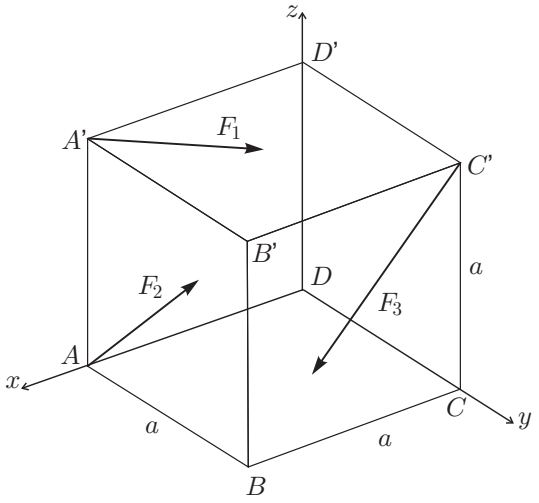
Vpisna številka: 261_ _ _ _ _

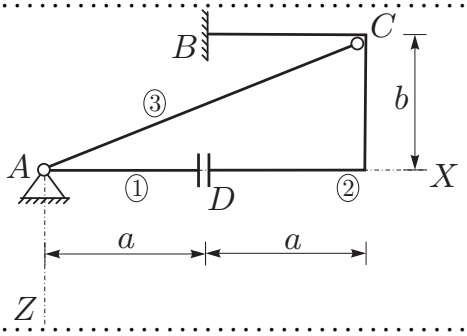
Ime in priimek:

naloga	točk
1	
2	
3	
4	

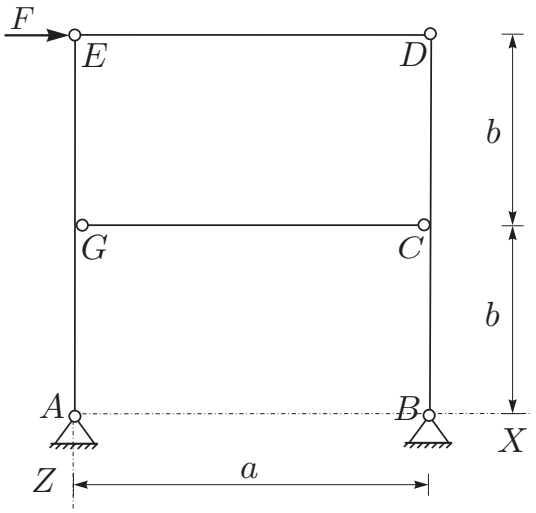
1. Prostorski sistem treh sil deluje na togo kocko z robom $a = 2\,\mathrm{m}$, kot kaže slika. Prijemališče sile F_1 leži na premici skozi točki A' in C'. Smernica sile F_2 poteka skozi točki A in B', smernica sile F_3 pa skozi točki B in C'. Določi rezultanto sil in rezultanto momentov na točki D in C'! Ali lahko dani sistem sil nadomestimo z eno samo silo? Odgovor utemelji!
Podatki: $F_1 = 10\,\mathrm{kN}$, $F_2 = 20\,\mathrm{kN}$, $F_3 = 30\,\mathrm{kN}$.



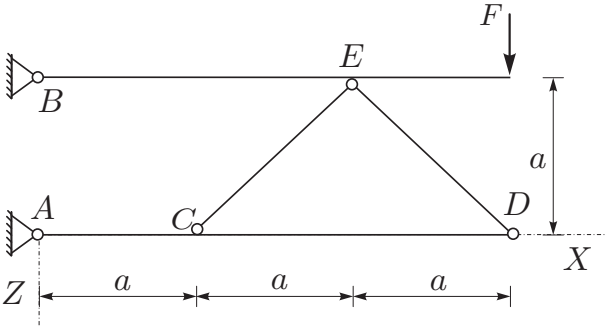
2. Za konstrukcijo na sliki določi računsko število prostostnih stopenj in zapiši kinematične enačbe!



3. Za konstrukcijo na sliki določi računsko število prostostnih stopenj in z uporabo ravnotežnih enačb preveri, če se dejansko število prostostnih stopenj ujema z računskim!



4. Za konstrukcijo na sliki določi računsko število prostostnih stopenj, reakcije in sile v vezeh!
Podatki: $a = 2$ m, $F = 10\,\mathrm{kN}$.



OSD 1. KOLOKVIJ

1. NALOGA

$\vec{F}_1 = F_1 \cdot \vec{e}_{A'C'} = F_1 \frac{1}{\sqrt{2}}(-1,1,0) = (-5\sqrt{2}, 5\sqrt{2}, 0)$ [kN]

$\vec{F}_2 = F_2 \cdot \vec{e}_{AB'} = F_2 \frac{1}{\sqrt{2}}(0,1,1) = (0, 10\sqrt{2}, 10\sqrt{2})$ [kN]

$\vec{F}_3 = F_3 \cdot \vec{e}_{C'B} = F_3 \frac{1}{\sqrt{2}}(1,0,-1) = (15\sqrt{2}, 0, -15\sqrt{2})$ [kN]

$\vec{R} = (10\sqrt{2}, 15\sqrt{2}, -5\sqrt{2})$

a.) $\vec{M}_R^D$

$\vec{M}_1 = (2,0,2) \times \vec{F}_1 = (-10\sqrt{2}, -10\sqrt{2}, 10\sqrt{2})$ [kNm]

$\vec{M}_2 = (2,0,0) \times \vec{F}_2 = (0, -20\sqrt{2}, 20\sqrt{2})$ [kNm]

$\vec{M}_3 = (0,2,2) \times \vec{F}_3 = (-30\sqrt{2}, 30\sqrt{2}, -30\sqrt{2})$ [kNm]

$\Rightarrow \vec{M}_R^D = (-40\sqrt{2}, 0, 0)$ [kNm]

b.) $\vec{M}_R^{C'}$

$\vec{M}_1 = \vec{M}_3 = \vec{0}$!

$\vec{M}_2^{C'} = \vec{C'A} \times \vec{F}_2 = (2,-2,-2) \times \vec{F}_2 = (0, -20\sqrt{2}, 20\sqrt{2})$

$\Rightarrow \vec{M}_R^{C'} = (0, -20\sqrt{2}, 20\sqrt{2})$ [kNm]

c.) $\vec{R} \cdot \vec{M}_R^D \neq 0 \Rightarrow$ NI MOGOČE

2. NALOGA

$\tilde{n}_{PS} = 3 \cdot 3 - 2 - 3 - 2 - 2 - 2 = -2$

PODPORE:

A: $u_{A1} = 0$ $u_{A3} = 0$
$w_{A1} = 0$ $w_{A3} = 0$

B: $u_{B2} = 0$
$w_{B2} = 0$
$\varphi_{B2} = 0$

VEZI

A: $u_{A1} = u_{A3}$, $w_{A1} = w_{A3}$ } ODVISNI ENAČBI

C: $u_{C2} = u_{C3}$, $w_{C2} = w_{C3}$

D: $u_{D1} = u_{D2}$, $\varphi_{D1} = \varphi_{D2}$

TELESA

① $u_{D1} = u_{A1}$
$w_{D1} = w_{A1} - a\varphi_{A1}$
$\varphi_{D1} = \varphi_{A1}$

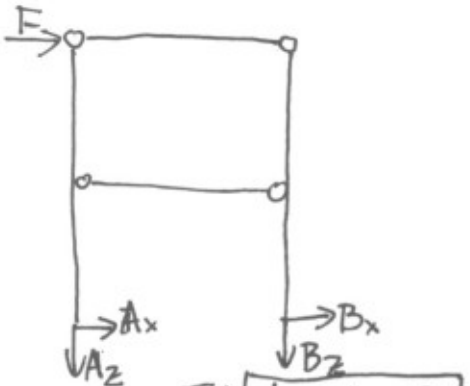
② $u_{B2} = u_{D2} - b\varphi_{D2}$
$w_{B2} = w_{D2}$
$\varphi_{B2} = \varphi_{D2}$

$u_{C2} = u_{D2} - b\varphi_{D2}$
$w_{C2} = w_{D2} - a\varphi_{D2}$
$\varphi_{C2} = \varphi_{D2}$

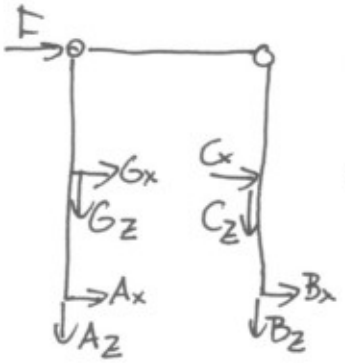
③ $u_{C3} = u_{A3} - b\varphi_{A3}$
$w_{C3} = w_{A3} - 2\varphi_{A3}$
$\varphi_{C3} = \varphi_{A3}$

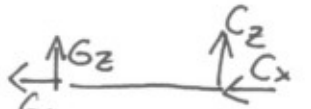
OSD 1. KOLOKVIJ

3. NALOGA $\widetilde{m}_{PS} = 3\cdot4 - 2\cdot2 - 4\cdot2 = 0$



ΣX: $\boxed{A_x + B_x = -F}$





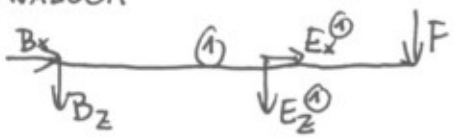
$\Downarrow$

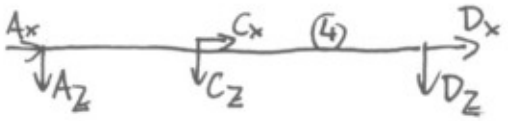
$\boxed{C_x + G_x = 0}$

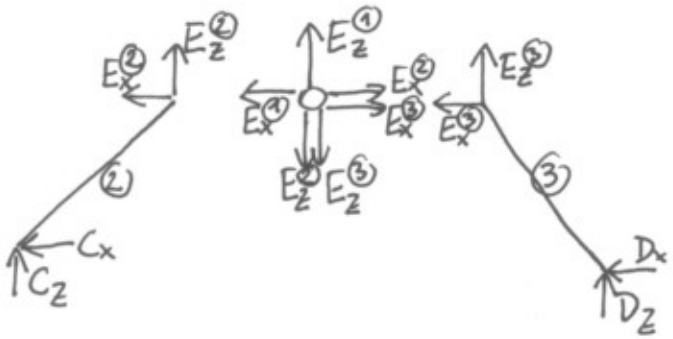
$A_x \cdot 2b + G_x \cdot b = 0$
$B_x \cdot 2b + C_x \cdot b = 0$ $\Rightarrow$ $\boxed{A_x + B_x = 0}$

PROTISLOVJE $\Rightarrow$ KONST. JE LABILNA

4. NALOGA







① ΣM^E: $B_z \cdot 2a - F \cdot a = 0$

$\boxed{B_z = \frac{F}{2} = 5\,kN}$

CELOTNA KONST.

ΣZ: $A_z + B_z + F = 0$

$\boxed{A_z = -\frac{3F}{2} = -15\,kN}$

① ΣZ: $E_z^{①} + B_z + F = 0$

$\boxed{E_z^{①} = -\frac{3F}{2} = -15\,kN}$

④ ΣM^D_{AD}: $A_z \cdot 3a + C_z \cdot 2a = 0$

$\boxed{C_z = \frac{9F}{4} = 22{,}5\,kN}$

ΣZ: $A_z + C_z + D_z = 0$

$\boxed{D_z = -7{,}5\,kN}$

② ΣM^E_{CE} $-C_x \cdot a - C_z \cdot a = 0$

$\boxed{C_x = -22{,}5\,kN}$

ΣX: $\boxed{E_x^{②} = 22{,}5\,kN}$

ΣZ: $\boxed{E_z^{②} = -22{,}5\,kN}$

③ ΣM^E: $-D_x \cdot a + D_z \cdot a = 0$

$\boxed{D_x = -7{,}5\,kN}$

ΣX: $-D_x - E_x^{③} = 0$

$\boxed{E_x^{③} = 7{,}5\,kN}$

ΣZ: $\boxed{E_z^{③} = 7{,}5\,kN}$

VEZ (E)

ΣX: $-E_x^{①} + E_x^{②} + E_x^{③} = 0$

$\boxed{E_x^{①} = 30\,kN}$

ΣZ: $-E_z^{①} + E_z^{②} + E_z^{③}$

$= 15 - 22{,}5 + 7{,}5 = 0$ (kontrola)

④ ΣX: $A_x = -C_x - D_x$

$\boxed{A_x = 30\,kN}$

① ΣX: $B_x + E_x^{①} = 0$ $\boxed{B_x = -30\,kN}$