Statika 3. HF

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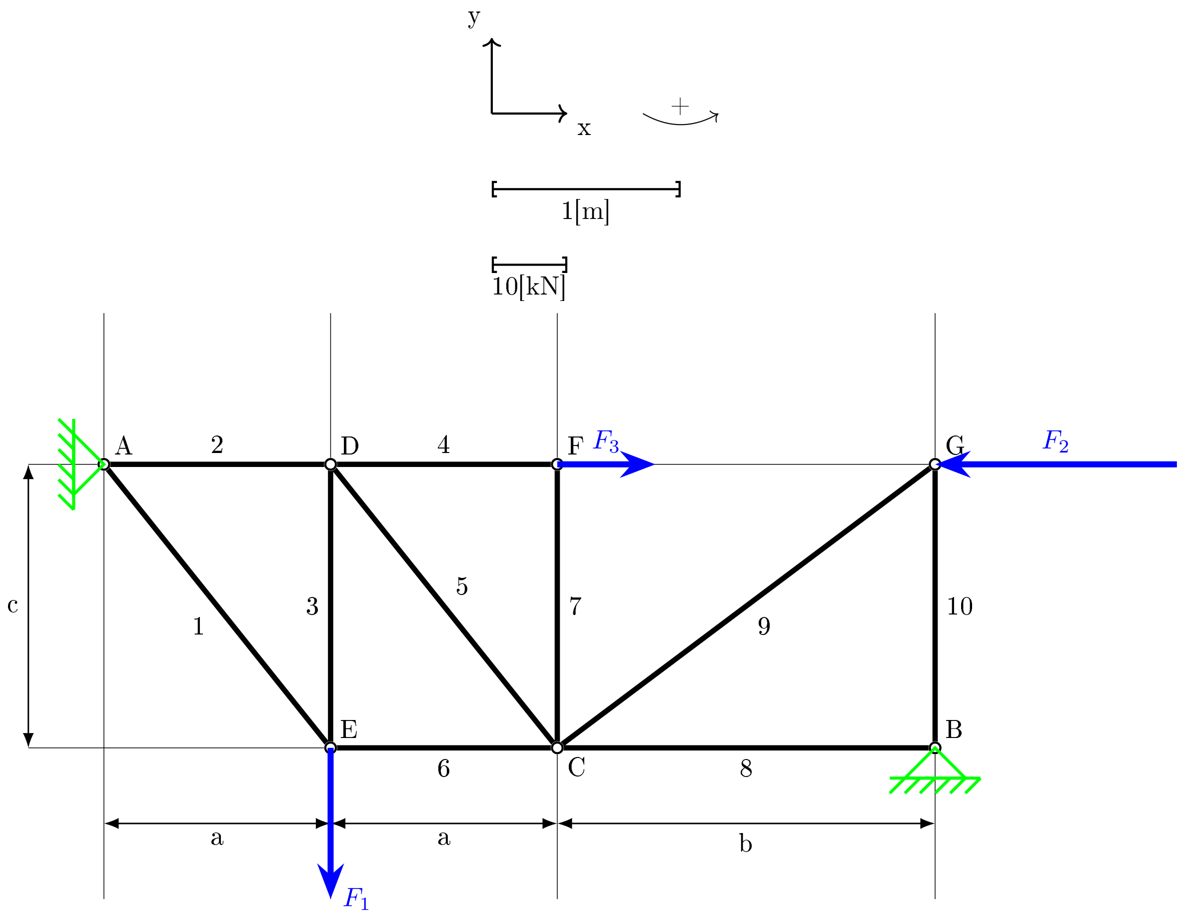
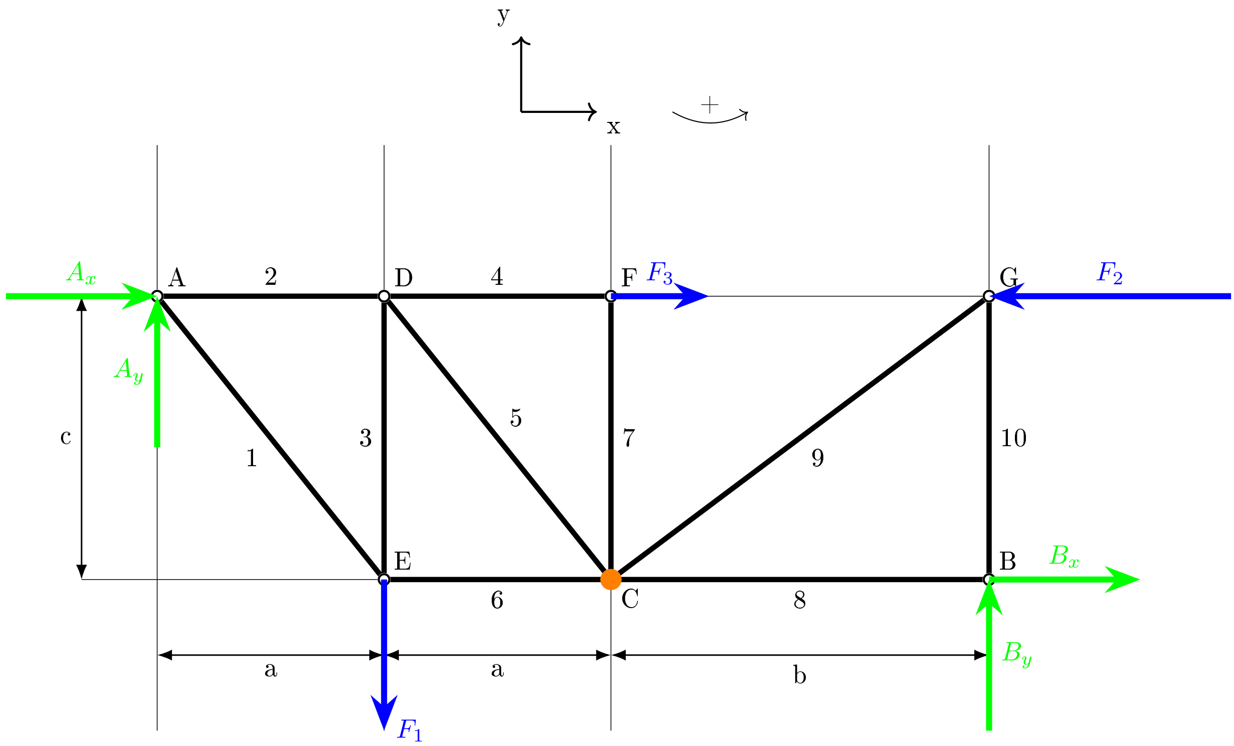
2024. november 4.

1. Méretarányos ábra



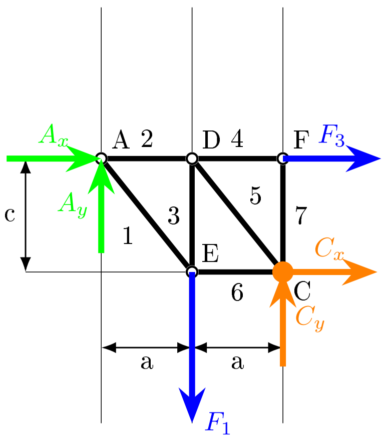
2. Részekre bontás elve

2.1. Szabadtest-ábra (SZTÁ)



2.2. Részek vizsgálata

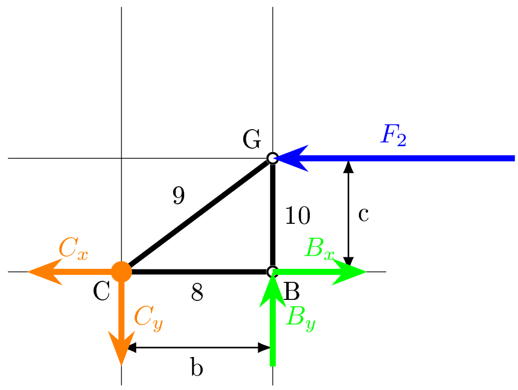
2.2.1.



$$\sum \vec{F}_x := 0 = A_x + F_3 + C_x$$
$$\sum \vec{F}_y := 0 = A_y - F_1 + C_y$$
$$\sum \vec{M}_C := 0 = -A_x \times c - A_y \times 2a + F_1 \times a - F_3 \times c$$

$$A_y = F_1 - C_y \qquad = 44[\text{kN}]$$
$$A_x = \frac{-A_y \times 2a + F_1 \times a - F_3 \times c}{c} \qquad = -67.4[\text{kN}]$$
$$C_x = -A_x - F_3 \qquad = 54.4[\text{kN}]$$

2.2.2.

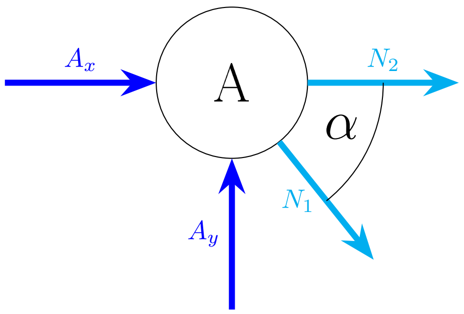


$$\sum \vec{F}_x := 0 = B_x - F_2 - C_x$$
$$\sum \vec{F}_y := 0 = B_y - C_y$$
$$\sum \vec{M}_C := 0 = F_2 \times c + B_y \times b$$

$$B_y = -F_2 \frac{c}{b} \qquad = -24[\text{kN}]$$
$$C_y = B_y \qquad = -24[\text{kN}]$$
$$B_x = C_x + F_2 \qquad = 86.4[\text{kN}]$$

$$\boxed{\begin{aligned} A &= \begin{bmatrix} -67.4 \\ 44 \end{bmatrix} \quad [\mathrm{kN}] \\ B &= \begin{bmatrix} 86.4 \\ -24 \end{bmatrix} \quad [\mathrm{kN}] \end{aligned}}$$

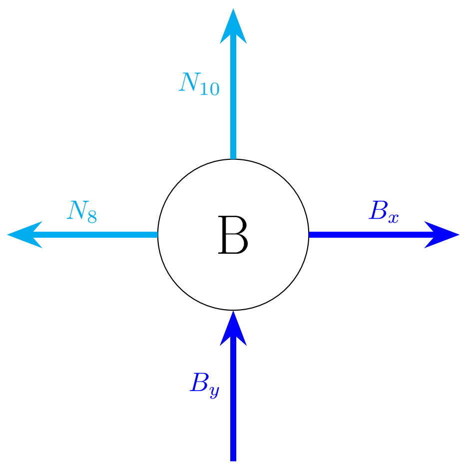
3. Csomóponti módszer



$$\sum \vec{F}_x := 0 = A_x + N_2 + N_{1x}$$
$$\sum \vec{F}_y := 0 = A_y - N_{1y}$$

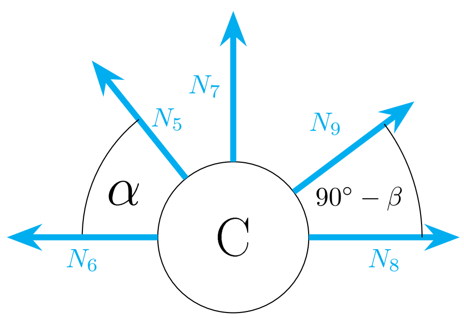
$$\tan\alpha = \frac{c}{a} \Rightarrow \alpha = 51.33^\circ$$

$$N_{1y} = A_y = \quad 44[\text{kN}]$$
$$\mathbf{N_1} = \frac{N_{1y}}{\sin\alpha} = \quad \mathbf{56.36}[\text{kN}]$$
$$N_{1x} = N_1 \times \cos\alpha = \quad 35.21[\text{kN}]$$



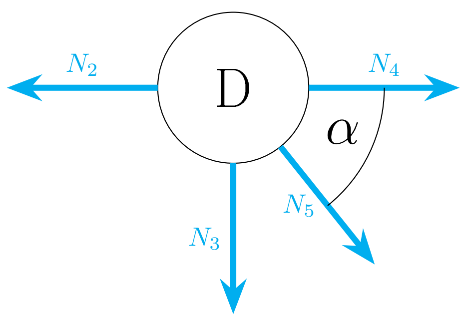
$$\sum \vec{F}_x := 0 = B_x - N_8$$
$$\sum \vec{F}_y := 0 = B_y + N_{10}$$

$$\mathbf{N_8} = B_x = \quad \mathbf{86.4}[\text{kN}]$$
$$\mathbf{N_{10}} = -B_y = \quad \mathbf{24}[\text{kN}]$$



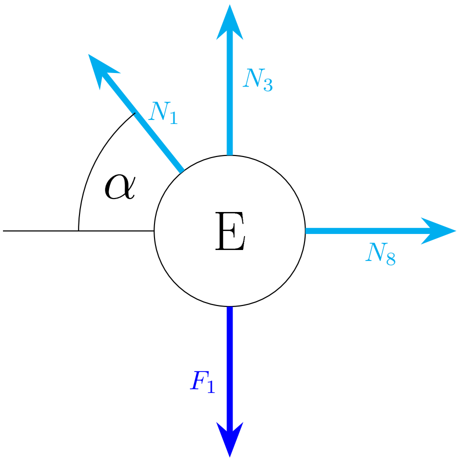
$$\sum \vec{F}_x := 0 = N_8 - N_6 + N_{9x} - N_{5x}$$
$$\sum \vec{F}_y := 0 = N_7 + N_{5y} + N_{9y}$$

$$\mathbf{N_6} = N_8 + N_{9x} - N_{5x} = \quad \mathbf{35.21}[\text{kN}]$$
$$\mathbf{N_7} = -N_{5y} - N_{9y} = \quad \mathbf{0}[\text{kN}]$$



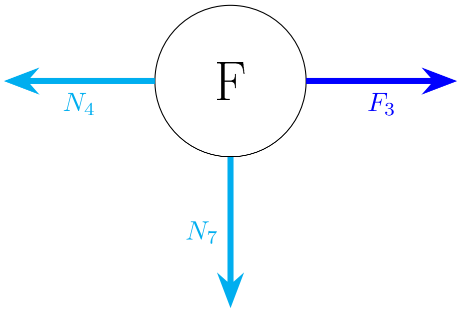
$$\sum \vec{F}_x := 0 = N_4 - N_2 + N_{5x}$$
$$\sum \vec{F}_y := 0 = -N_3 - N_{5y}$$

$$N_{5x} = N_2 - N_4 = \quad \mathbf{19.19}[\text{kN}]$$
$$N_{5y} = -N_3 = \quad \mathbf{24}[\text{kN}]$$
$$\mathbf{N_5} = \sqrt{{N_{5x}}^2 + {N_{5y}}^2} = \quad \mathbf{30.73}[\text{kN}]$$



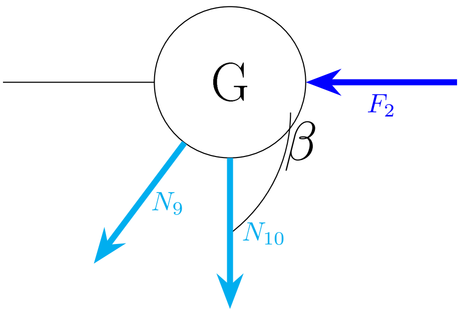
$$\sum \vec{F}_x := 0 = N_6 - N_{1x}$$
$$\sum \vec{F}_y := 0 = N_3 - F_1 + N_{1y}$$

$$N_6 = N_{1x} = \quad 35.21[\text{kN}]\checkmark$$
$$\mathbf{N_3} = F_1 - N_{1y} = \quad \mathbf{-24}[\text{kN}]$$



$$\sum \vec{F}_x := 0 = F_3 - N_4$$
$$\sum \vec{F}_y := 0 = -N_7$$

$$\mathbf{N_4} = F_3 = \quad \mathbf{13}[\text{kN}]$$
$$N_7 = \quad 0[\text{kN}]\checkmark$$

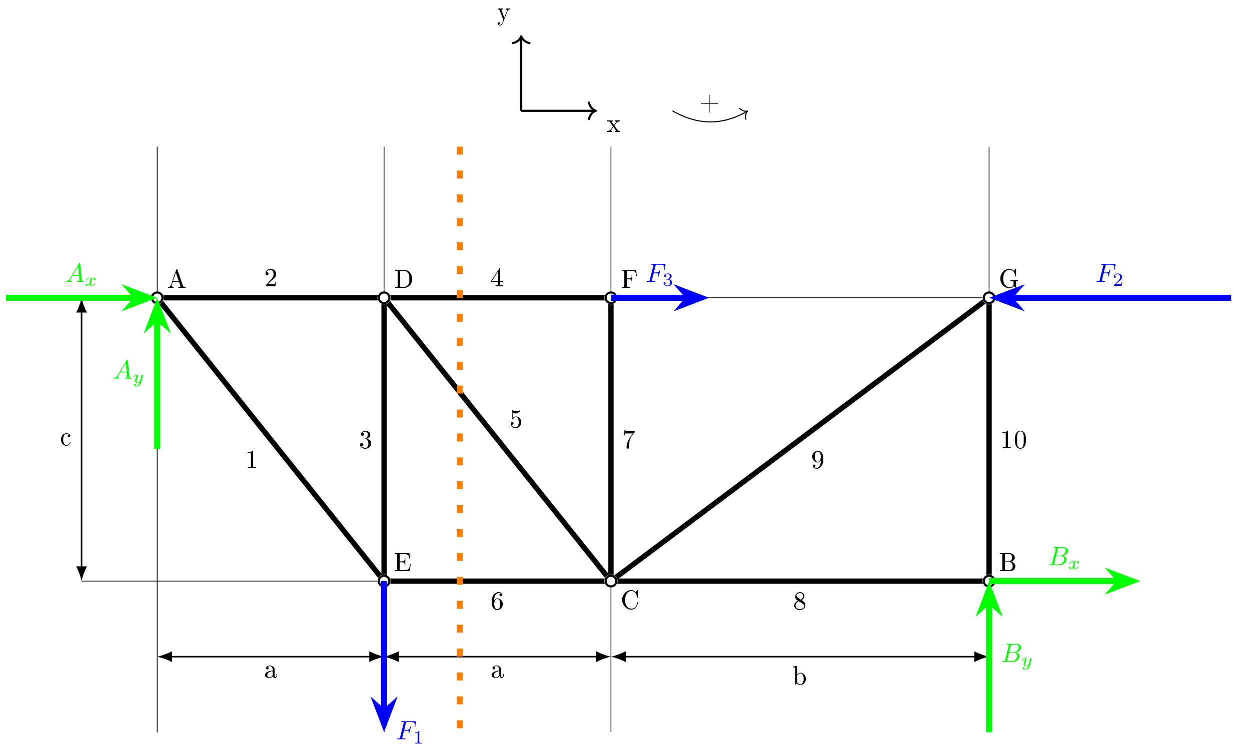


$$\sum \vec{F}_x := 0 = -F_2 - N_{9x}$$
$$\sum \vec{F}_y := 0 = -N_{10} - N_{9y}$$
$$\tan\beta = \tfrac{b}{c} \Rightarrow \beta = 53.12°$$

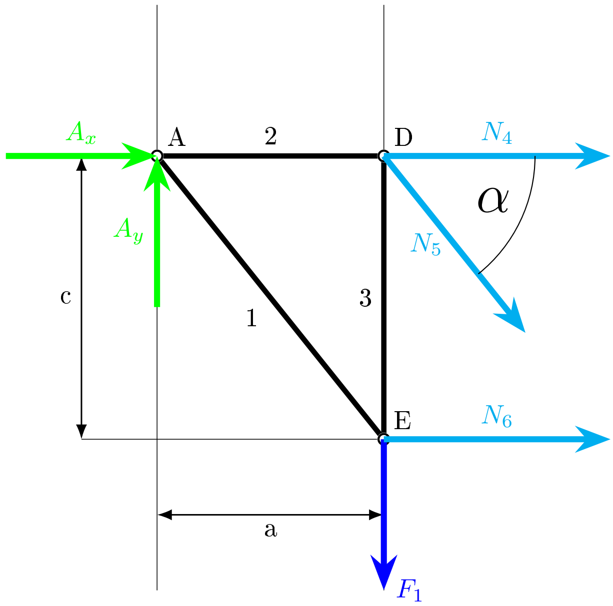
$$N_{9x} = -F_2 = \quad \mathbf{-32}[\text{kN}]$$
$$\mathbf{N_9} = \frac{N_{9x}}{\sin\beta} = \quad \mathbf{-40}[\text{kN}]$$
$$N_{9y} = N_9 \times \cos\beta = \quad \mathbf{-24.01}[\text{kN}]$$
$$\mathbf{N_{10}} = -N_{9y} = \quad \mathbf{24}[\text{kN}]$$

4. Átmetsző módszer

4.1. SZTÁ



4.2. Megmaradt rúderők



$$\sum \vec{F}_x := 0 = A_x + N_4 + N_{5x} + N_6$$
$$\sum \vec{F}_y := 0 = A_y - N_{5y} - F_1$$
$$\sum \vec{M}_D := 0 = A_y \times a + N_6 \times c$$

$$N_{5y} = A_y - F_2 = 24\checkmark$$
$$\mathbf{N_5} = \frac{N_{5y}}{\sin\alpha} = \mathbf{30.73}\checkmark$$

$$N_{5x} = N_5 \times \cos\alpha = 19.19\checkmark$$
$$N_4 = -A_x - N_{5x} - N_6 = 13\checkmark$$
$$N_6 = \frac{A_y \times a}{c} = 35.21\checkmark$$