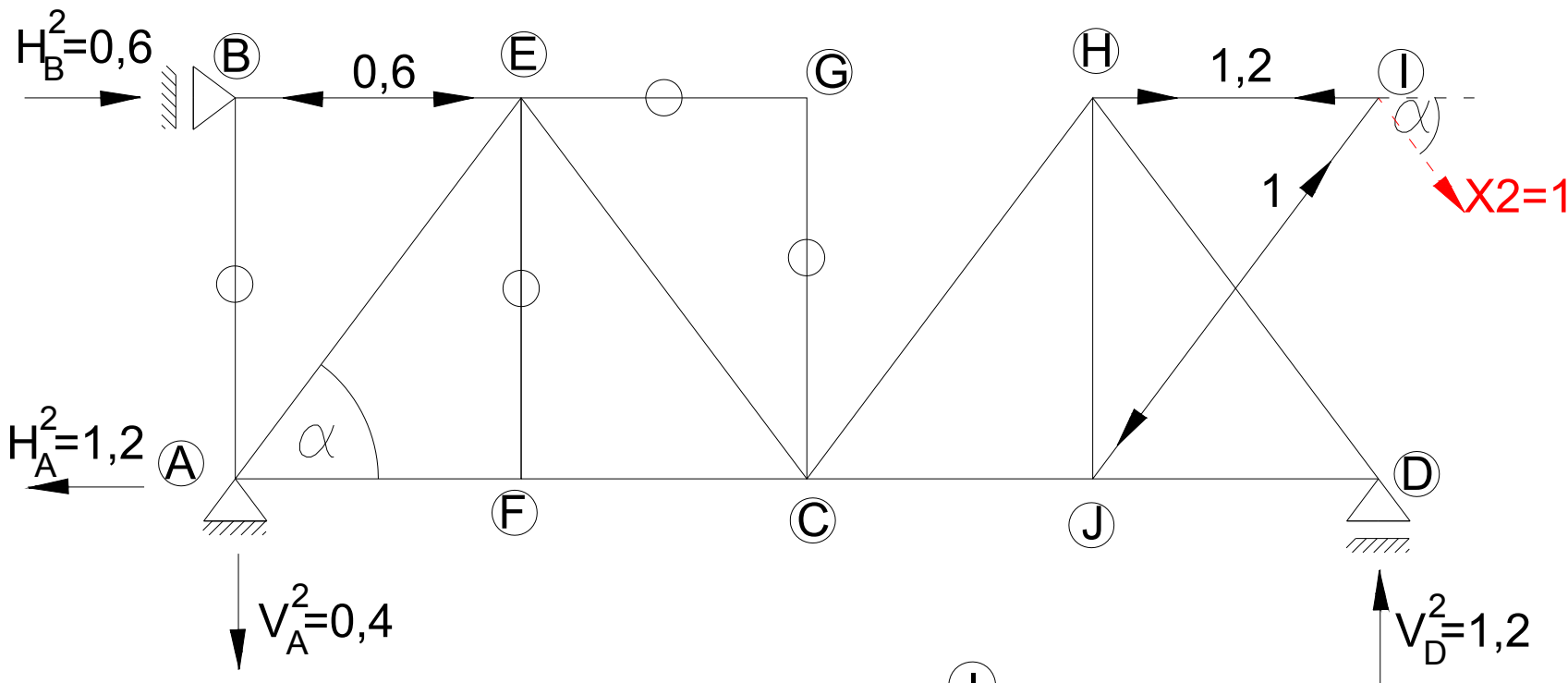
$$K_6 = -X_2 = -1$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -K_6 \cdot \cos \alpha + X_2 \cdot \cos \alpha - G_3 = 0$$

↓

$$G_3 = -K_6 \cdot \cos \alpha + X_2 \cdot \cos \alpha$$

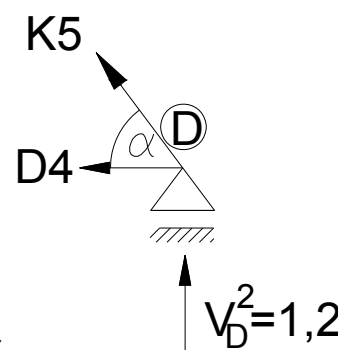
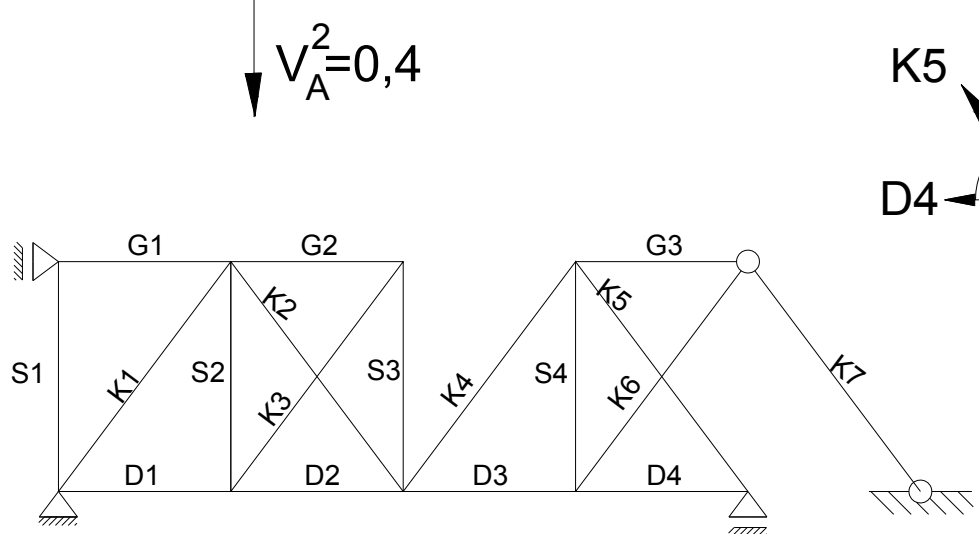
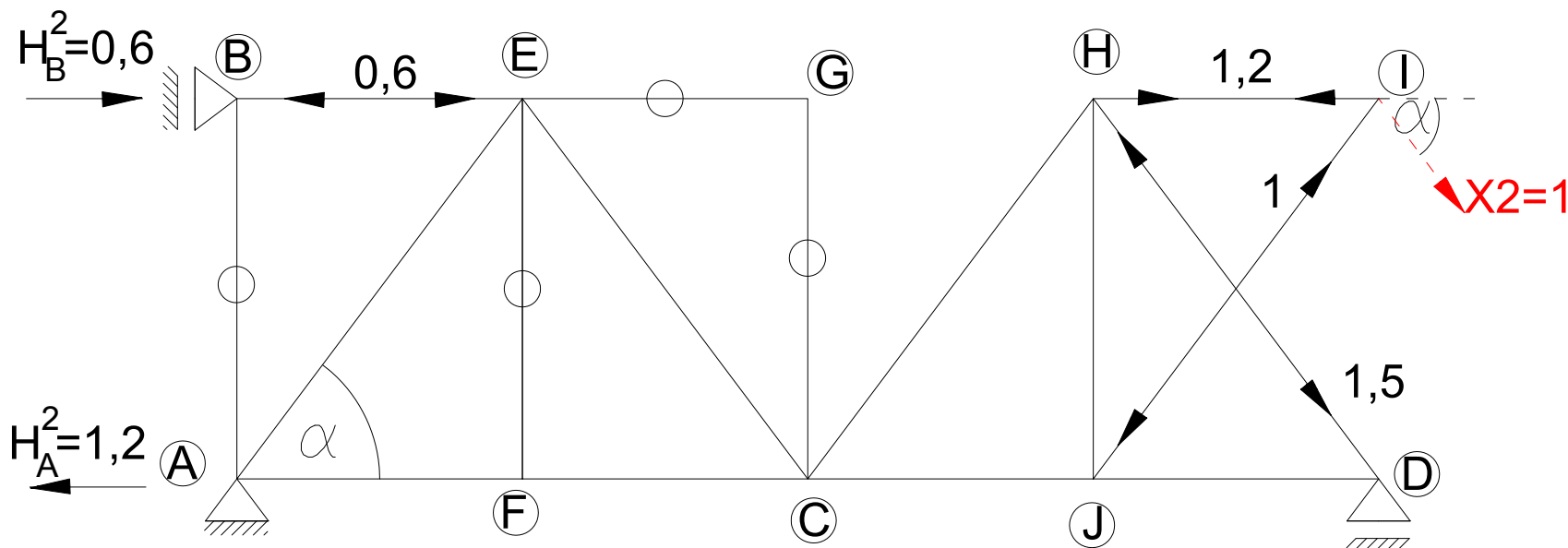
$$G_3 = -(-1) \cdot 0,6 + 0,6 = 1,2$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = K5 \cdot \sin \alpha + V_D^2 = 0$$

↓

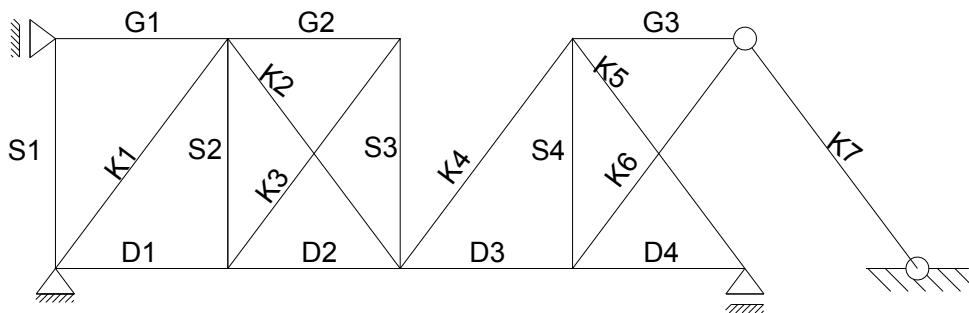
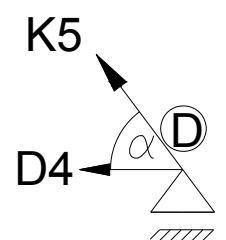
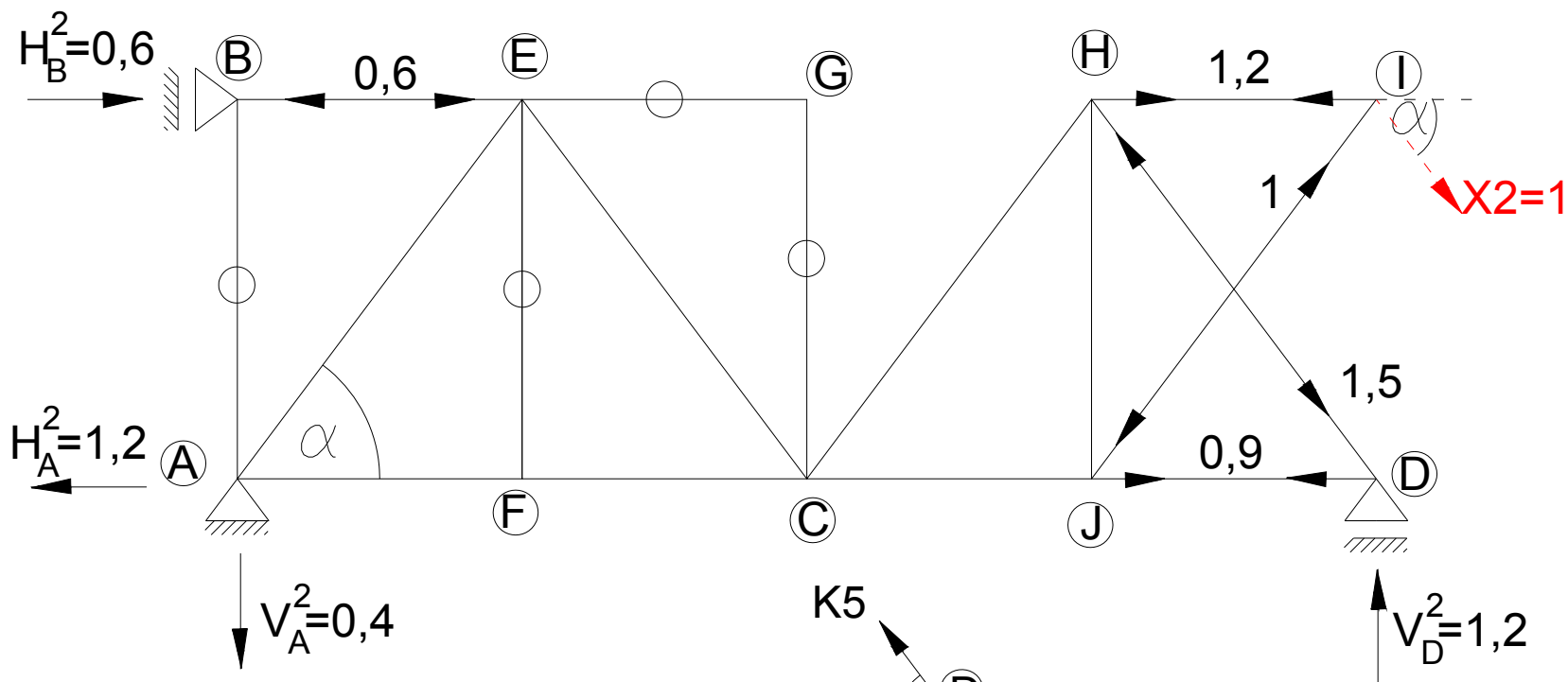
$$K5 = -\frac{V_D^2}{\sin \alpha} = -\frac{1,2}{0,8} = -1,5$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$V_D^2=1,2$

$$\sum R_x = -K5 \cdot \cos \alpha - D4 = 0$$

↓

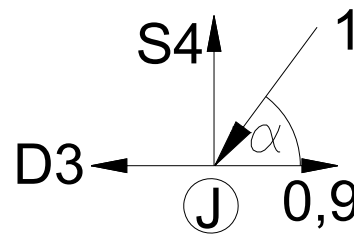
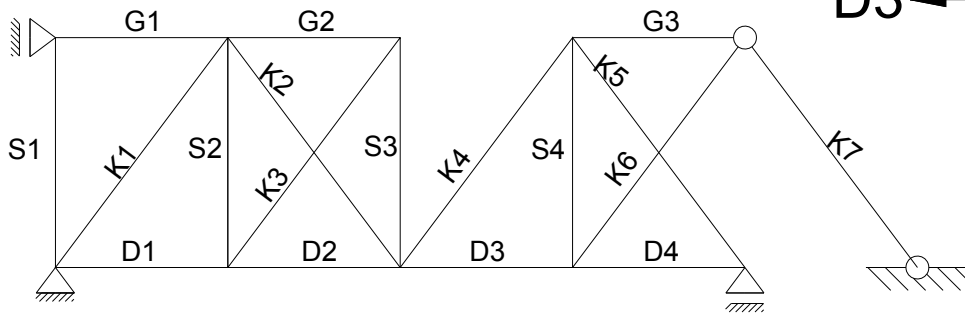
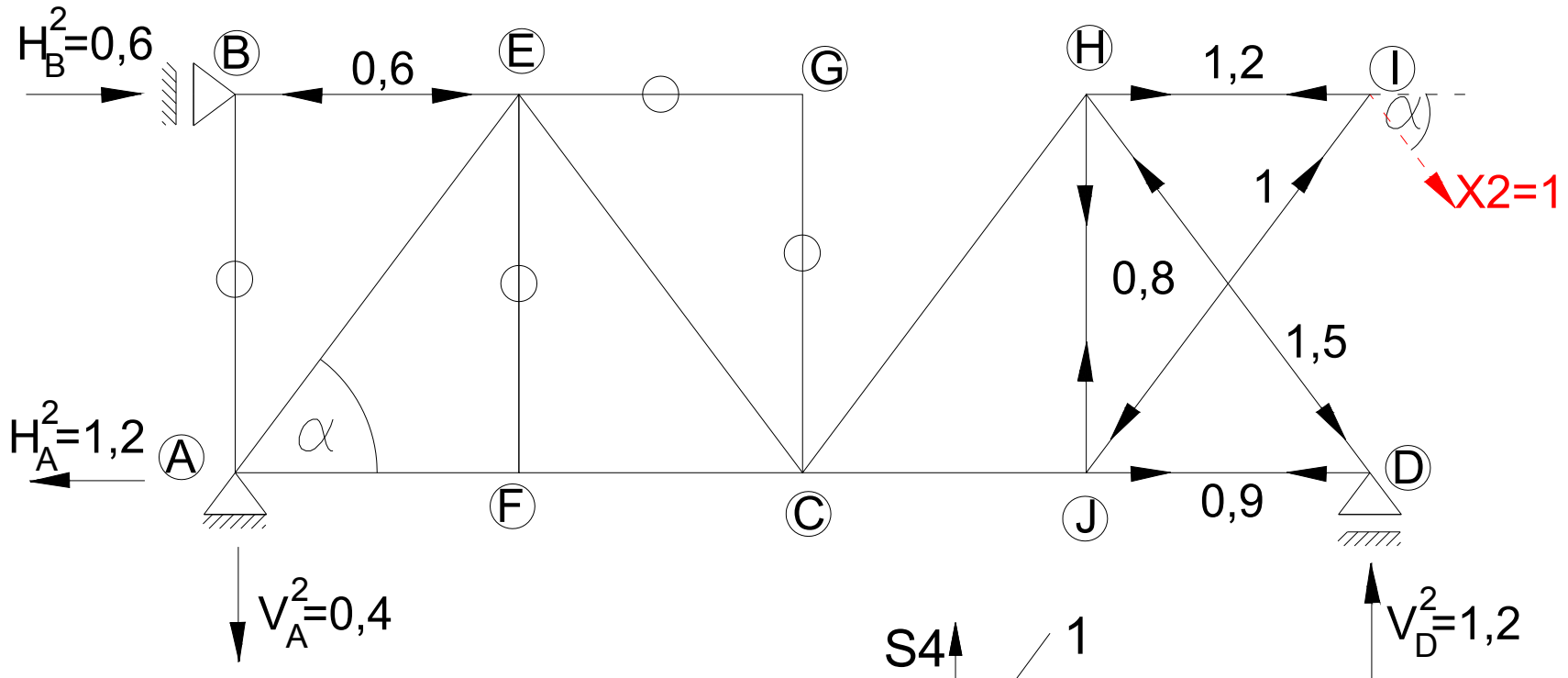
$$D4 = -K5 \cdot \cos \alpha = -(-1,5) \cdot 0,6 = 0,9$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_y = -1 \cdot \sin \alpha + S4 = 0$$

↓

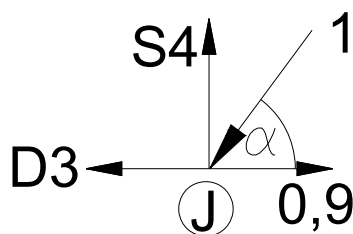
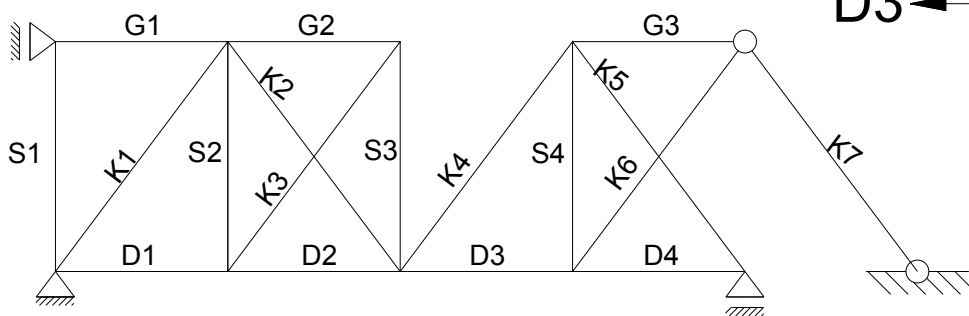
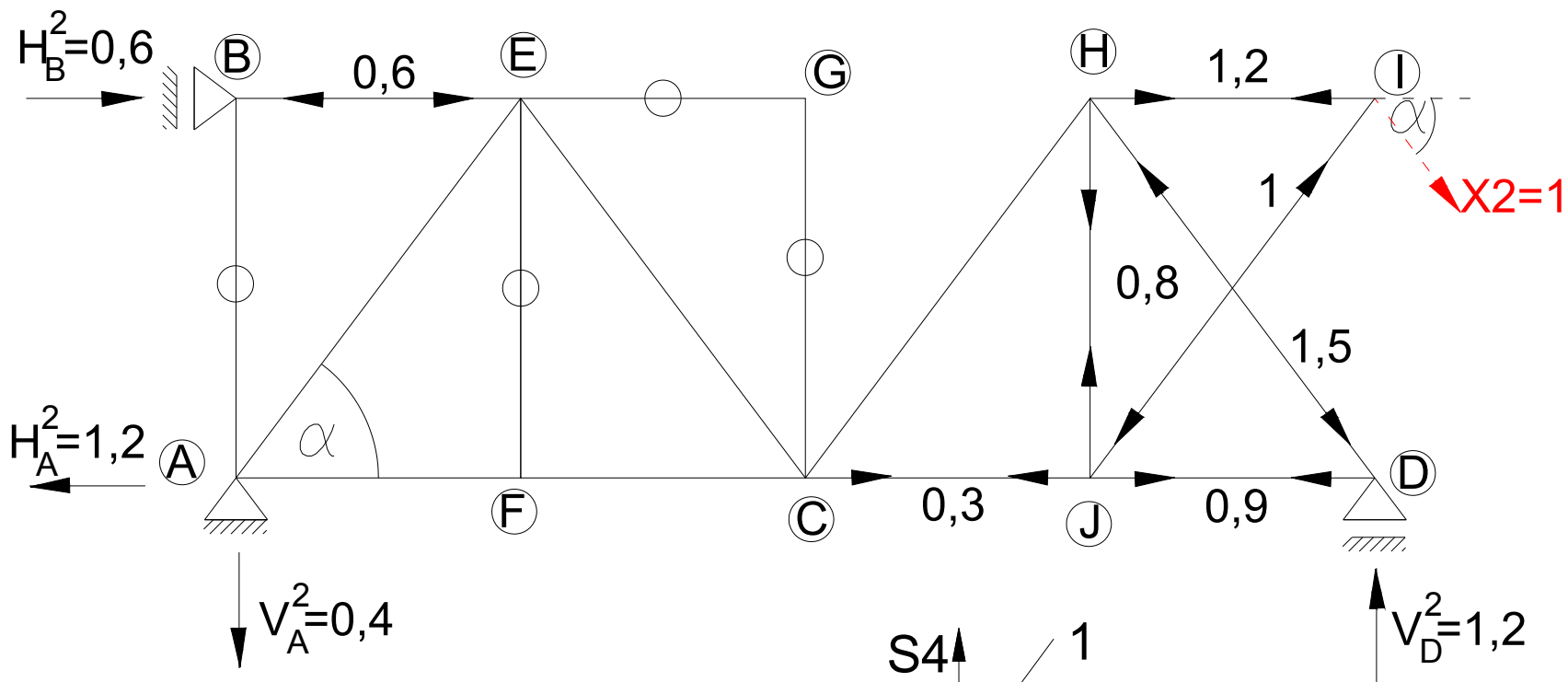
$$S4 = 1 \cdot \sin \alpha = 0,8$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -D3 - 1 \cdot \cos \alpha + 0,9 = 0$$

↓

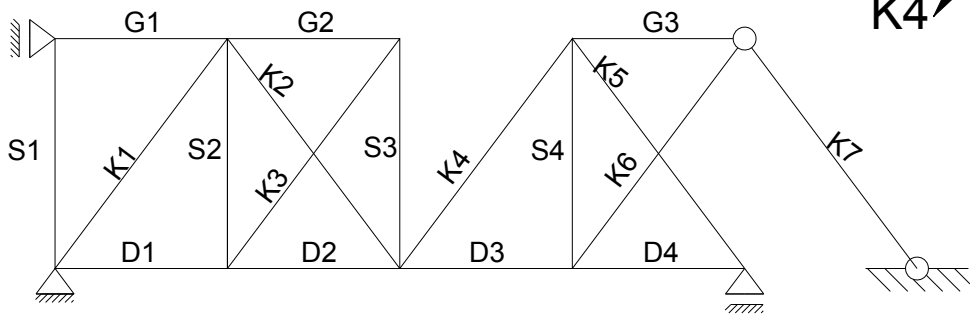
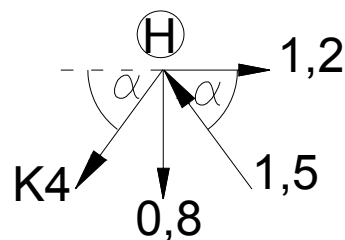
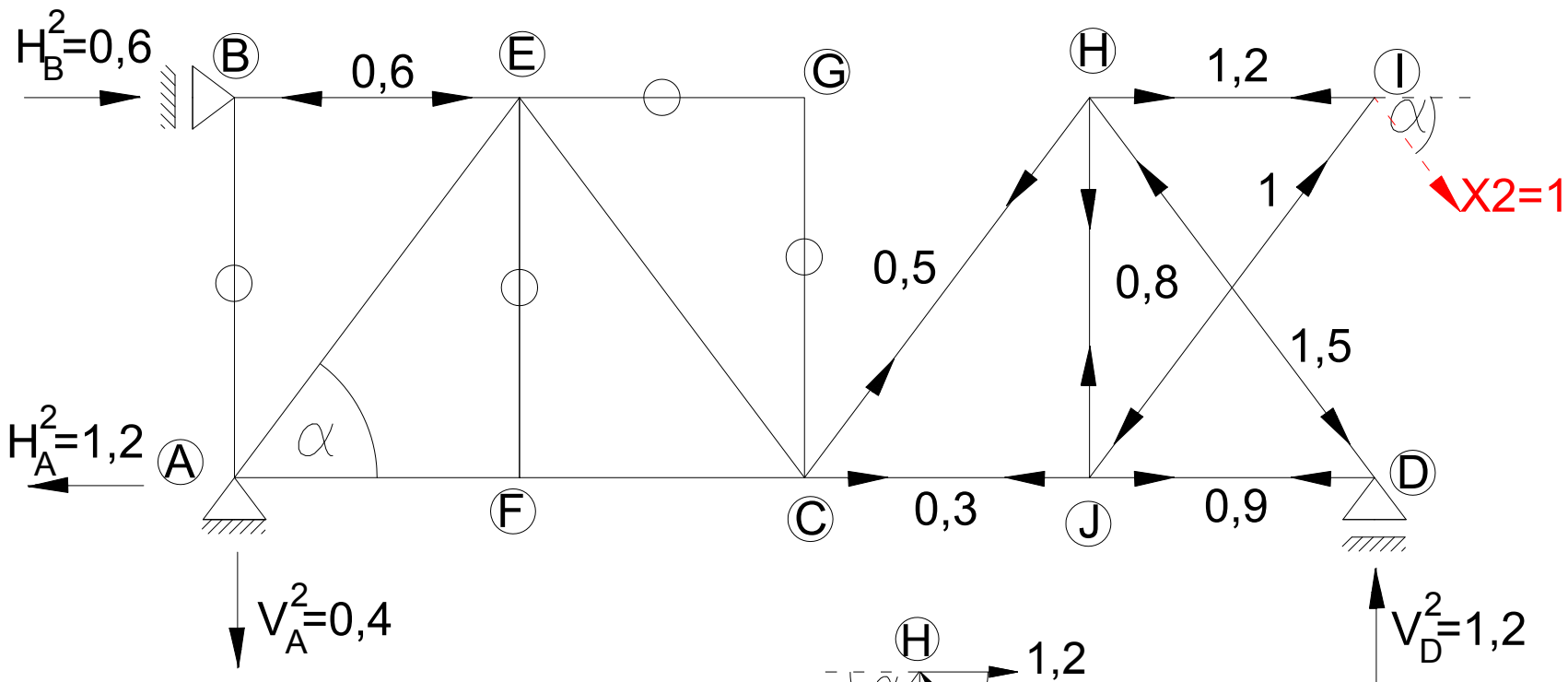
$$D3 = 0,9 - 1 \cdot 0,6 = 0,3$$

Wykresy jednostkowe

X2=1

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -K4 \cdot \cos \alpha - 1,5 \cdot \cos \alpha + 1,2 = 0$$

↓

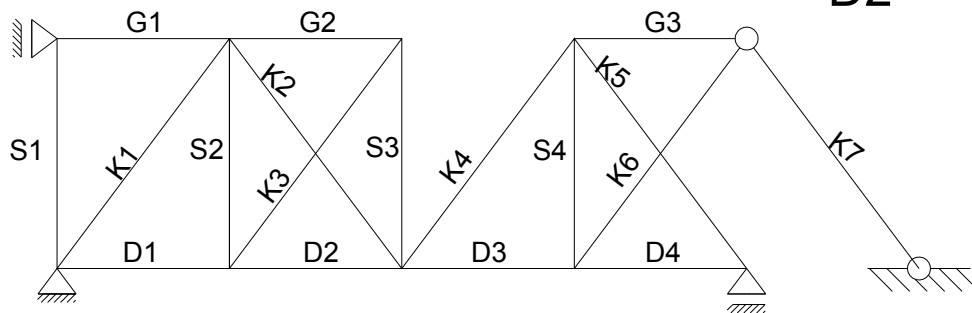
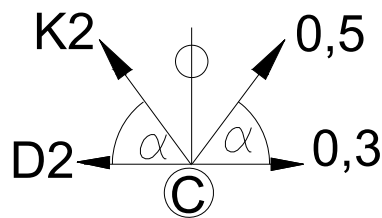
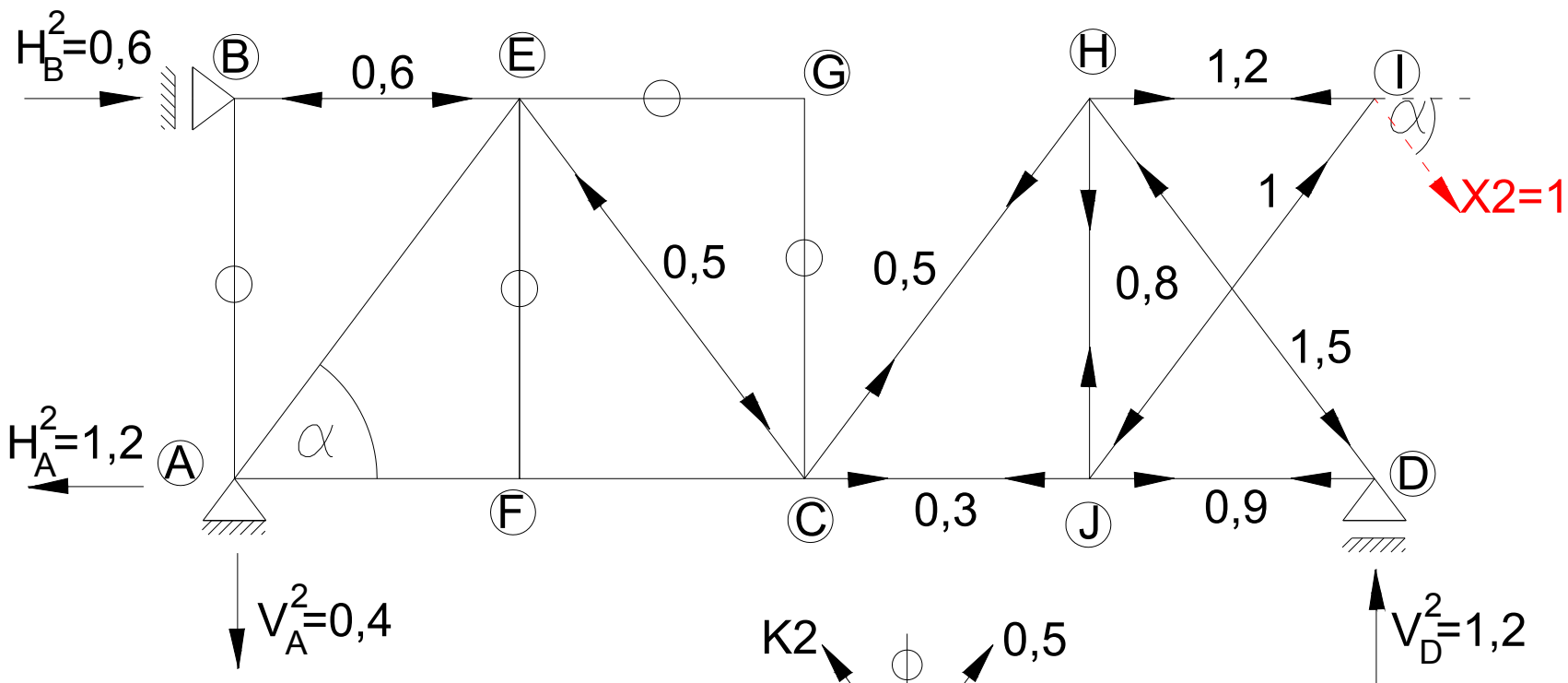
$$K4 = \frac{-1,5 \cdot \cos \alpha + 1,2}{\cos \alpha} = \frac{-1,5 \cdot 0,6 + 1,2}{0,6} = 0,5$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_Y = K_2 \cdot \sin \alpha + 0,5 \cdot \sin \alpha = 0$$

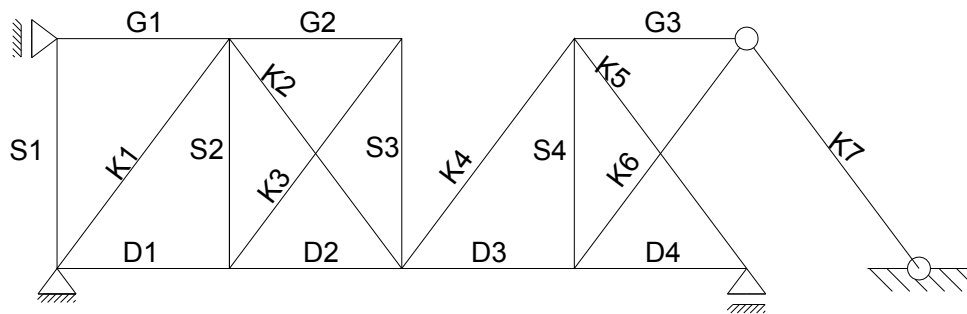
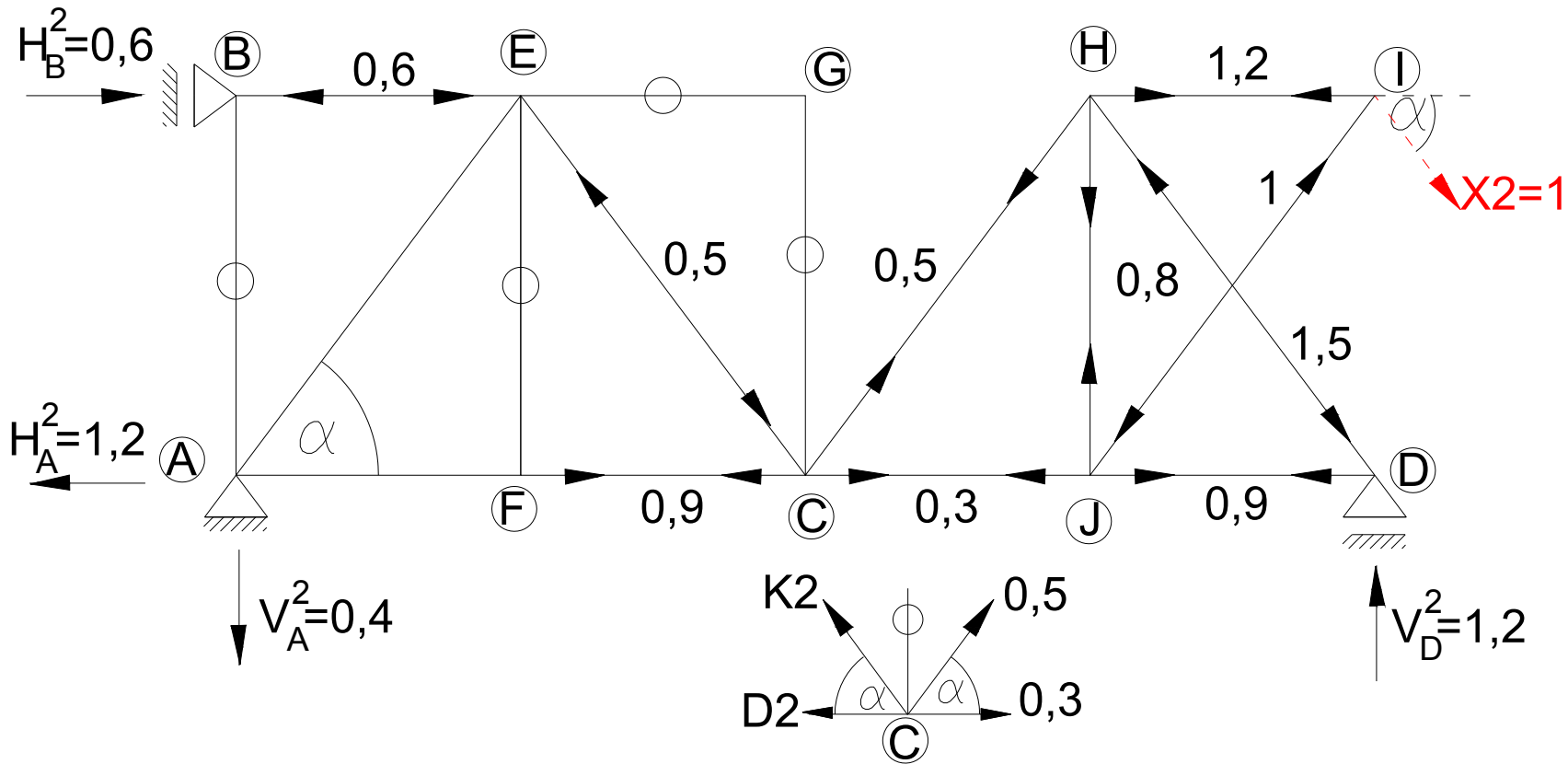
↓
 $K_2 = -0,5$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -D_2 - K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3 = 0$$

↓

$$D_2 = -K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3$$

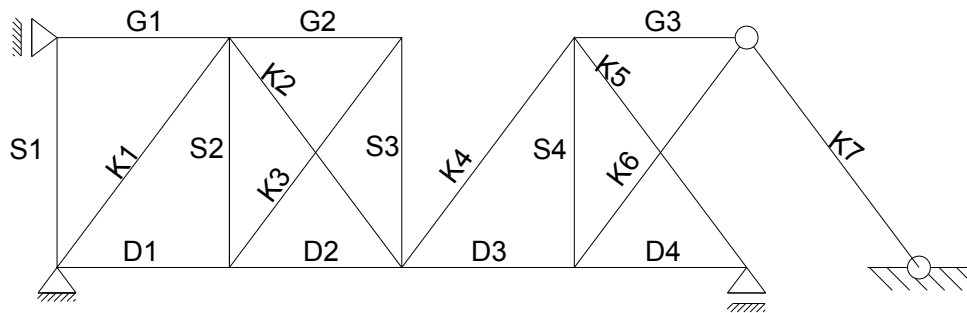
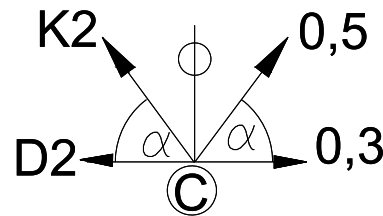
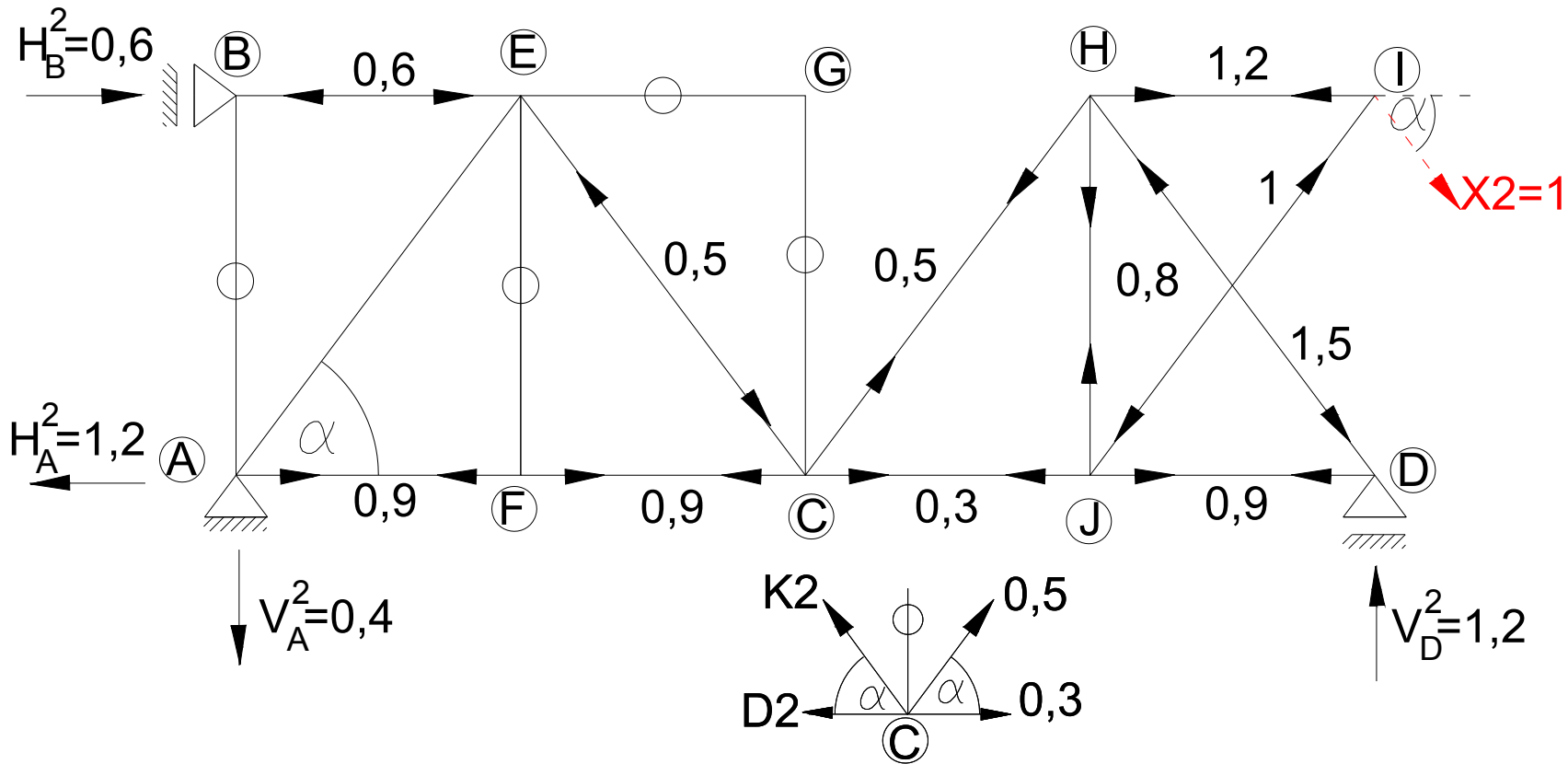
$$D_2 = -(-0,5) \cdot 0,6 + 0,5 \cdot 0,6 + 0,3 = 0,9$$

Wykresy jednostkowe

$X_2=1$

$\sin \alpha = 4/5 = 0,8$

$\cos \alpha = 3/5 = 0,6$



$$\sum R_x = -D_2 - K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3 = 0$$

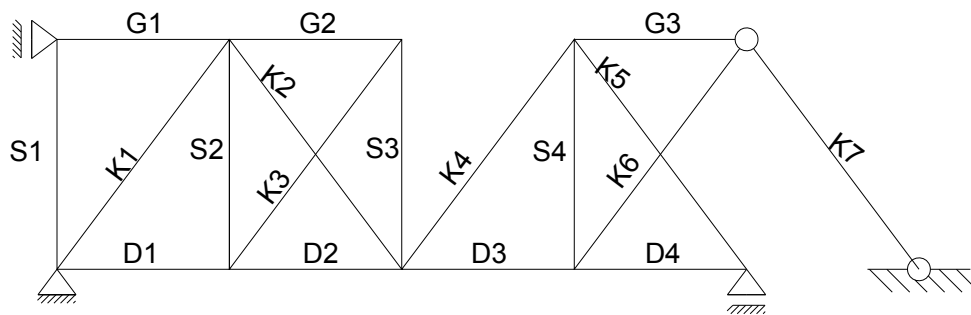
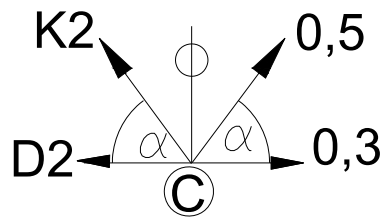
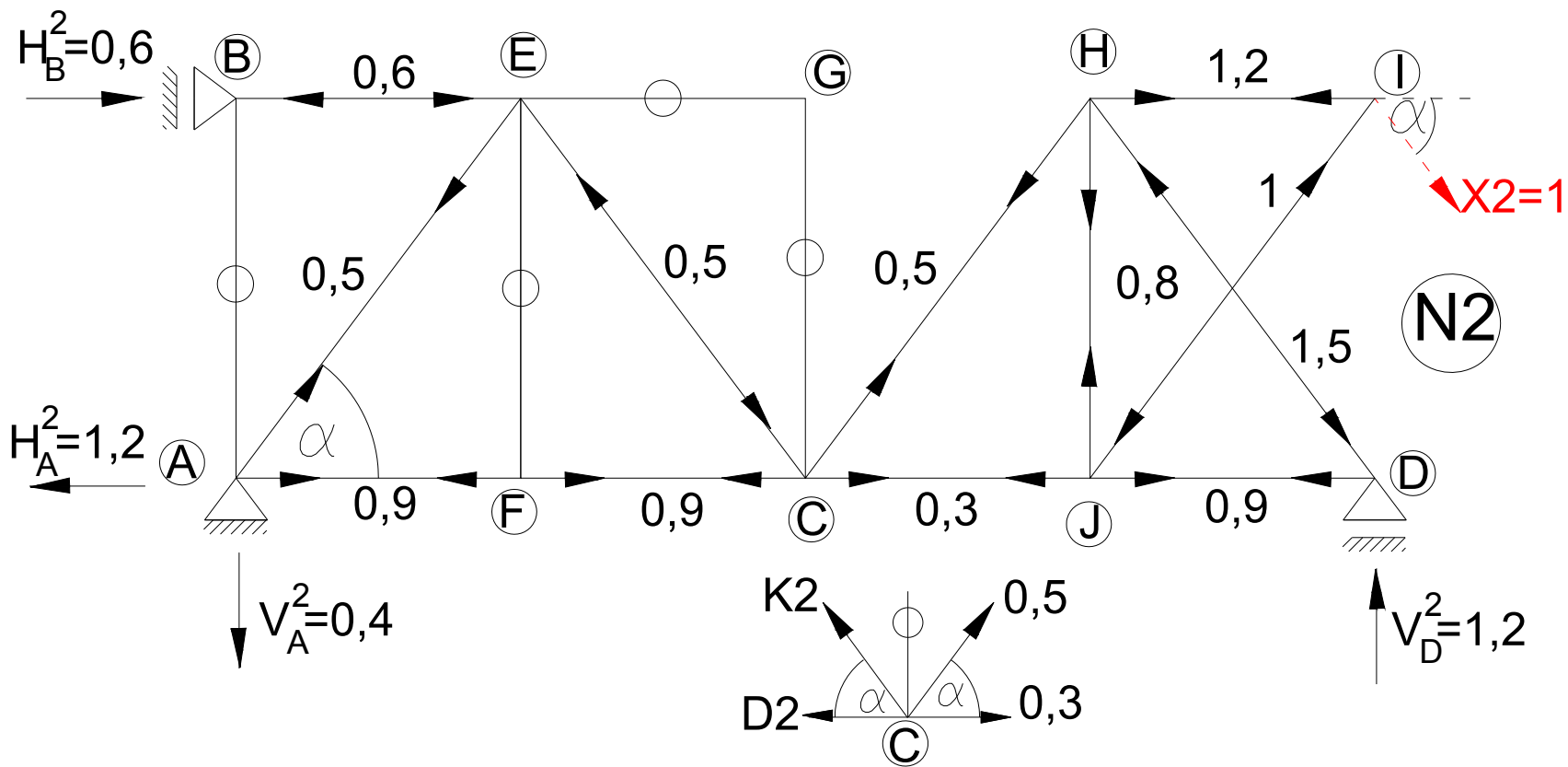
↓

$$D_2 = -K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3$$

$$D_2 = -(-0,5) \cdot 0,6 + 0,5 \cdot 0,6 + 0,3 = 0,9$$

Wykresy jednostkowe

$X_2=1$



$$\sum R_x = -D_2 - K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3 = 0$$

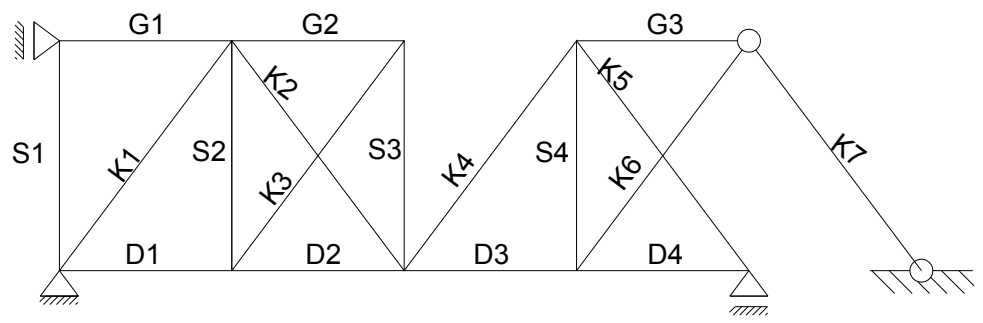
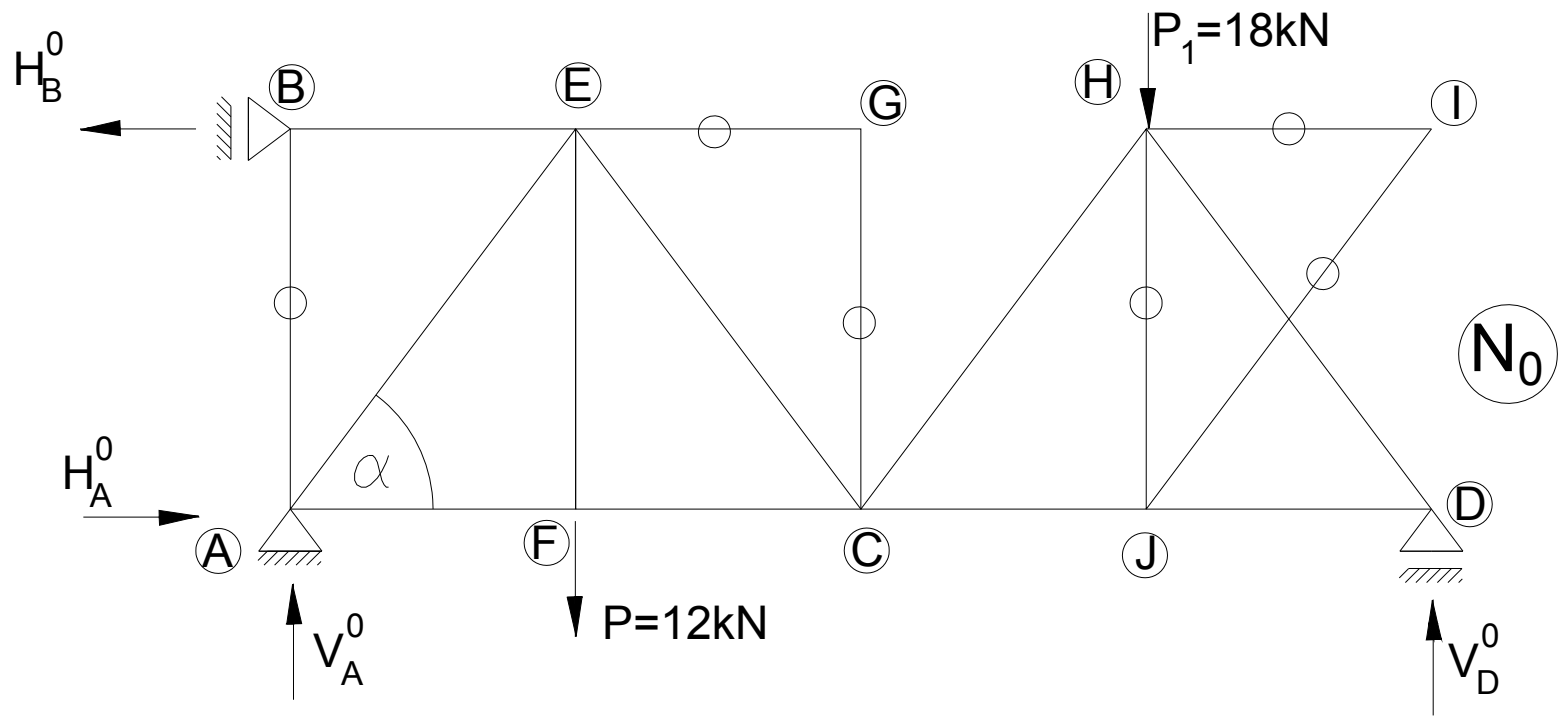
↓

$$D_2 = -K_2 \cdot \cos \alpha + 0,5 \cdot \cos \alpha + 0,3$$

$$D_2 = -(-0,5) \cdot 0,6 + 0,5 \cdot 0,6 + 0,3 = 0,9$$

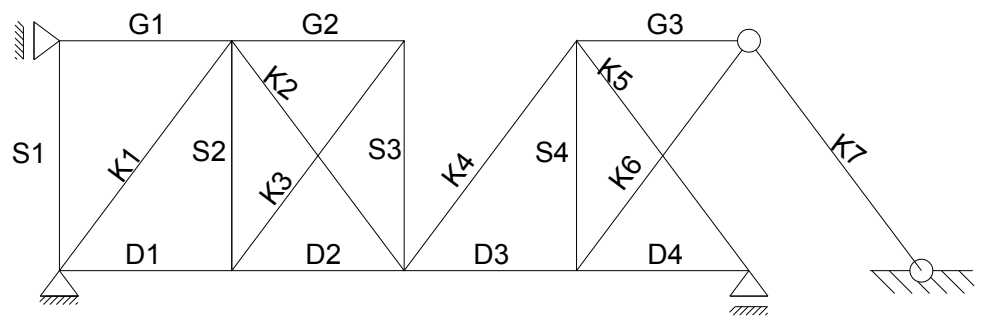
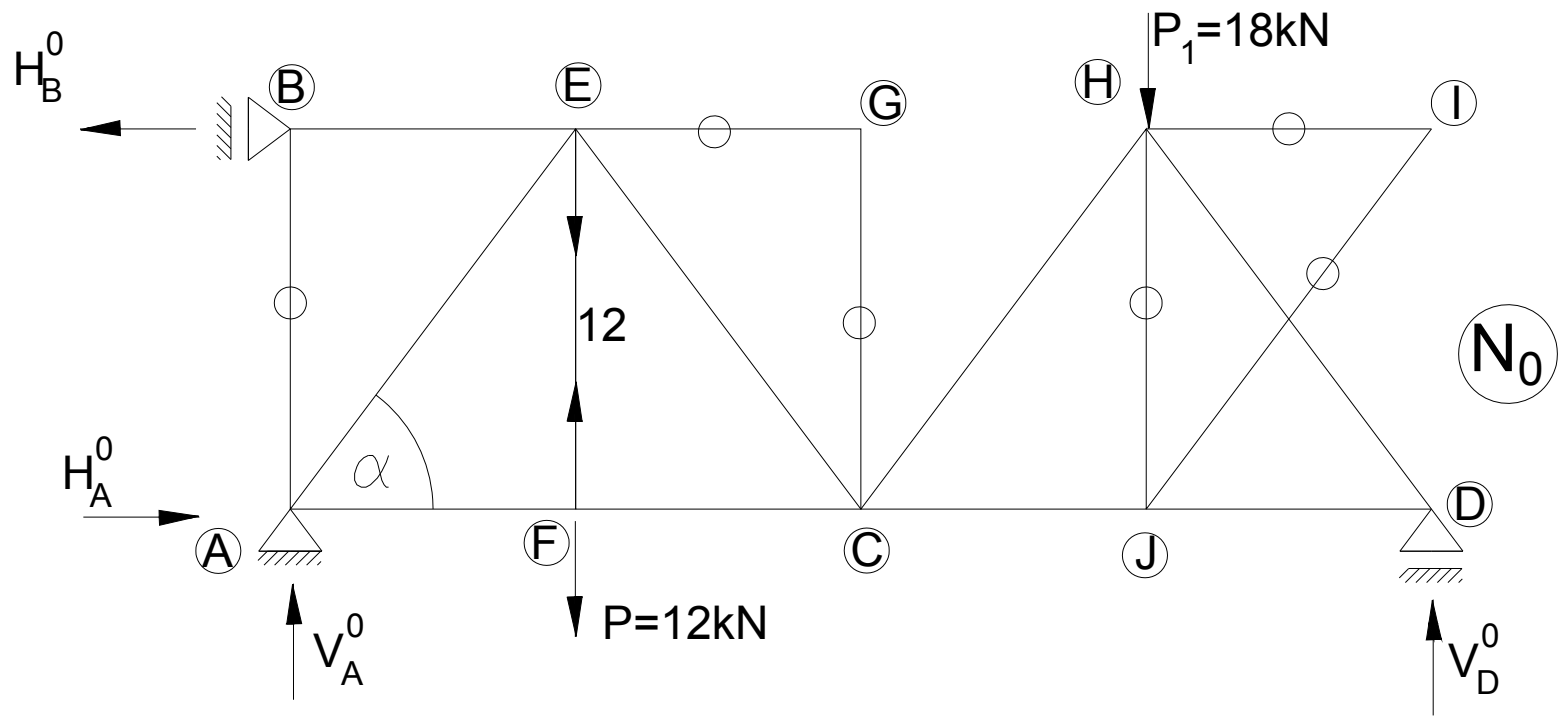
Wykresy jednostkowe

Obciążenie zewnętrzne



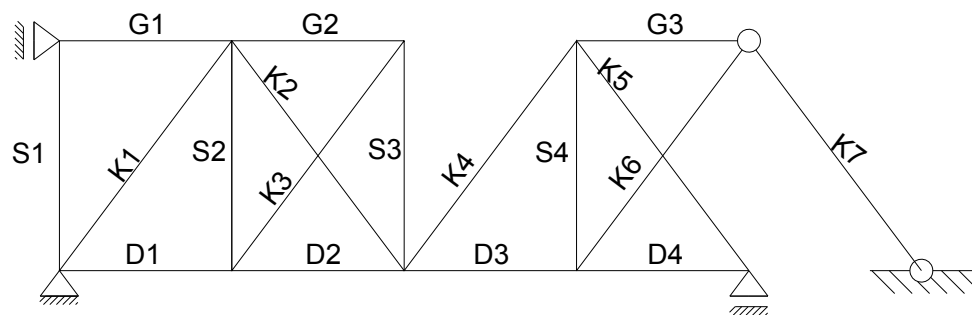
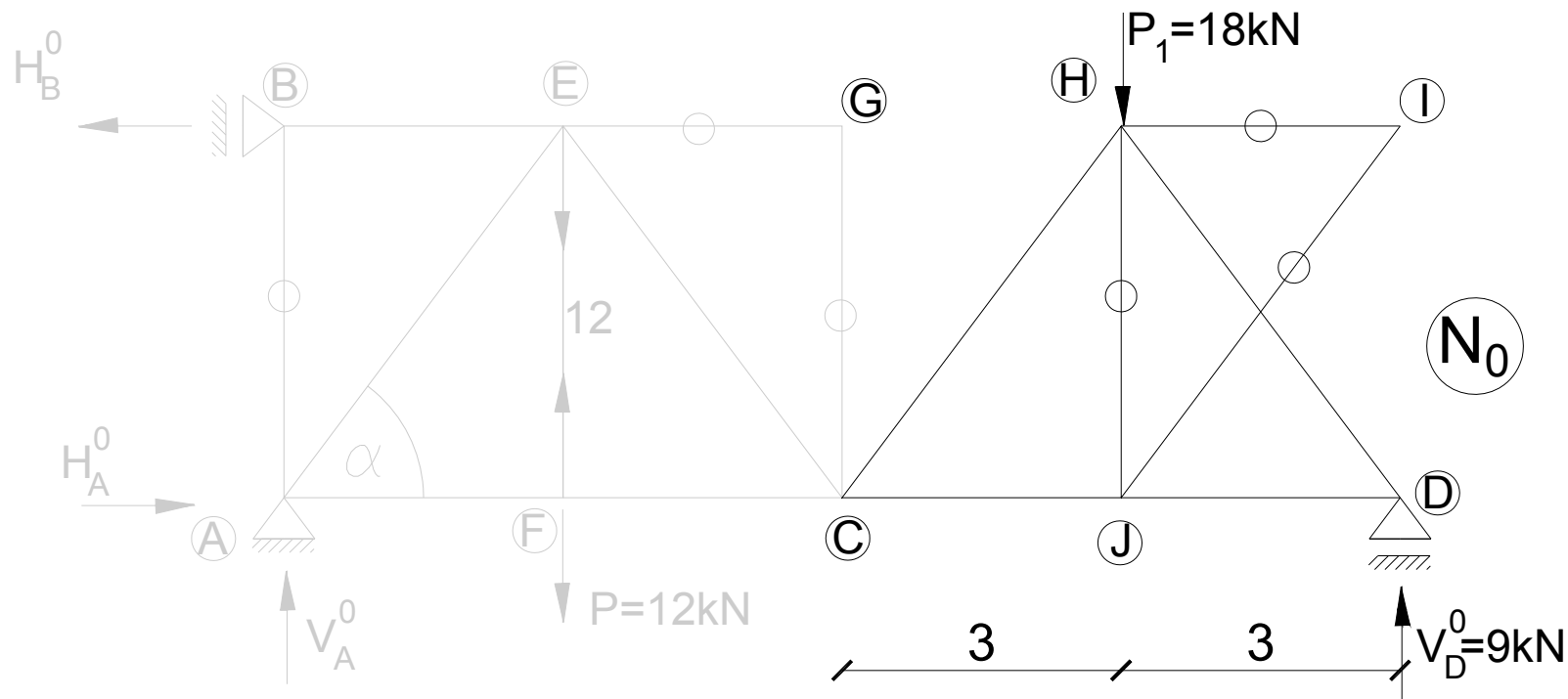
Wykresy jednostkowe

Obciążenie zewnętrzne



Wykresy jednostkowe

Obciążenie zewnętrzne



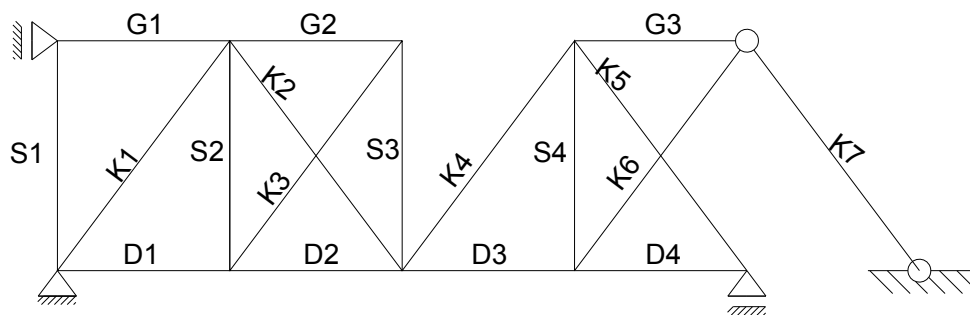
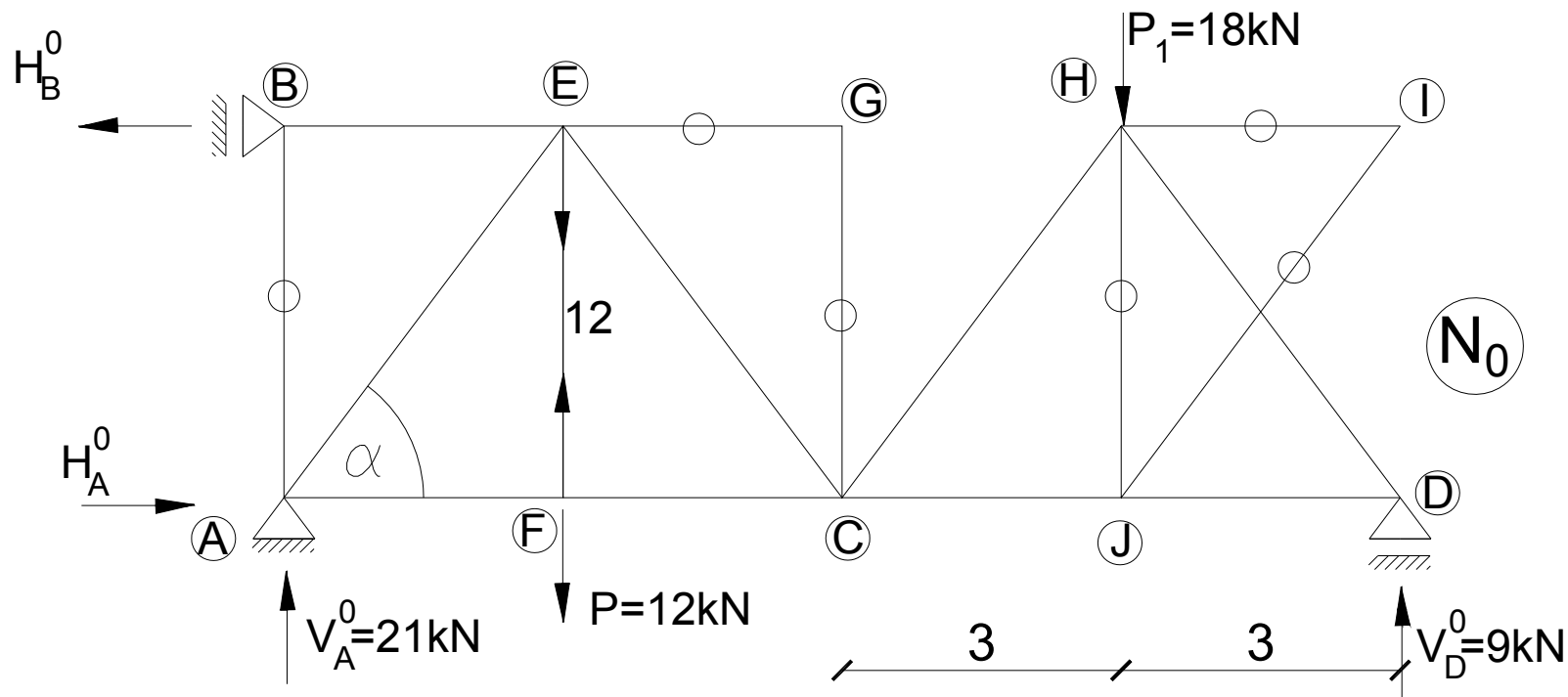
$$\sum M_C^P = 18 \cdot 3 - V_D^0 \cdot 6 = 0$$

↓

$$V_D^0 = \frac{18 \cdot 3}{6} = 9 \text{ kN}$$

Wykresy jednostkowe

Obciążenie zewnętrzne



$$\sum M_C^P = 18 \cdot 3 - V_D^0 \cdot 6 = 0$$

↓

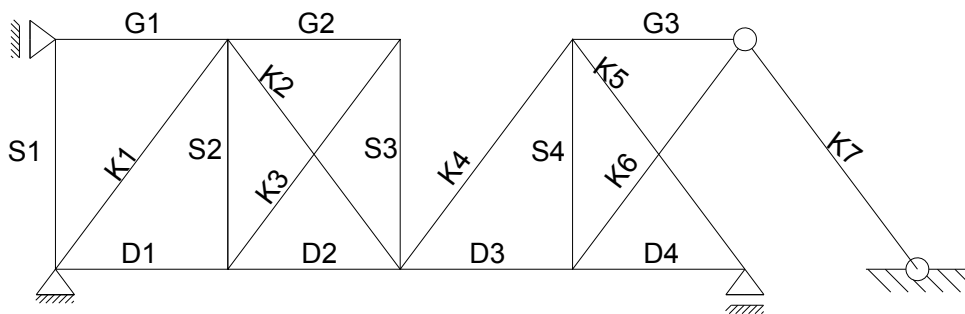
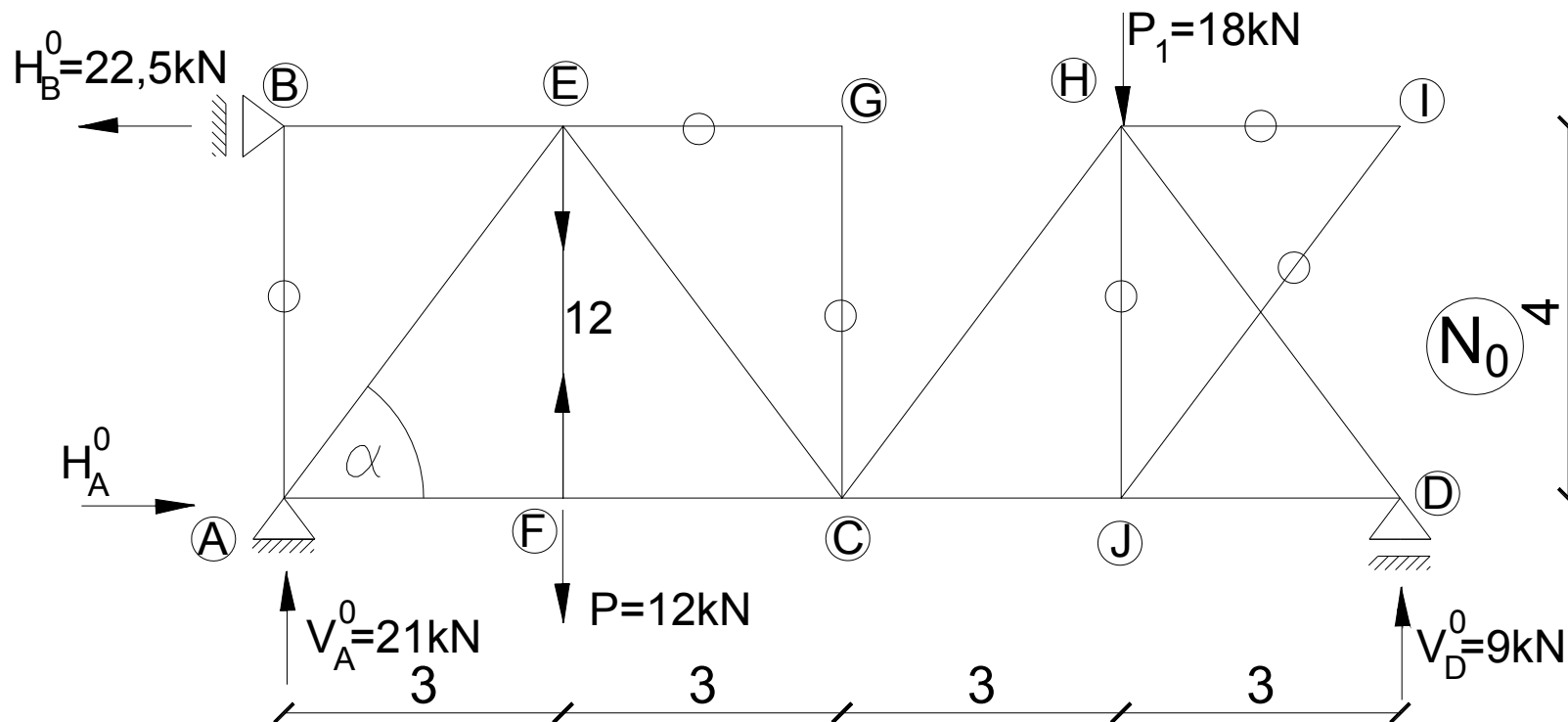
$$V_D^0 = \frac{18 \cdot 3}{6} = 9\text{kN}$$

$$\sum R_y = V_A^0 - 12 - 18 + 9 = 0$$

$$V_A^0 = 21\text{kN}$$

Wykresy jednostkowe

Obciążenie zewnętrzne



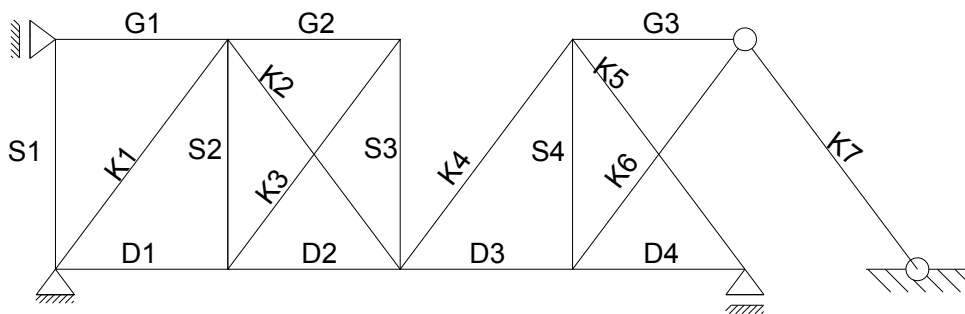
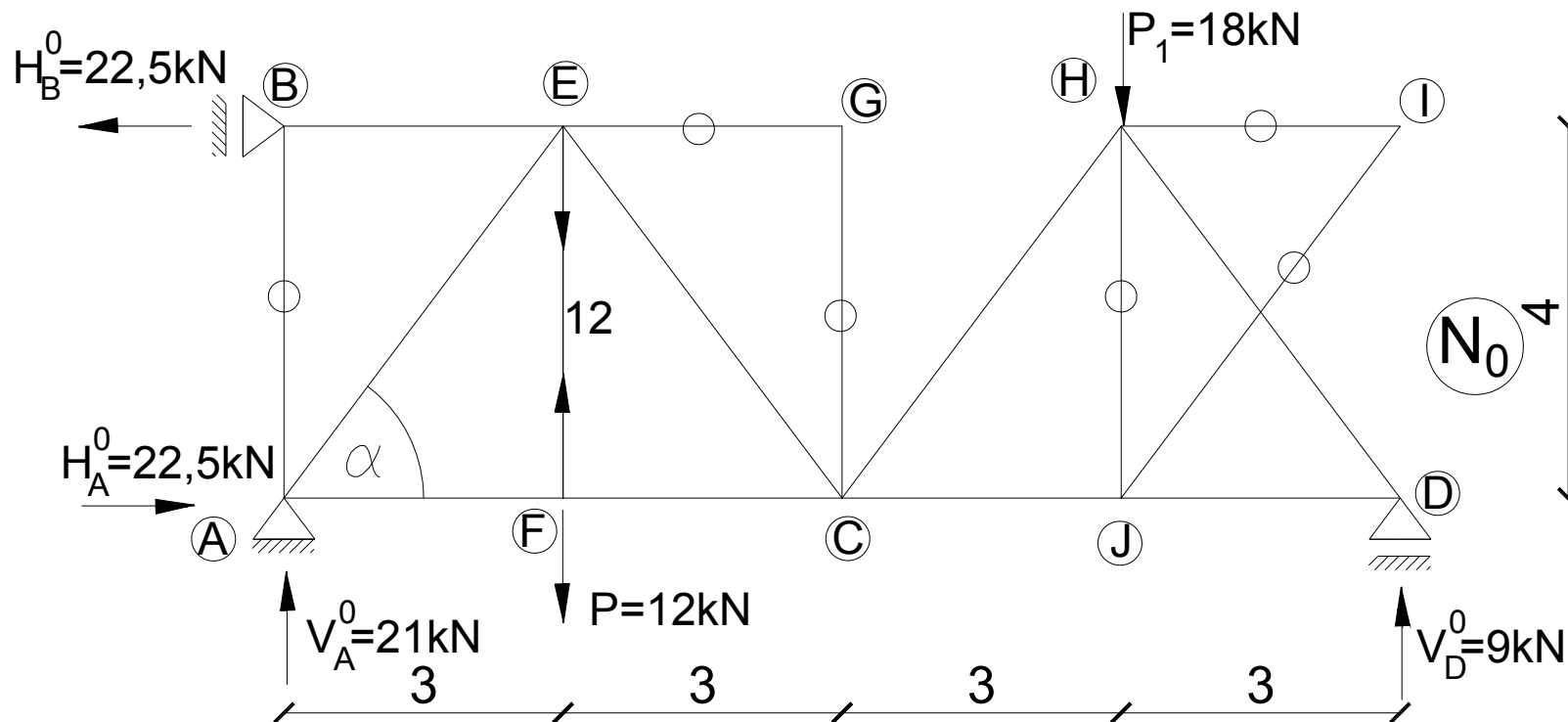
$$\sum M_A = -H_B^0 \cdot 4 + 12 \cdot 3 + 18 \cdot 9 - 9 \cdot 12 = 0$$

↓

$$H_B^0 = \frac{12 \cdot 3 + 18 \cdot 9 - 9 \cdot 12}{4} = 22,5 \text{ kN}$$

Wykresy jednostkowe

Obciążenie zewnętrzne



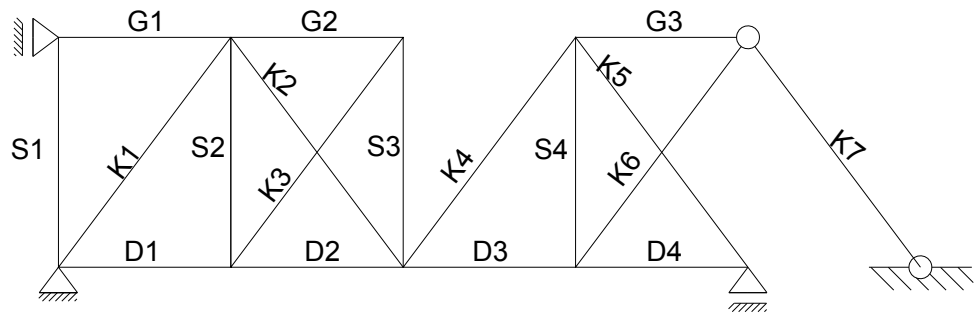
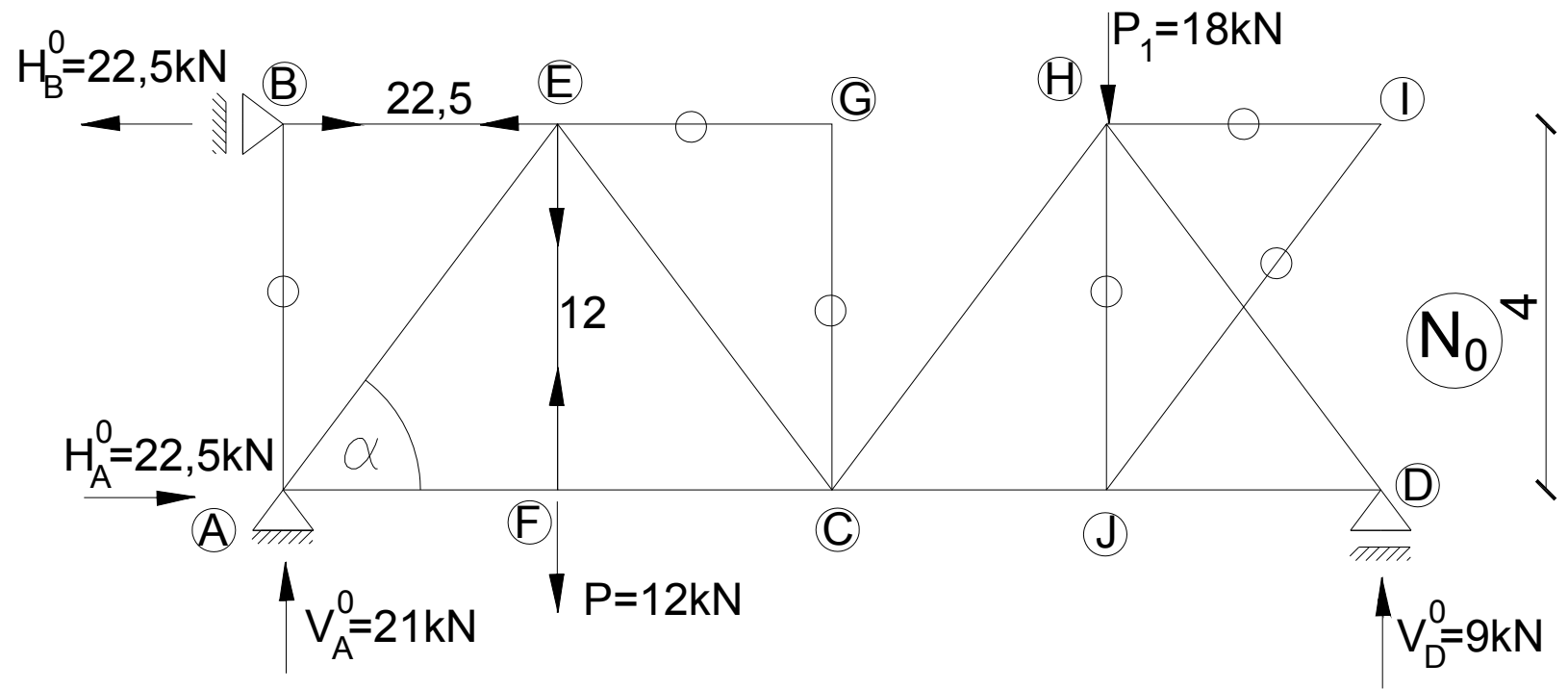
$$\sum M_A = -H_B^0 \cdot 4 + 12 \cdot 3 + 18 \cdot 9 - 9 \cdot 12 = 0$$

↓

$$H_B^0 = \frac{12 \cdot 3 + 18 \cdot 9 - 9 \cdot 12}{4} = 22,5 \text{ kN}$$

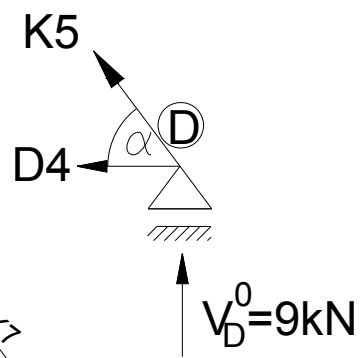
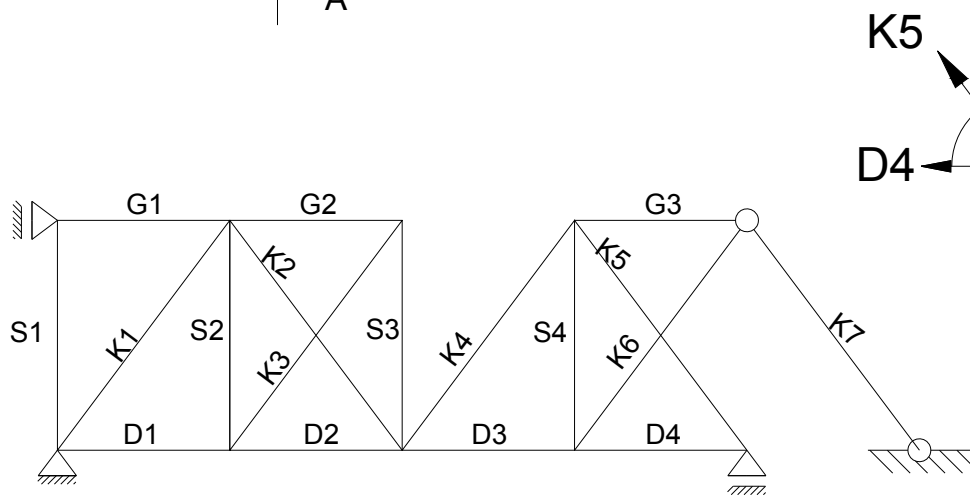
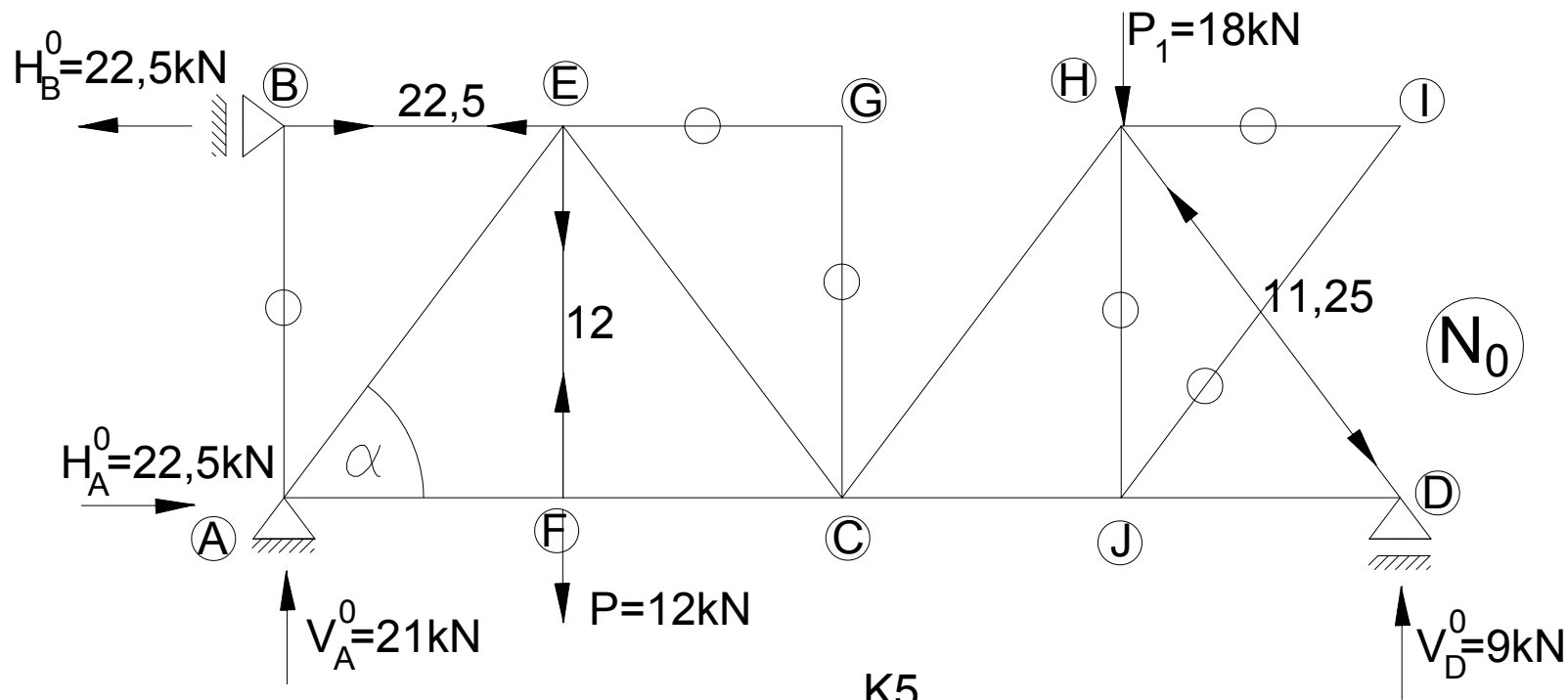
Wykresy jednostkowe

Obciążenie zewnętrzne



Wykresy jednostkowe

Obciążenie zewnętrzne



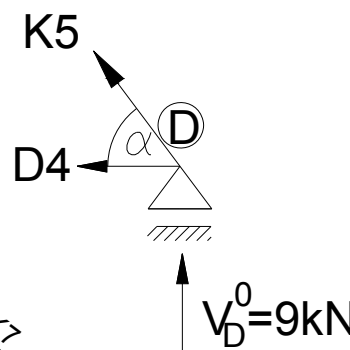
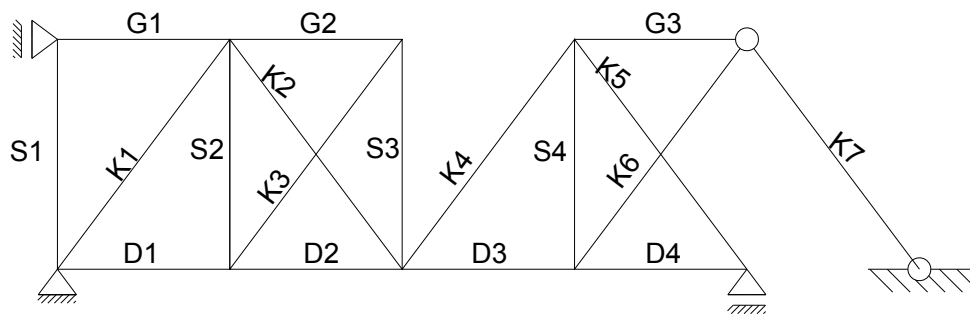
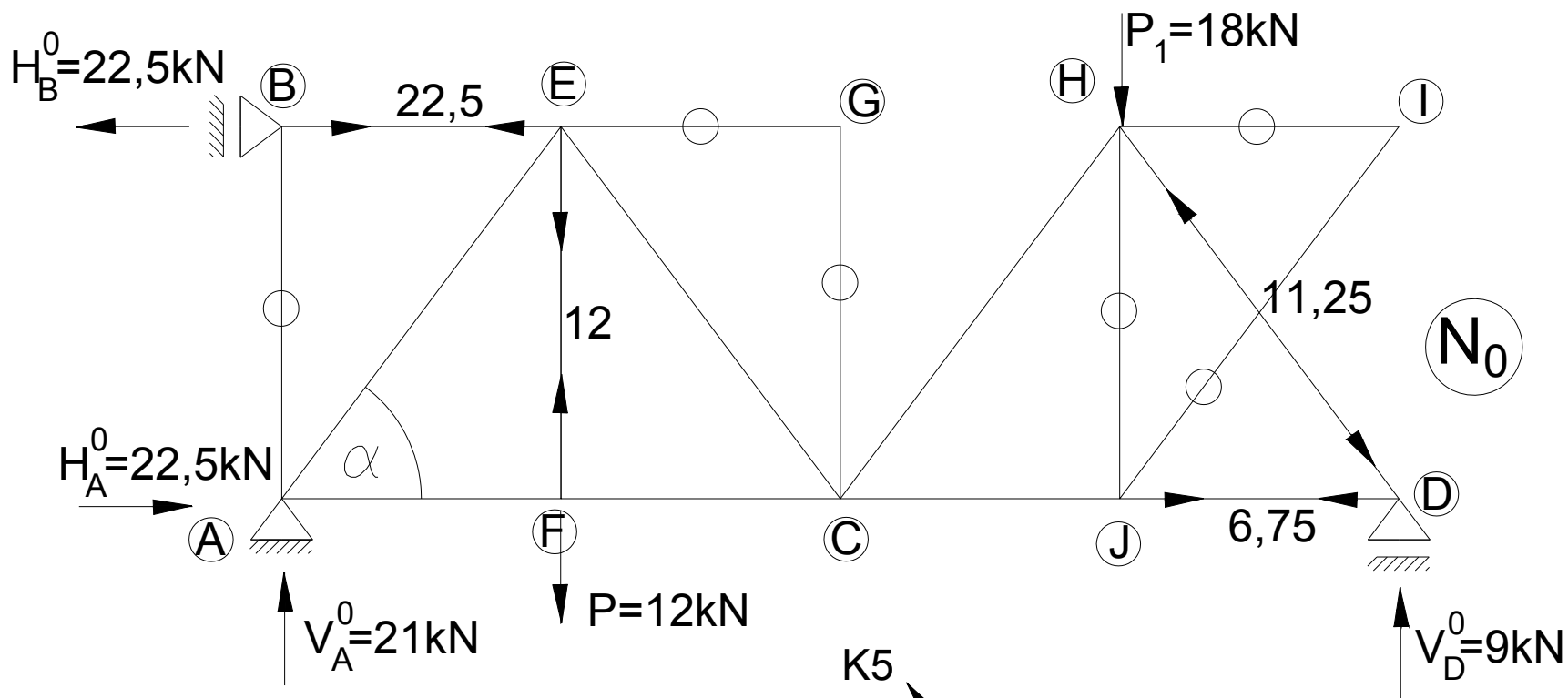
$$\sum R_y = K5 \cdot \sin \alpha + 9 = 0$$

$$\downarrow$$

$$K5 = -\frac{9}{\sin \alpha} = -\frac{9}{0,8} = -11,25$$

Wykresy jednostkowe

Obciążenie zewnętrzne



$$\sum R_x = -D4 - K5 \cdot \cos \alpha = 0$$

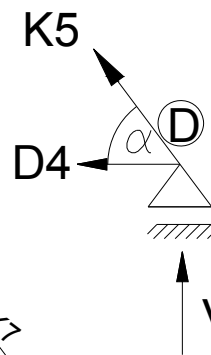
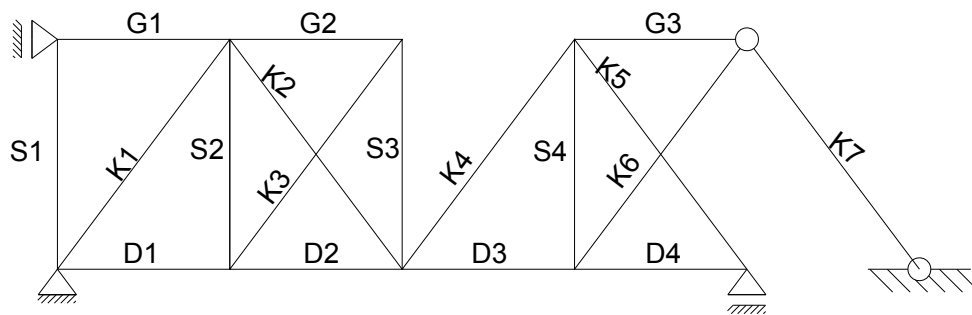
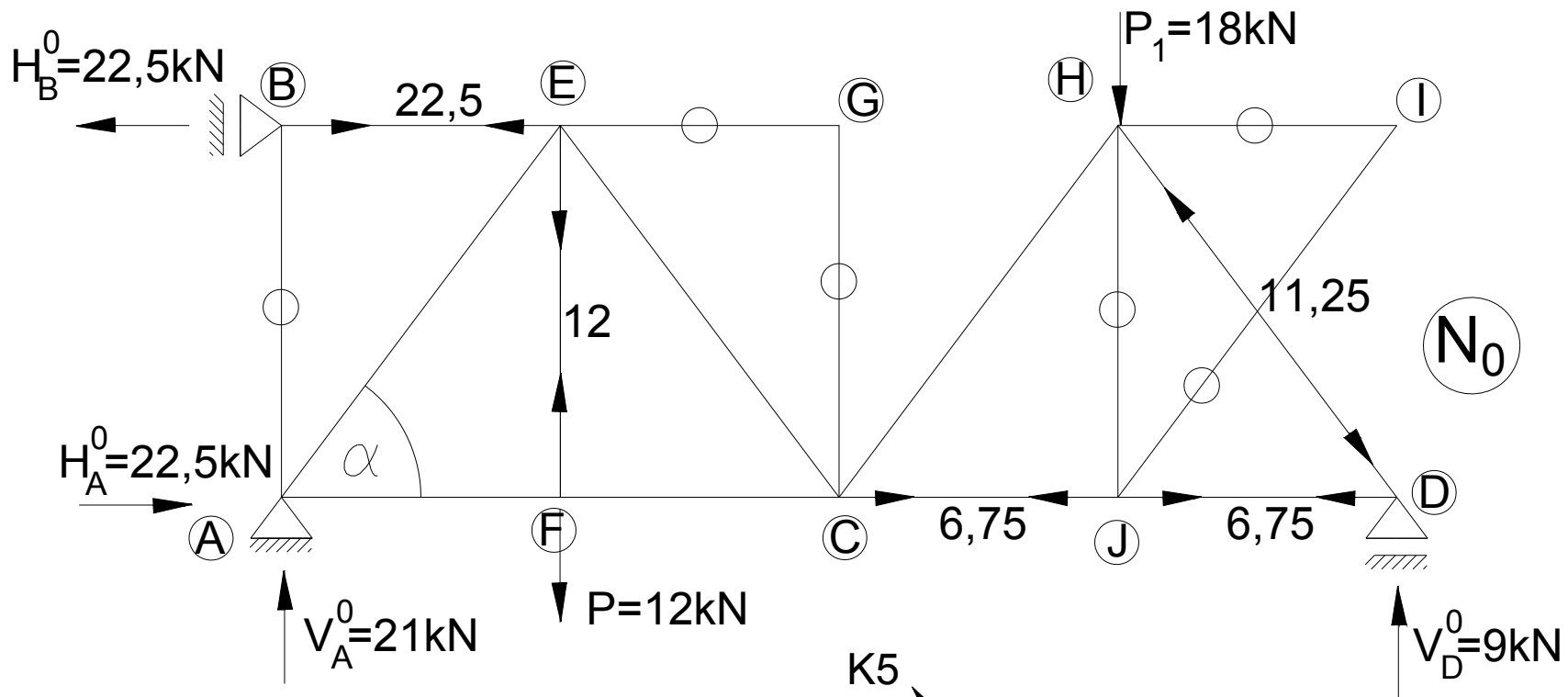
$$\downarrow$$

$$D4 = -K5 \cdot \cos \alpha$$

$$D4 = -(-11,25) \cdot 0,6 = 6,75 \text{ kN}$$

Wykresy jednostkowe

Obciążenie zewnętrzne



$$\sum R_x = -D4 - K5 \cdot \cos \alpha = 0$$

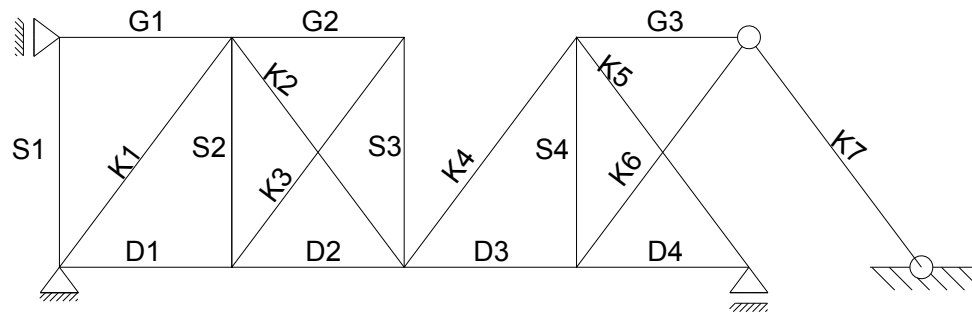
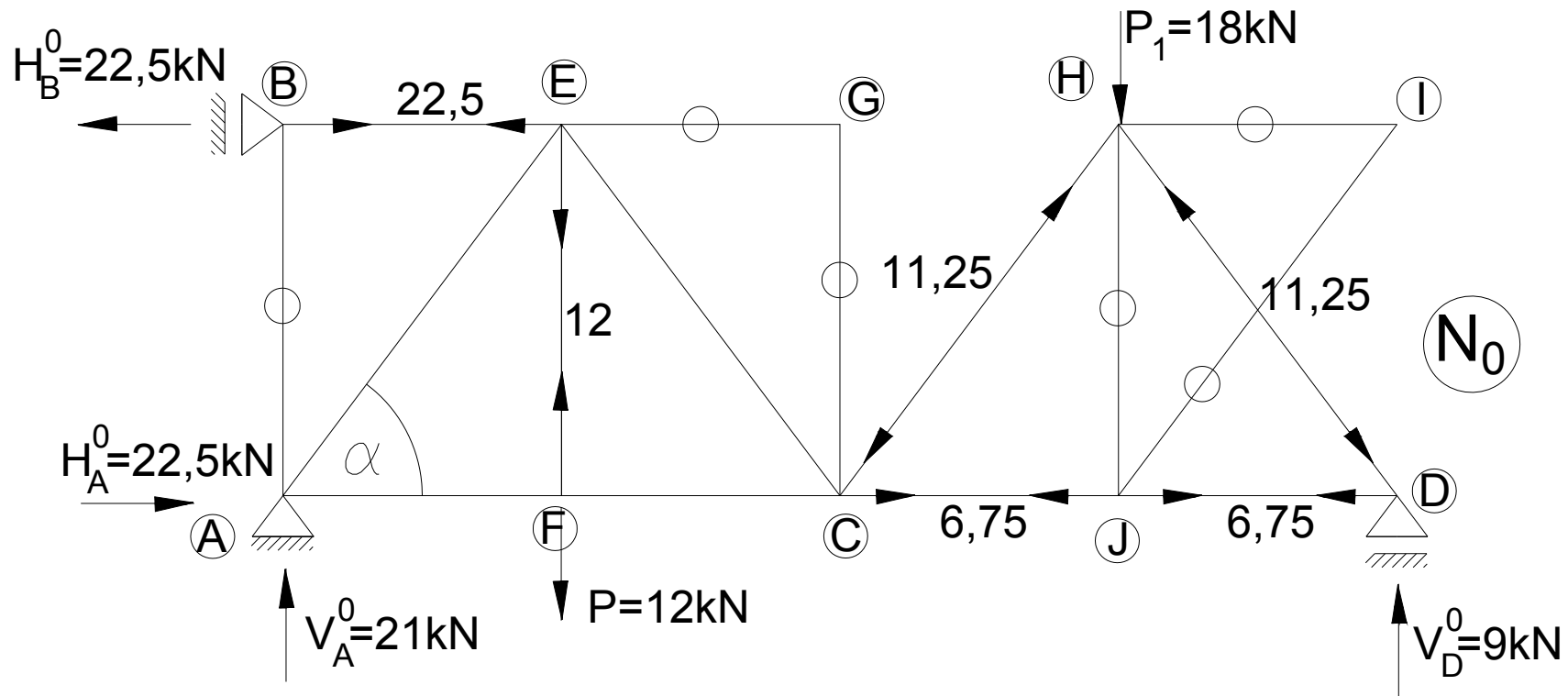
$$\downarrow$$

$$D4 = -K5 \cdot \cos \alpha$$

$$D4 = -(-11,25) \cdot 0,6 = 6,75 \text{ kN}$$

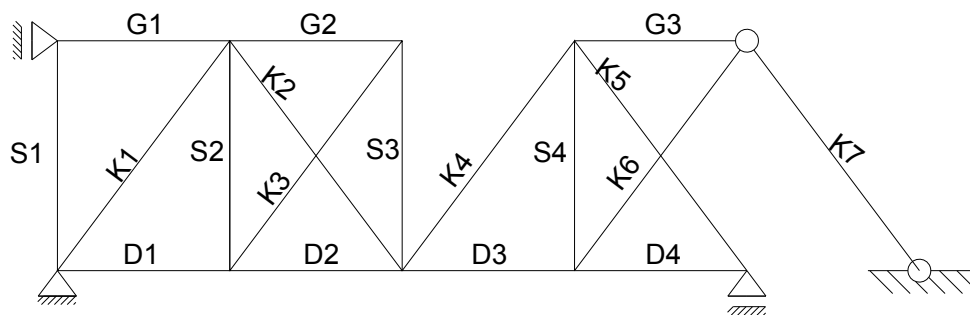
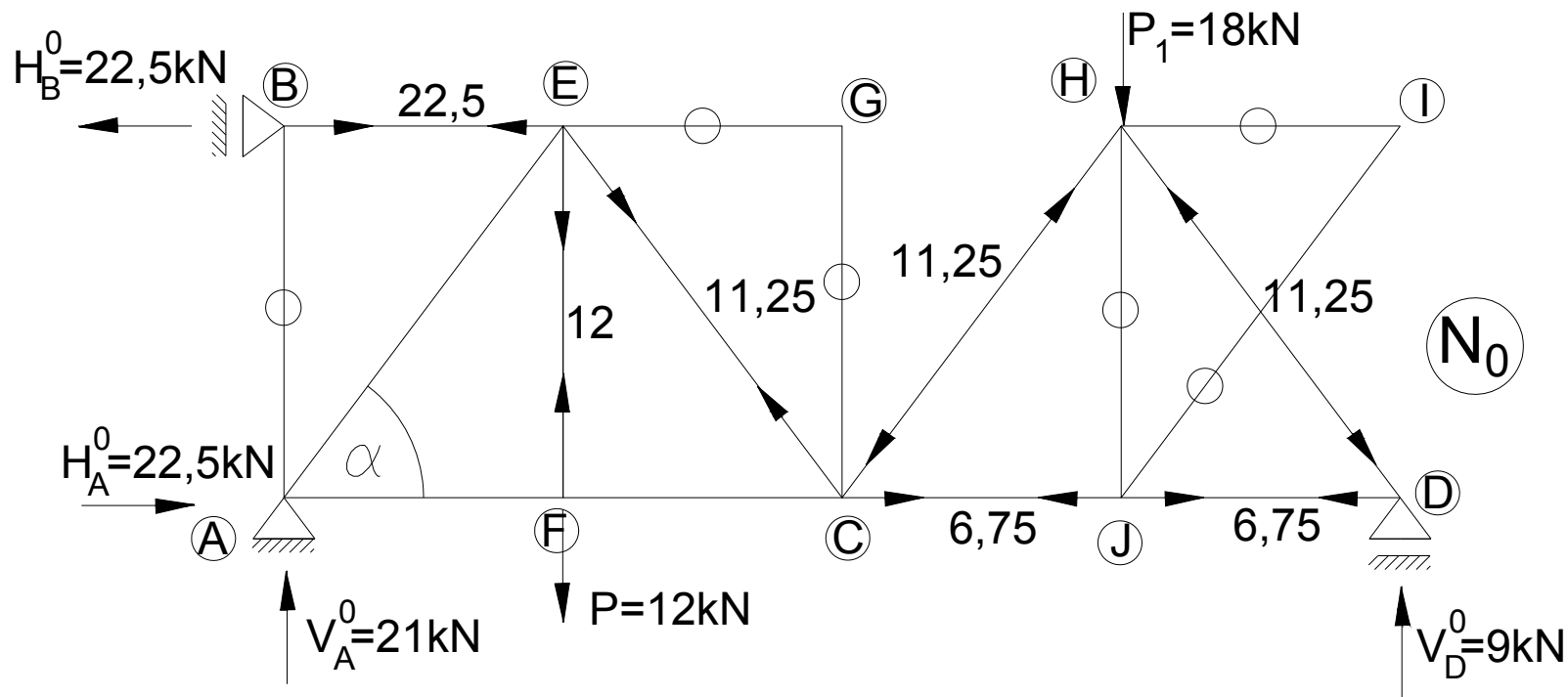
Wykresy jednostkowe

Obciążenie zewnętrzne



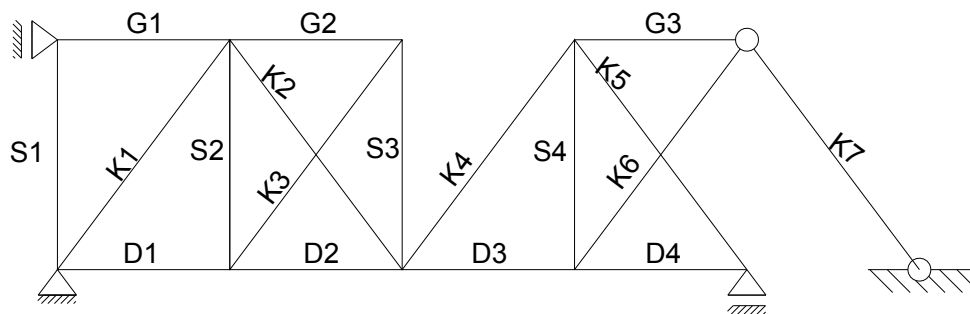
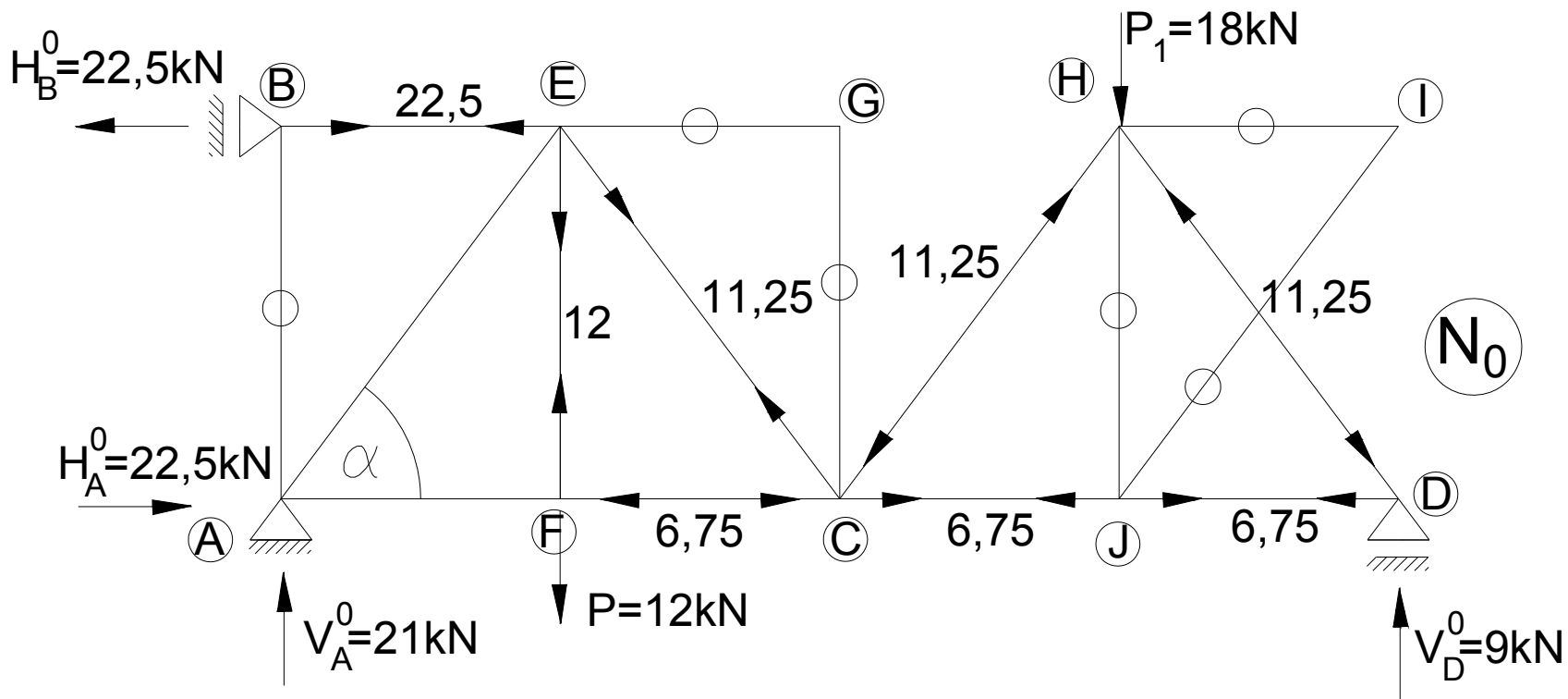
Wykresy jednostkowe

Obciążenie zewnętrzne



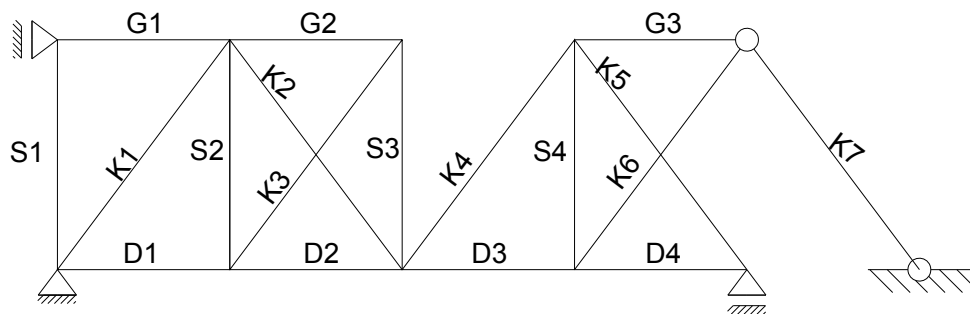
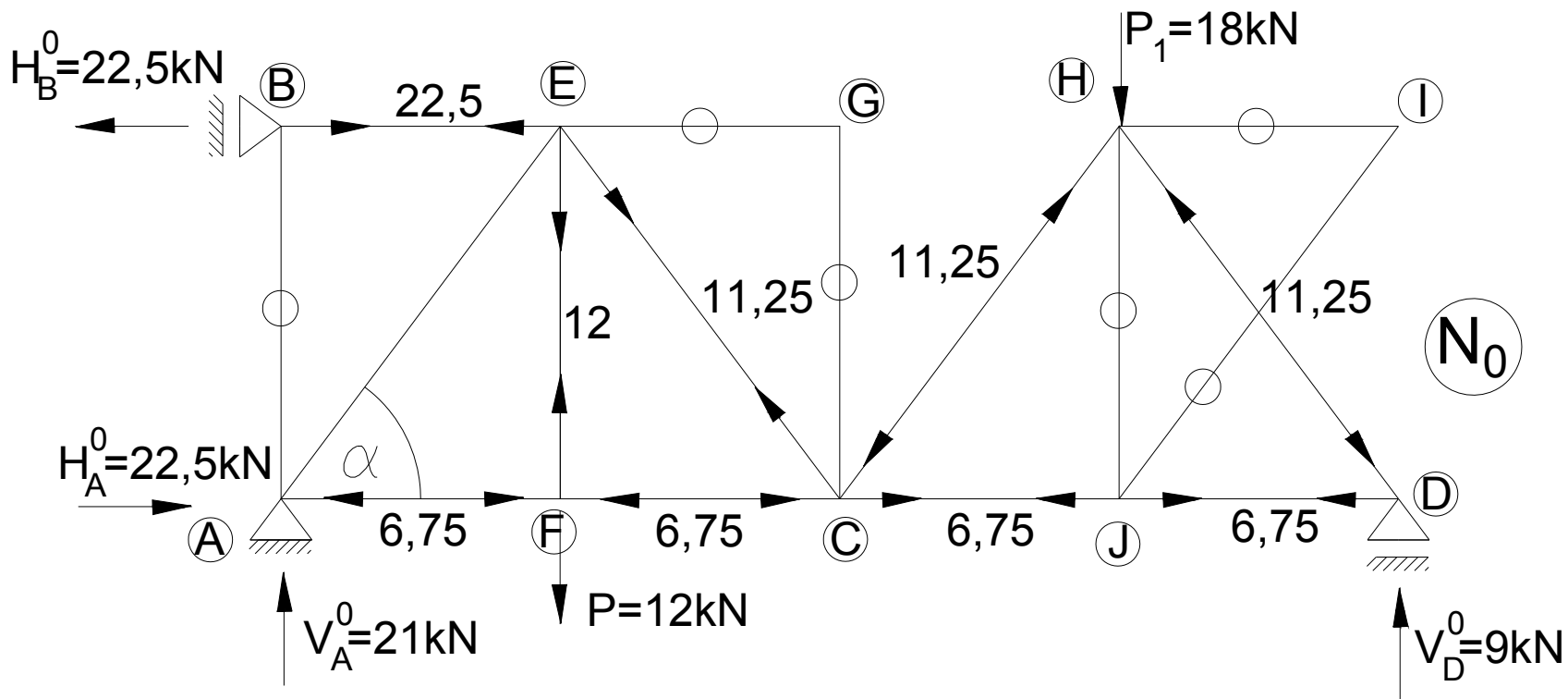
Wykresy jednostkowe

Obciążenie zewnętrzne



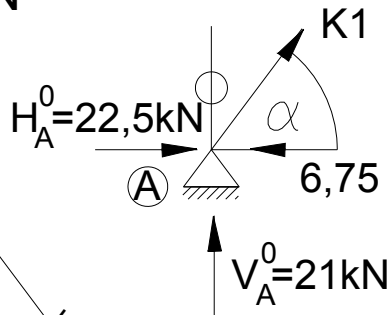
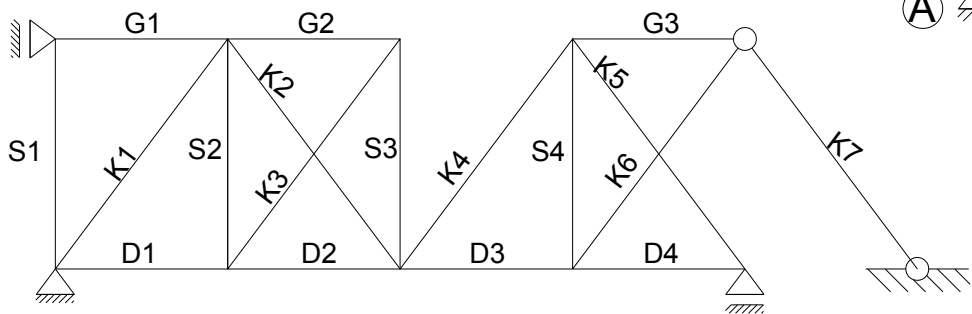
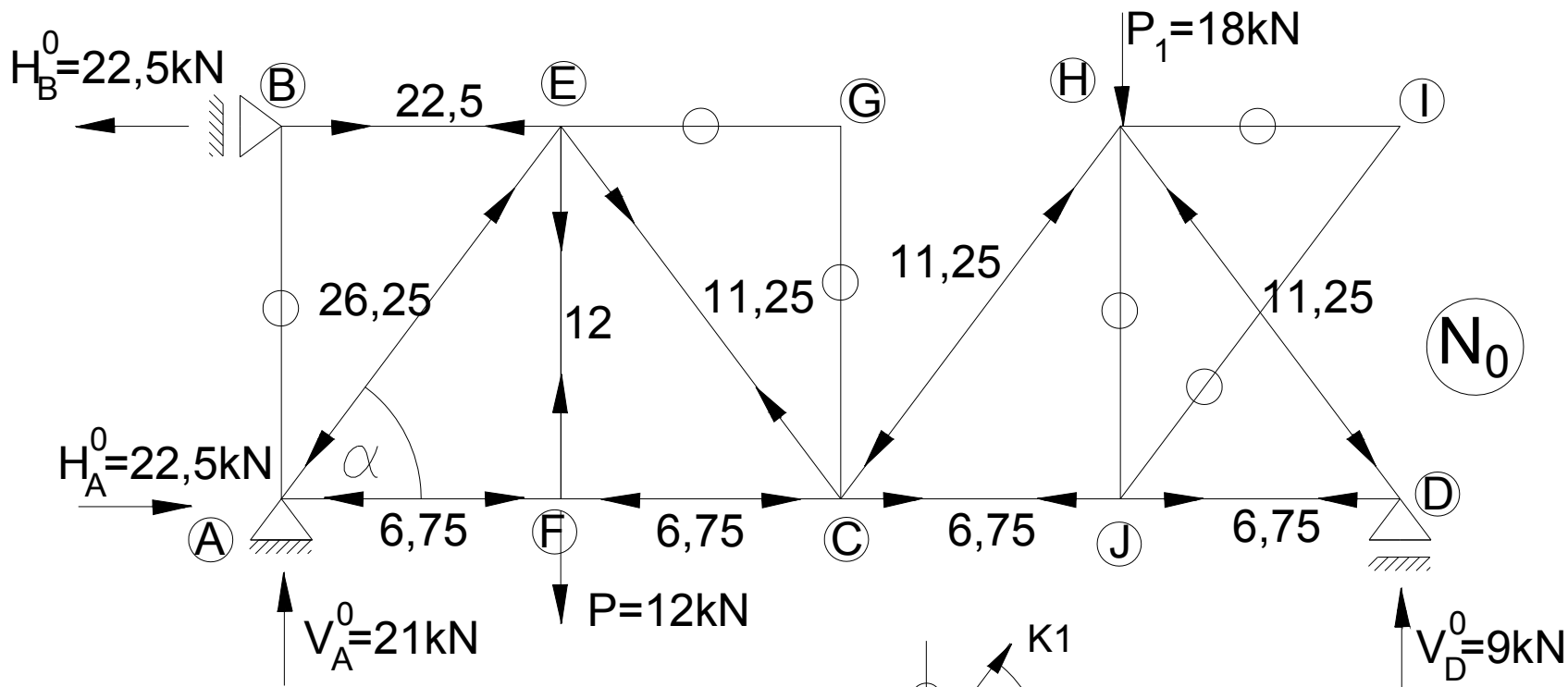
Wykresy jednostkowe

Obciążenie zewnętrzne



Wykresy jednostkowe

Obciążenie zewnętrzne

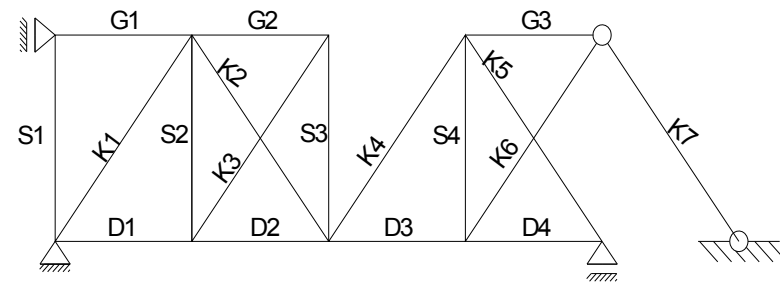
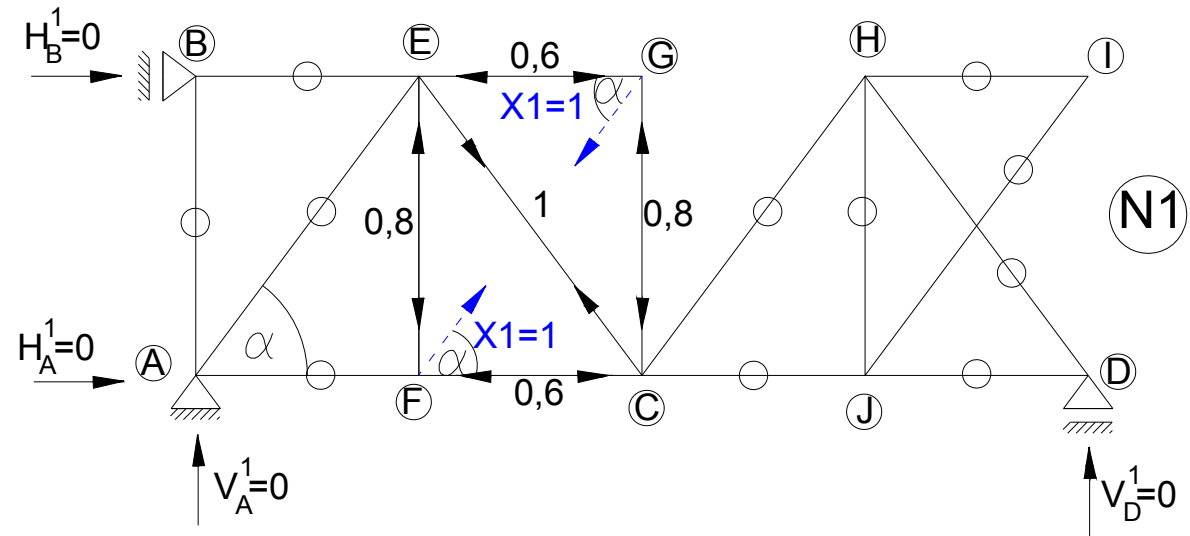


$$\sum R_y = 21 + K1 \cdot \sin \alpha = 0$$

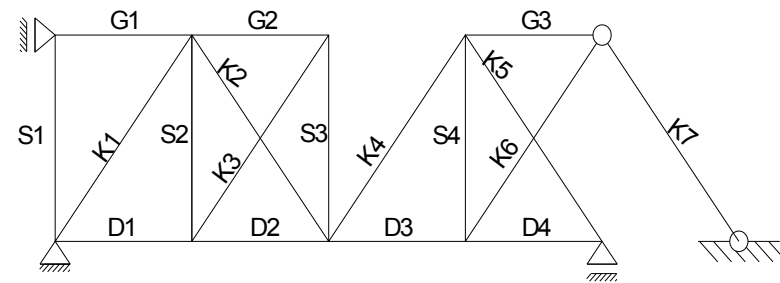
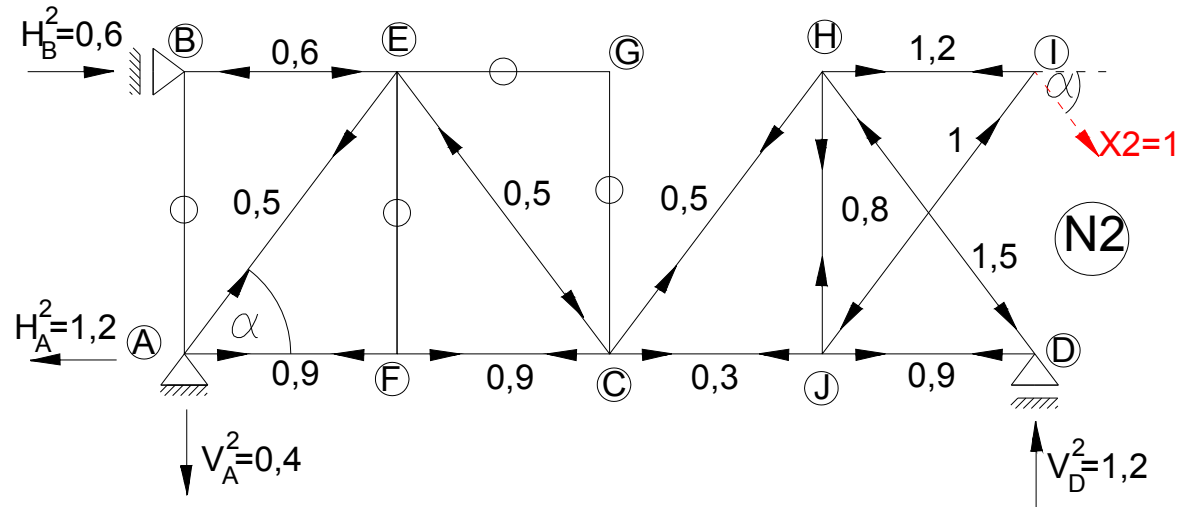
↓

$$K1 = -\frac{21}{\sin \alpha} = -\frac{21}{0,8} = -26,25$$

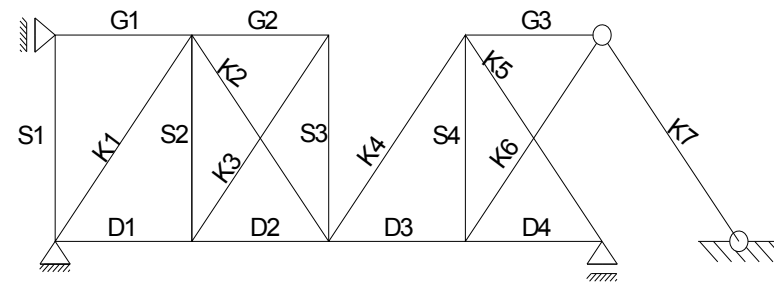
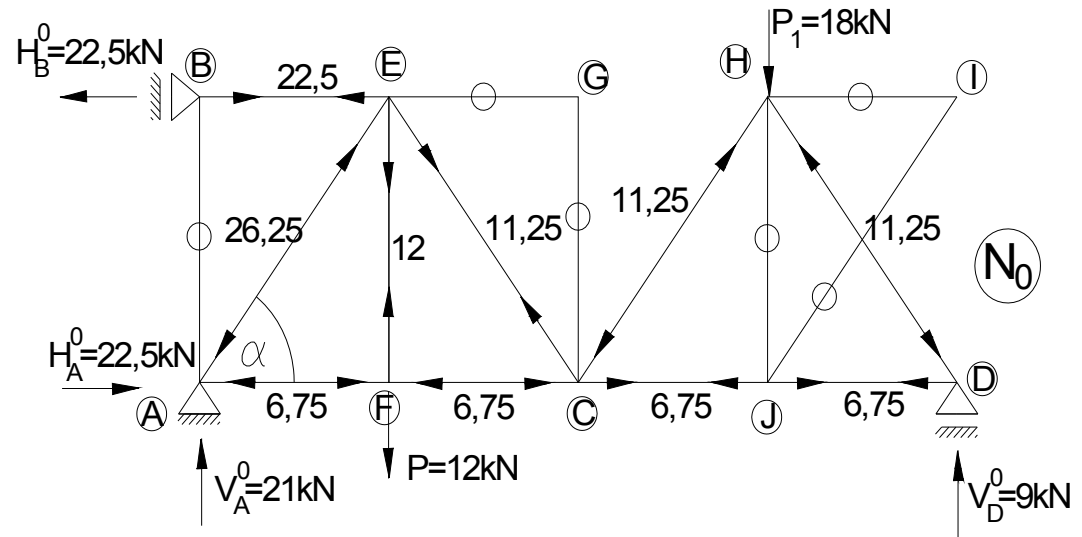
| Pręt | L/EA | N1 |
|------|------|------|
| G1 | 3 | 0 |
| G2 | 3 | -0,6 |
| G3 | 3 | 0 |
| D1 | 3 | 0 |
| D2 | 3 | -0,6 |
| D3 | 3 | 0 |
| D4 | 3 | 0 |
| S1 | 4 | 0 |
| S2 | 4 | -0,8 |
| S3 | 4 | -0,8 |
| S4 | 4 | 0 |
| K1 | 5 | 0 |
| K2 | 5 | 1 |
| K3 | 5 | 1 |
| K4 | 5 | 0 |
| K5 | 5 | 0 |
| K6 | 5 | 0 |
| K7 | 5 | 0 |



| Pręt | L/EA | N1 | N2 |
|------|------|------|------|
| G1 | 3 | 0 | -0,6 |
| G2 | 3 | -0,6 | 0 |
| G3 | 3 | 0 | 1,2 |
| D1 | 3 | 0 | 0,9 |
| D2 | 3 | -0,6 | 0,9 |
| D3 | 3 | 0 | 0,3 |
| D4 | 3 | 0 | 0,9 |
| S1 | 4 | 0 | 0 |
| S2 | 4 | -0,8 | 0 |
| S3 | 4 | -0,8 | 0 |
| S4 | 4 | 0 | 0,8 |
| K1 | 5 | 0 | 0,5 |
| K2 | 5 | 1 | -0,5 |
| K3 | 5 | 1 | 0 |
| K4 | 5 | 0 | 0,5 |
| K5 | 5 | 0 | -1,5 |
| K6 | 5 | 0 | -1 |
| K7 | 5 | 0 | 1 |



| Pręt | L/EA | N1 | N2 | N0 |
|------|------|------|------|--------|
| G1 | 3 | 0 | -0,6 | 22,5 |
| G2 | 3 | -0,6 | 0 | 0 |
| G3 | 3 | 0 | 1,2 | 0 |
| D1 | 3 | 0 | 0,9 | -6,75 |
| D2 | 3 | -0,6 | 0,9 | -6,75 |
| D3 | 3 | 0 | 0,3 | 6,75 |
| D4 | 3 | 0 | 0,9 | 6,75 |
| S1 | 4 | 0 | 0 | 0 |
| S2 | 4 | -0,8 | 0 | 12 |
| S3 | 4 | -0,8 | 0 | 0 |
| S4 | 4 | 0 | 0,8 | 0 |
| K1 | 5 | 0 | 0,5 | -26,25 |
| K2 | 5 | 1 | -0,5 | 11,25 |
| K3 | 5 | 1 | 0 | 0 |
| K4 | 5 | 0 | 0,5 | -11,25 |
| K5 | 5 | 0 | -1,5 | -11,25 |
| K6 | 5 | 0 | -1 | 0 |
| K7 | 5 | 0 | 1 | 0 |



| Pręt | L/EA | N1 | N2 | N0 | N1*N1*L/EA | N1*N2*L/EA | N2*N2*L/EA | N1*N0*L/EA | N2*N0*L/EA |
|------|------|------|------|--------|------------------------|------------------------|------------------------|---------------------|-------------------------|
| G1 | 3 | 0 | -0,6 | 22,5 | 0 | 0 | 1,08 | 0 | -40,5 |
| G2 | 3 | -0,6 | 0 | 0 | 1,08 | 0 | 0 | 0 | 0 |
| G3 | 3 | 0 | 1,2 | 0 | 0 | 0 | 4,32 | 0 | 0 |
| D1 | 3 | 0 | 0,9 | -6,75 | 0 | 0 | 2,43 | 0 | -18,225 |
| D2 | 3 | -0,6 | 0,9 | -6,75 | 1,08 | -1,62 | 2,43 | 12,15 | -18,225 |
| D3 | 3 | 0 | 0,3 | 6,75 | 0 | 0 | 0,27 | 0 | 6,075 |
| D4 | 3 | 0 | 0,9 | 6,75 | 0 | 0 | 2,43 | 0 | 18,225 |
| S1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S2 | 4 | -0,8 | 0 | 12 | 2,56 | 0 | 0 | -38,4 | 0 |
| S3 | 4 | -0,8 | 0 | 0 | 2,56 | 0 | 0 | 0 | 0 |
| S4 | 4 | 0 | 0,8 | 0 | 0 | 0 | 2,56 | 0 | 0 |
| K1 | 5 | 0 | 0,5 | -26,25 | 0 | 0 | 1,25 | 0 | -65,625 |
| K2 | 5 | 1 | -0,5 | 11,25 | 5 | -2,5 | 1,25 | 56,25 | -28,125 |
| K3 | 5 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 |
| K4 | 5 | 0 | 0,5 | -11,25 | 0 | 0 | 1,25 | 0 | -28,125 |
| K5 | 5 | 0 | -1,5 | -11,25 | 0 | 0 | 11,25 | 0 | 84,375 |
| K6 | 5 | 0 | -1 | 0 | 0 | 0 | 5 | 0 | 0 |
| K7 | 5 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 0 |
| | | | | | $\delta_{11}=17,28/EA$ | $\delta_{12}=-4,12/EA$ | $\delta_{22}=40,52/EA$ | $\delta_{10}=30/EA$ | $\delta_{20}=-90,15/EA$ |

Wyznaczenie nadliczbowych

Układ równań metody sił:

$$\delta_{11} \cdot X_1 + \delta_{12} \cdot X_2 + \delta_{10} = 0$$

$$\delta_{21} \cdot X_1 + \delta_{22} \cdot X_2 + \delta_{20} = 0$$

Podstawiając wyliczone wcześniej wartości otrzymujemy:

$$\frac{17,28}{EA} \cdot X_1 - \frac{4,12}{EA} \cdot X_2 - \frac{30}{EA} = 0$$

$$-\frac{4,12}{EA} \cdot X_1 + \frac{40,52}{EA} \cdot X_2 - \frac{90,15}{EA} = 0$$

Rozwiązanie układu równań:

$$X_1 = -1,24kN$$

$$X_2 = 2,10kN$$

| Pręt | L/EA | N1 | N2 | N0 | N1*X1 | N2*X2 | N[kN] |
|------|------|------|------|--------|-------|-------|--------|
| G1 | 3 | 0 | -0,6 | 22,5 | 0,0 | -1,26 | 21,24 |
| G2 | 3 | -0,6 | 0 | 0 | 0,74 | 0 | 0,74 |
| G3 | 3 | 0 | 1,2 | 0 | 0 | 2,52 | 2,52 |
| D1 | 3 | 0 | 0,9 | -6,75 | 0 | 1,89 | -4,86 |
| D2 | 3 | -0,6 | 0,9 | -6,75 | 0,74 | 1,89 | -4,12 |
| D3 | 3 | 0 | 0,3 | 6,75 | 0 | 0,63 | 7,38 |
| D4 | 3 | 0 | 0,9 | 6,75 | 0 | 1,89 | 8,64 |
| S1 | 4 | 0 | 0 | 0 | 0 | 0 | 0,0 |
| S2 | 4 | -0,8 | 0 | 12 | 0,99 | 0 | 12,99 |
| S3 | 4 | -0,8 | 0 | 0 | 0,99 | 0 | 0,99 |
| S4 | 4 | 0 | 0,8 | 0 | 0 | 1,68 | 1,68 |
| K1 | 5 | 0 | 0,5 | -26,25 | 0 | 1,05 | -25,20 |
| K2 | 5 | 1 | -0,5 | 11,25 | -1,24 | -1,05 | 8,96 |
| K3 | 5 | 1 | 0 | 0 | -1,24 | 0 | -1,24 |
| K4 | 5 | 0 | 0,5 | -11,25 | 0 | 1,05 | -10,20 |
| K5 | 5 | 0 | -1,5 | -11,25 | 0 | -3,15 | -14,40 |
| K6 | 5 | 0 | -1 | 0 | 0 | -2,10 | -2,10 |
| K7 | 5 | 0 | 1 | 0 | 0 | 2,10 | 2,10 |

Wyznaczenie ostatecznych wartości sił normalnych dla układu statycznie niewyznaczalnego

| Pręt | N[kN] |
|------|--------|
| G1 | 21,24 |
| G2 | 0,74 |
| G3 | 2,52 |
| D1 | -4,86 |
| D2 | -4,12 |
| D3 | 7,38 |
| D4 | 8,64 |
| S1 | 0,0 |
| S2 | 12,99 |
| S3 | 0,99 |
| S4 | 1,68 |
| K1 | -25,20 |
| K2 | 8,96 |
| K3 | -1,24 |
| K4 | -10,20 |
| K5 | -14,40 |
| K6 | -2,10 |
| K7 | 2,10 |

