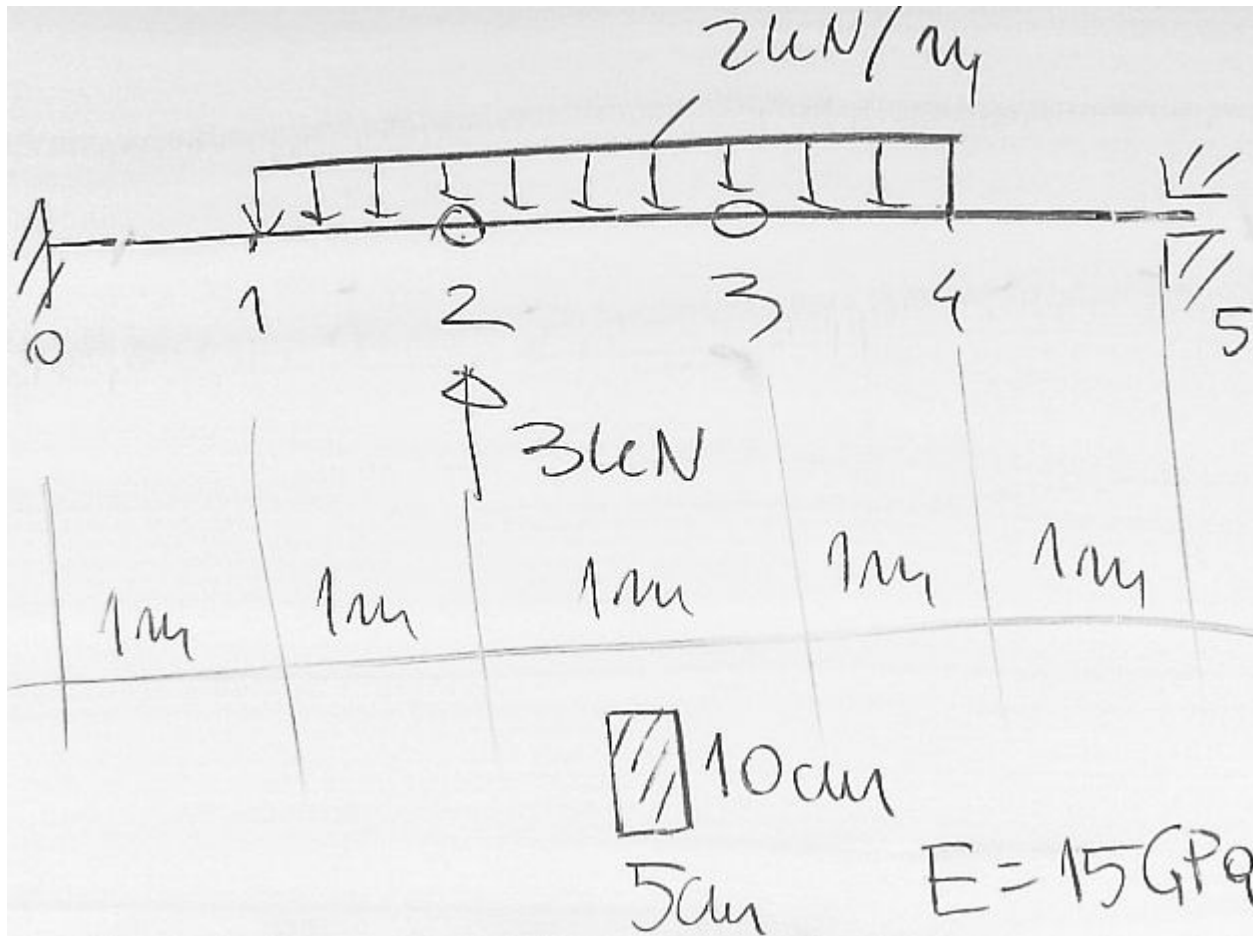


Metoda różnic skończonych - ugięcie belki



$$P := 3 \text{ kN} \quad q := 2 \frac{\text{kN}}{\text{m}}$$

$$L := 5 \text{ m} \quad b := 5 \text{ cm} \quad h := 10 \text{ cm} \quad J := b \cdot \frac{h^3}{12} \quad E := 15 \text{ GPa}$$

$$T2 := \frac{q \cdot 1 \text{ m}}{2} = 1 \cdot \text{kN} \quad T3 := T2 \quad R0 := q \cdot 1 \text{ m} - P + T2 = 0 \cdot \text{kN} \quad R5 := q \cdot 1 \text{ m} + T2 = 3 \text{ kN}$$

$$M0 := q \cdot 1 \text{ m} \cdot 1.5 \text{ m} - P \cdot 2 \text{ m} + T2 \cdot 2 \text{ m} = -1 \cdot \text{kN} \cdot \text{m} \quad M5 := q \cdot 1 \text{ m} \cdot 1.5 \text{ m} + T3 \cdot 2 \text{ m} = 5 \cdot \text{kN} \cdot \text{m}$$

$$n := 5 \quad \Delta := \frac{L}{n} = 1 \text{ m} \quad \alpha := \frac{\Delta^2}{E \cdot J} \quad \alpha = 16 \cdot \frac{1}{\text{MN}}$$

$$M1(x) := R0 \cdot x - M0$$

$$M2(x) := M1(x) - q \cdot \frac{(x - 1\text{m})^2}{2}$$

$$M3(x) := M2(x) + P \cdot (x - 2\text{m})$$

$$M4(x) := M3(x) + q \cdot \frac{(x - 4\text{m})^2}{2}$$

$$i := 0 \dots n$$

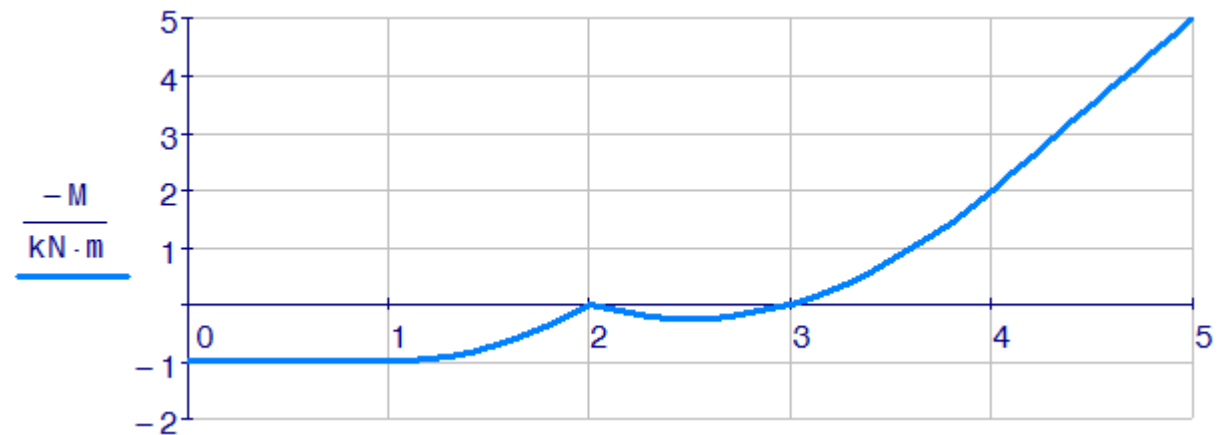
$$X_i := i \cdot \Delta$$

$$i := 0 \dots 1 \quad M_i := M1(X_i)$$

$$i := 1 \dots 2 \quad M_i := M2(X_i)$$

$$i := 2 \dots 4 \quad M_i := M3(X_i)$$

$$M = \begin{array}{|c|c|} \hline & 0 \\ \hline 0 & 1 \\ 1 & 1 \\ 2 & 0 \\ 3 & 0 \\ 4 & -2 \\ 5 & -5 \\ \hline \end{array} \cdot \text{kN} \cdot \text{m} \quad X = \begin{array}{|c|c|} \hline & 0 \\ \hline 0 & 0 \\ 1 & 1 \\ 2 & 2 \\ 3 & 3 \\ 4 & 4 \\ 5 & 5 \\ \hline \end{array} \text{m}$$



Równania MRS

$$y_0 = 0 \quad \varphi_0 = 0$$

$$y_5 = 0 \quad \varphi_5 = 0$$

$$-2 y_0 + 2 y_1 = \alpha M_0$$

$$2 y_1 = \alpha M_0$$

$$-2 y_5 + 2 y_4 = \alpha M_5$$

$$2 y_4 = \alpha M_5$$

$$y_0 - 2 y_1 + y_2 = \alpha M_1 \quad \text{-----} > \quad -2 y_2 + y_3 = \alpha M_1$$

$$y_3 - 2 y_4 + y_5 = \alpha M_4$$

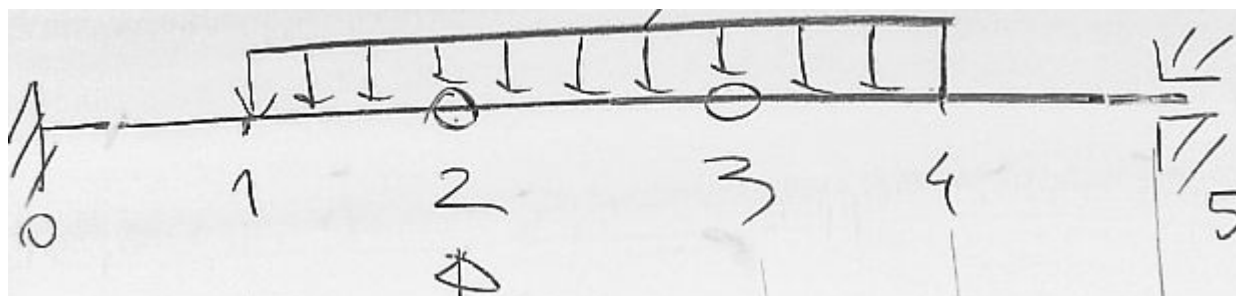
$$y_3 - 2 y_4 = \alpha M_4$$

M =

	0
0	1
1	1
2	0
3	0
4	-2
5	-5

· kN · m

$$\alpha = 16 \cdot \frac{1}{\text{MN}}$$



y =

	0
0	0.00
1	8.00
2	32.00
3	-112.00
4	-40.00
5	0.00

· mm

$\frac{y}{\text{mm}}$

