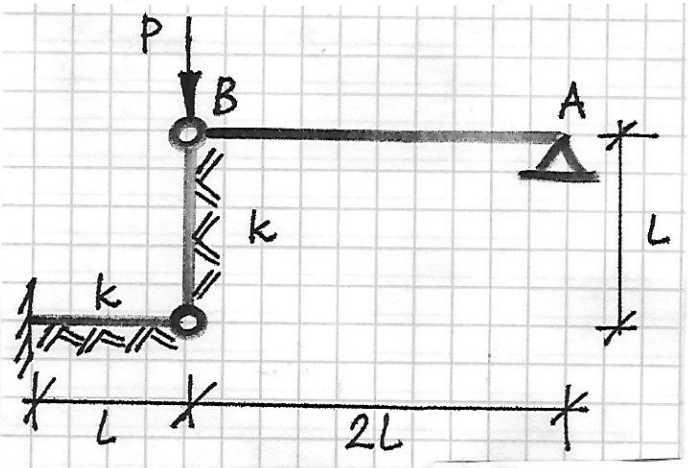
Egzamin z Mechaniki Konstrukcji (MK IPB), 8.09.2017
studia niestacjonarne

NAZWISKO, Imię				
rok akademicki zaliczenia ćwiczeń		nr albumu	grupa (IPB / BZ)	tryb studiów (ST / NST)
ocena zadania 1	ocena zadania 2	ocena zadania 3	ocena egzaminu	ocena łączna

Zadanie 1.

$EJ = const.,\qquad k = 0{,}0064\dfrac{EJ}{l^4}$

Oblicz kąt obrotu w punkcie A ramy z rys. 1 korzystając z funkcji ugięcia pręta AB.

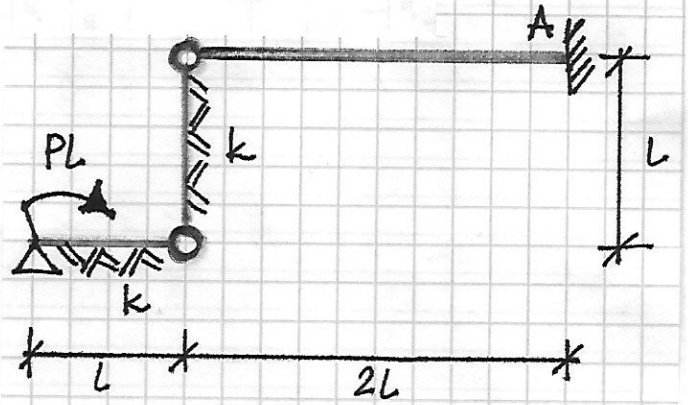


rys. 1

Zadanie 2.

$EJ = const.,\qquad k = 0{,}0064\dfrac{EJ}{l^4}$

Oblicz moment w utwierdzeniu A w ramie z rys. 2 korzystając z tw. Bettiego.

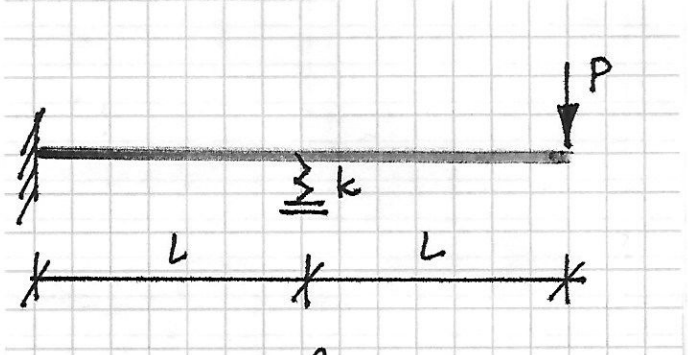


rys. 2

Zadanie 3.

$EJ = const.$

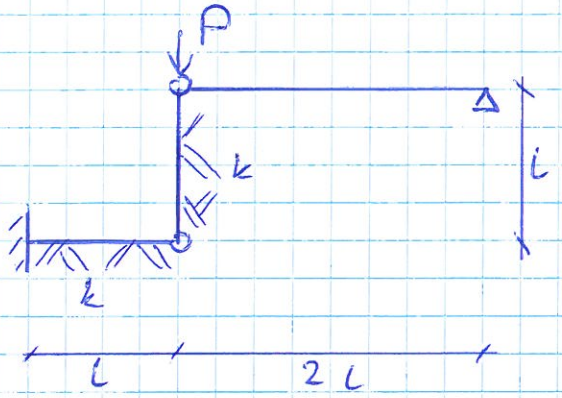
Wyznacz wartość współczynnika k, dla którego moment w utwierdzeniu belki z rys. 3 jest równy zeru.



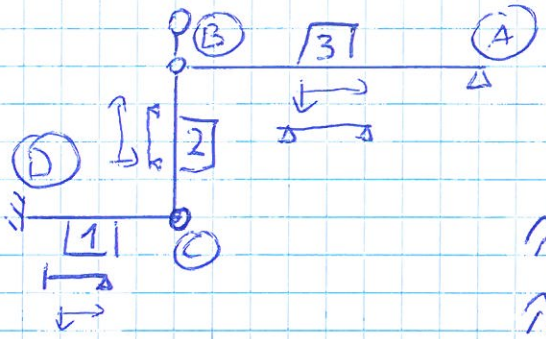
rys. 3

Egzamin z MK3 (IPBz) 08.09.2017

Zadanie 1



UGW



$q_1 = \left\{ \frac{u}{l} \right\}$

$\lambda_1 = 0,2$

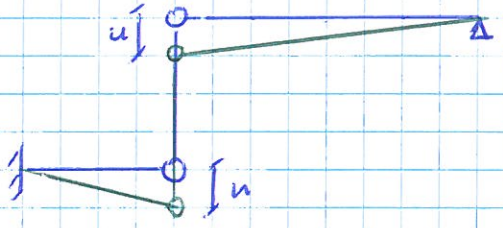
$\lambda_2 = 0,2$

$\lambda_3 = 0$

RR:

$$-\left(\bar{W}_B^3 \bar{u} + \bar{W}_C^1 \bar{u}\right) + P\bar{u} = 0$$

PP



$$\bar{W}_B^3 + \bar{W}_C^1 = P$$

$$\bar{W}_B^3 = 0$$

$$\bar{W}_C^1 = -\frac{EJ}{l^2}\left(-\chi^1(0,2)\frac{u}{l}\right) = \frac{EJ}{l^2}\left(3,002\,\frac{u}{l}\right)$$

P_{red}	$^*w$	w^*	u
1	0	u	0
2	0	0	$-u$
3	u	0	0

$$\frac{EJ}{l^2}\left(3,002\,\frac{u}{l}\right) = P$$

$$\frac{u}{l} = \frac{Pl^2}{EJ} \cdot \frac{1}{3,002}$$

WB:

$w(\xi) = A_0 + A_1\xi + A_2\xi^2 + A_3\xi^3$

$w(0) = u \qquad M(0) = 0$

$w(1) = 0 \qquad M(1) = 0$

$\varphi(\xi) = \frac{1}{2l} w'(\xi)$

$M(\xi) = -\frac{EJ}{(2l)^2} w''(\xi)$

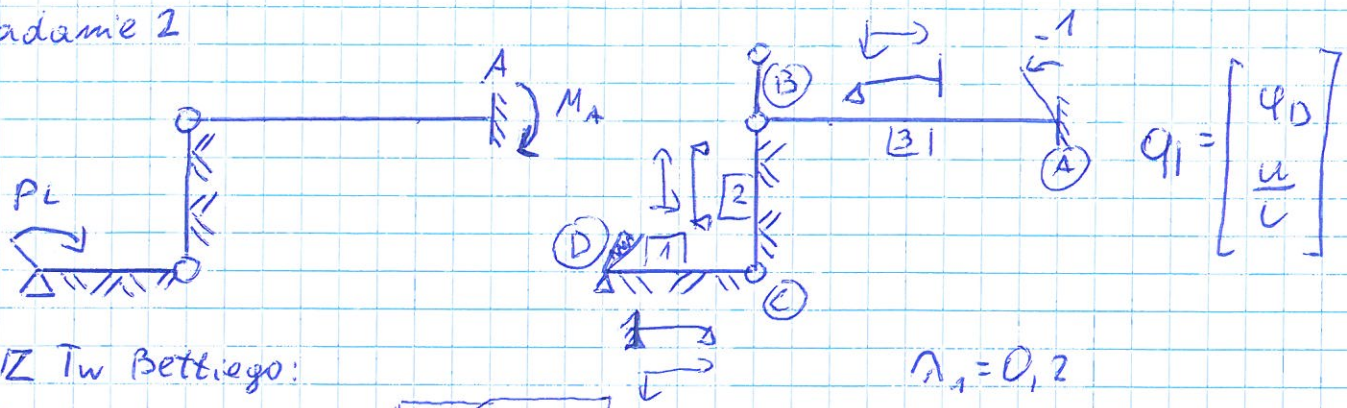
$w(\xi) = u - u\xi$

$\varphi(\xi) = -\frac{u}{2l}$

$$\varphi_B = \varphi(0) = -\frac{u}{2l} = -\frac{Pl^2}{EJ}\,\frac{1}{6,004}$$

Egzamin z MK3 (IPB2) 08.09.2017

Zadanie 2



Z Tw Bettiego:

$(-1) M_A + \varphi_D \cdot PL = 0 \Rightarrow \boxed{M_A = PL\,\varphi_D}$

$\lambda_1 = 0{,}2$

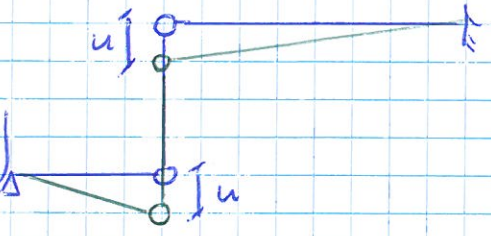
$\lambda_2 = 0{,}2$

$\lambda_3 = 0$

RR:

$$\begin{cases} \bar{\Phi}_D^1 = 0 \\ -\bar{W}_C^1 \bar{u} - \bar{W}_B^3 \bar{u} = 0 \end{cases}$$

PP



$$\bar{\Phi}_D^1 = \frac{EJ}{L}\left(\lambda'(0{,}2)\,\varphi_D - \delta'(0{,}2)\frac{u}{L}\right) = \frac{EJ}{L}\left(3\varphi_D - 3\frac{u}{L}\right)$$

$$\bar{W}_C^1 = -\frac{EJ}{L^2}\left(\delta'(0{,}2)\,\varphi_D - \chi'(0{,}2)\frac{u}{L}\right) = +\frac{EJ}{L^2}\left(-3\varphi_D + 3{,}002\frac{u}{L}\right)$$

Przęt	w^*	w^*	u
1	0	u	0
2	0	0	-u
3	u	0	0

$$\bar{W}_B^3 = \frac{EJ}{(2L)^2}\left(\delta'(0)(-1) + \chi'(0)\frac{u}{2L}\right) = \frac{EJ}{L^2}\left(-\frac{3}{4} + \frac{3}{8}\frac{u}{L}\right)$$

$\bar{\Phi}_D^1 = 0 \Rightarrow \varphi_D = \frac{u}{L}$

$\bar{W}_C^1 + \bar{W}_B^3 = 0 \Rightarrow \frac{EJ}{L^2}\left(-3\varphi_D + 3{,}002\varphi_D - \frac{3}{4} + \frac{3}{8}\varphi_D\right) = 0$

$\varphi_D = \frac{6}{3{,}016} \approx 1{,}989$

$M_A = PL\,\varphi_D = 1{,}989\,PL$

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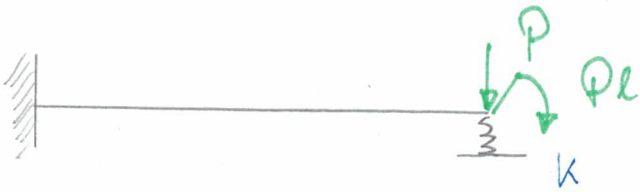
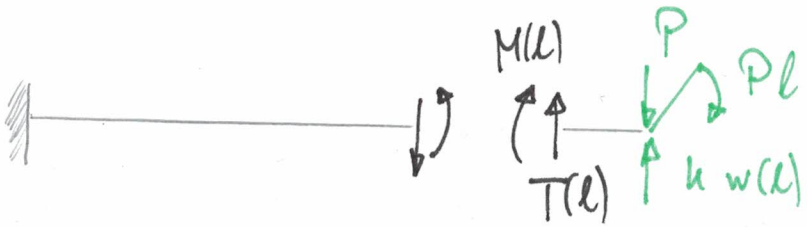
Układ zredukowany





$$w(x) = C_0 + C_1 x + C_2 x^2 + C_3 x^3$$

w.b

$w(0) = 0$

$\varphi'(0) = w'(0) = 0$

$M(l) = -EJ\, w''(l) = -Pl$

$T(l) = -EJ\, w'''(l) = P - k\, w(l)$

$$C_0 = C_1 = 0$$

$$C_2 = \frac{Pl(12EJ - kl^3)}{4EJ(3EJ + kl^3)}$$

$$C_3 = \frac{P(kl^3 - EJ)}{4EJ(3EJ + kl^3)}$$

Moment w utwierdzeniu

$$M(0) = -EJ\, w''(0) = 0 \iff k = \frac{12EJ}{l^3}$$