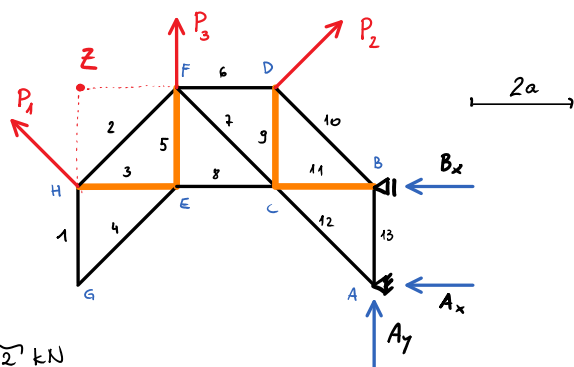


KARTKÓWKA 1 - BELKI - Oblicz siły w oznaczonych punktach

czwartek, 30 marca 2017 23:28



$$P_1 = 2\sqrt{2} \text{ kN}$$

$$P_2 = 4\sqrt{2} \text{ kN}$$

$$P_3 = 5 \text{ kN}$$

$$\sum F_{ix}: -P_{1x} + P_{2x} - B_x - A_x = 0$$

$$\sum F_{iy}: P_{1y} + P_3 + P_{2y} + A_y = 0 \quad A_y = -11 \text{ kN}$$

$$\sum M_i^A: -B_x 2a + P_2 3a\sqrt{2} + P_3 4a + P_1 2a\sqrt{2} = 0$$

$$2B_x = 3\sqrt{2}P_2 + 4P_3 + 2\sqrt{2}P_1$$

$$2B_x = 24 + 20 + 8$$

$$2B_x = 52$$

$$B_x = 26 \text{ kN}$$

$$A_x = P_{2x} - P_{1x} - B_x = 4 - 2 - 26$$

$$A_x = -24 \text{ kN}$$

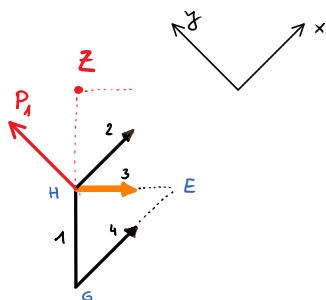
SPRAWDZENIE

$$\sum M_i^z: P_1 a\sqrt{2} - P_3 2a - P_2 2a\sqrt{2} + B_x 2a + A_x 4a - A_y 6a = 0 \quad / :a$$

$$P_1 \sqrt{2} - 2P_3 - 2\sqrt{2}P_2 + 2B_x + 4A_x - 6A_y = 0$$

$$4 - 10 - 16 + 52 - 96 + 66 = 0$$

$$122 - 122 = 0 \quad \checkmark$$



Wygódnie będzie obrócić układ do wartości sił o 45° . Wówczas suma wartości sił na płaszczyźnie XY wyeliminuje siły S_2 i S_4 .

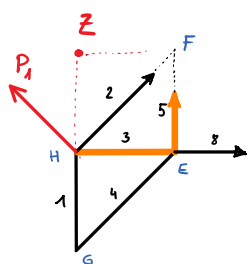
$$\sum F_{ix}: P_1 - S_{3x} = 0$$

$$P_1 - S_3 \frac{\sqrt{2}}{2} = 0$$

$$P_1 = S_3 \frac{\sqrt{2}}{2} \quad / \cdot \frac{2}{\sqrt{2}}$$

$$P_1 \cdot \frac{2}{\sqrt{2}} = S_3$$

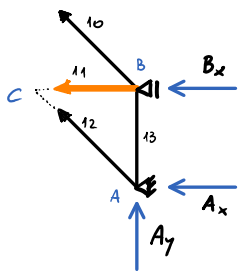
$$S_3 = 2\sqrt{2} \cdot \frac{2}{\sqrt{2}} = 4 \text{ kN}$$



Przyjmując biegun w węzle H wyeliminujemy siły S_2 i S_8 oraz P_1 .

$$\sum M_i^H: -S_5 \cdot 2a = 0$$

$$S_5 = 0$$



$$\sum M_i^C: -S_{10} a\sqrt{2} - 2aA_y + 2aA_x = 0$$

$$S_{10}\sqrt{2} = 2A_x - 2A_y$$

$$S_{10}\sqrt{2} = -48 + 22$$

$$S_{10} = -13\sqrt{2}$$

$$\sum M_i^B: S_{12} a\sqrt{2} + 2aA_x = 0$$

$$S_{12} = -\frac{2}{\sqrt{2}} A_x = 24\sqrt{2} \text{ kN}$$

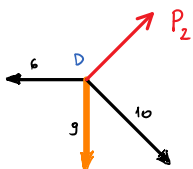
$$\sum F_x: -S_{10x} - S_{12x} - S_{11} - B_x - A_x = 0$$

$$S_{11} = -S_{10x} - S_{12x} - B_x - A_x$$

$$S_{11} = 13 - 24 - 26 + 24$$

$$S_{11} = -13 \text{ kN}$$

Metoda wyznaczania węzłów

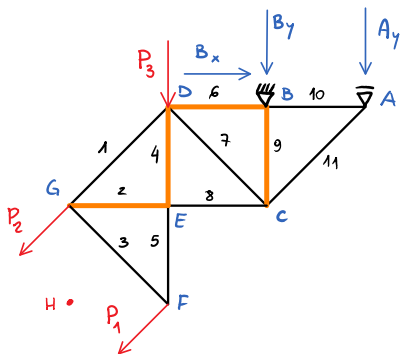


$$\sum F_{iy}: -S_9 - S_{10y} + P_{2y} = 0$$

$$S_9 = P_{2y} - S_{10y}$$

$$S_9 = 4 + 13$$

$$S_9 = 17 \text{ kN}$$



$$B_x - P_{2x} - P_{1x} = 0 \quad B_x = 7 \text{ kN}$$

$$-P_{1y} - P_{2y} - P_3 - B_y - A_y = 0$$

$$\sum M_i^A: -2aB_y - 4aP_3 - 2a\sqrt{2}P_2 = 0 \quad / : a$$

$$2B_y = -4P_3 - 2\sqrt{2}P_2$$

$$2B_y = -8 - 2\sqrt{2} \cdot 4\sqrt{2}$$

$$2B_y = -8 - 16$$

$$B_y = -12 \text{ kN}$$

$$A_y = -3 - 4 - 2 + 12$$

$$A_y = 3 \text{ kN}$$

$$P_1 = 3\sqrt{2} \text{ kN}$$

$$P_2 = 4\sqrt{2} \text{ kN}$$

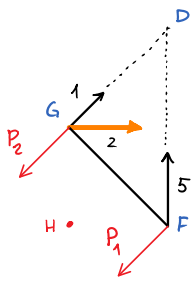
$$P_3 = 2 \text{ kN}$$

SPRAWDZENIE:

$$\sum M_i^H: -P_2 a\sqrt{2} + P_1 a\sqrt{2} + 2aP_3 + 4aB_x + 4aB_y + 6aA_y = 0 \quad / : a$$

$$-8 + 6 + 4 + 28 - 48 + 18 = 0$$

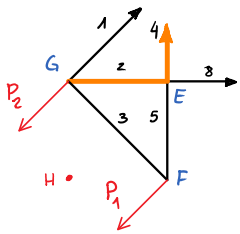
$$-56 + 56 = 0$$



$$\sum M_i^D: -2a S_2 + 2a \sqrt{2} P_1 = 0$$

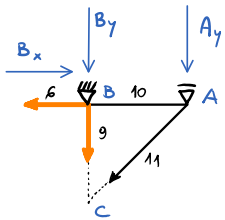
$$S_2 = \sqrt{2} P_1 = 3 \sqrt{2} \cdot \sqrt{2}$$

$$S_2 = 6 \text{ kN}$$



$$\sum M_i^E: -2a S_4 + 2a \sqrt{2} P_1 = 0$$

$$S_4 = \sqrt{2} P_1 = 6 \text{ kN}$$



$$\sum M_i^C: -2a S_6 + 2a B_x + 2a A_y = 0$$

$$S_6 = B_x + A_y$$

$$S_6 = 7 + 3$$

$$S_6 = 10 \text{ kN}$$

$$\sum M_i^A: -2a S_9 - 2a B_y = 0$$

$$S_9 = -B_y$$

$$S_9 = 12 \text{ kN}$$