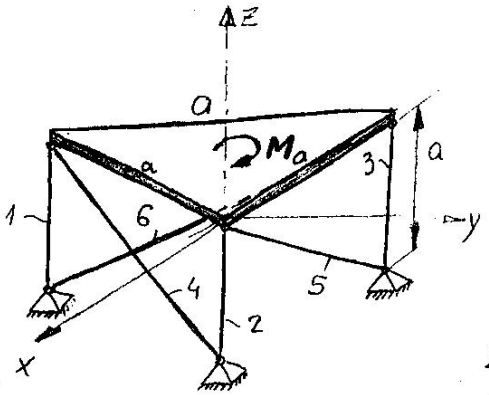
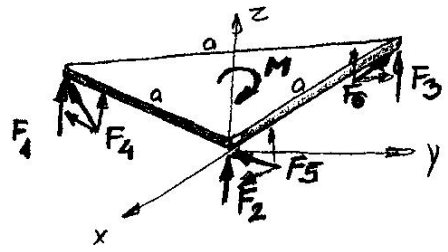
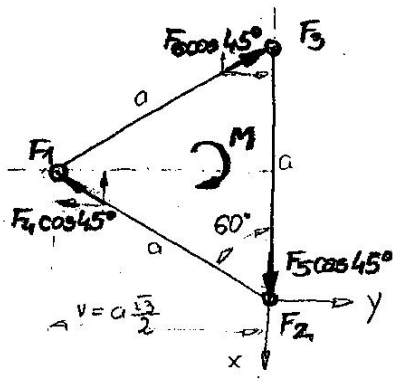
(pr)

Ploča u obliku jednakostraničnog trokuta stranice a poduprta je na 6 štapova. Štapovi 1, 2 i 3 su međusobno paralelni i dužine a. U ravnini ploče djeluje spreg čiji je moment M. Odrediti sile u svim štapovima uslijed djelovanja sprega.

Zadano: M, a







~JEDNADŽBE RAVNOTEŽE~

$\Sigma F_x = 0;\quad -F_4\cos 45°\cos 60° + F_5\cos 45° - F_6\cos 45°\cos 60° = 0 \quad \ldots (1)$

$\Sigma F_y = 0;\quad -F_4\cos 45°\sin 60° + F_6\cos 45°\sin 60° = 0 \quad \ldots (2)$

$\Sigma F_z = 0;\quad F_1 + F_2 + F_3 + F_4\sin 45° + F_5\sin 45° + F_6\sin 45° = 0 \quad \ldots (3)$

$\Sigma M_x = 0;\quad -F_1\left(\frac{a\sqrt{3}}{2}\right) - F_4\sin 45°\cdot\left(\frac{a\sqrt{3}}{2}\right) = 0 \quad \ldots (4)$

$\Sigma M_y = 0;\quad F_1\cdot\frac{a}{2} + F_3\cdot a + F_4\sin 45°\cdot\frac{a}{2} + F_6\sin 45°\cdot a = 0 \quad \ldots (5)$

$\Sigma M_z = 0;\quad -F_6\cos 45°\sin 60°\cdot a - M = 0 \quad \ldots (6)$

$-F_4\frac{\sqrt{2}}{2}\cdot\frac{1}{2} + F_5\frac{\sqrt{2}}{2} - F_6\frac{\sqrt{2}}{2}\cdot\frac{1}{2} = 0 \quad \ldots (1a)$

$-F_4\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2} + F_6\cdot\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2} = 0 \quad \ldots (2a)$

$F_1 + F_2 + F_3 + F_4\frac{\sqrt{2}}{2} + F_5\frac{\sqrt{2}}{2} + F_6\frac{\sqrt{2}}{2} = 0 \quad \ldots (3a)$

$-F_1 - F_4\cdot\frac{\sqrt{2}}{2} = 0 \quad \ldots (4a)$

$F_1\cdot\frac{1}{2} + F_3 + F_4\cdot\frac{\sqrt{2}}{2} + F_5\frac{\sqrt{2}}{2} + F_6\frac{\sqrt{2}}{2} = 0 \quad \ldots (5a)$

$-F_6\cdot\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2}a - M = 0 \quad \ldots (6a)$

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iz (6a) $F_6 = -\frac{4}{\sqrt{6}}\frac{M}{a}$

iz (2a) $F_4 = F_6 = -\frac{4}{\sqrt{6}}\frac{M}{a}$

iz (4a) $F_1 = -F_4\frac{\sqrt{2}}{2} = \frac{2}{\sqrt{3}}\frac{M}{a}$

iz (1a) $F_5 = \frac{F_6}{2} + \frac{F_4}{2} = -\frac{2}{\sqrt{6}}\frac{M}{a} - \frac{2}{\sqrt{6}}\frac{M}{a} = -\frac{4}{\sqrt{6}}\frac{M}{a}$

iz (5a) $F_3 = -\frac{F_1}{2} - F_4\frac{\sqrt{2}}{4} - F_6\frac{\sqrt{2}}{2} = -\frac{1}{\sqrt{3}}\frac{M}{a} + \frac{1}{\sqrt{3}}\frac{M}{a} + \frac{2}{\sqrt{3}}\frac{M}{a} = \frac{2}{\sqrt{3}}\frac{M}{a}$

iz (3a) $F_2 = -F_1 - F_3 - F_4\frac{\sqrt{2}}{2} - F_5\frac{\sqrt{2}}{2} - F_6\frac{\sqrt{2}}{2} = -\frac{2}{\sqrt{3}}\frac{M}{a} - \frac{2}{\sqrt{3}}\frac{M}{a} + \frac{2}{\sqrt{3}}\frac{M}{a} + \frac{2}{\sqrt{3}}\frac{M}{a} + \frac{2}{\sqrt{3}}\frac{M}{a} = \frac{2}{\sqrt{3}}\frac{M}{a}$

$F_1 = F_2 = F_3 = \frac{2}{\sqrt{3}}\frac{M}{a} \rightarrow 1{,}155\,\frac{M}{a}$

$F_4 = F_5 = F_6 = -\frac{4}{\sqrt{6}}\frac{M}{a} \rightarrow -1{,}633\,\frac{M}{a}$