TEHNIČKA MEHANIKA

Inženjerstvo zaštite životne sredine

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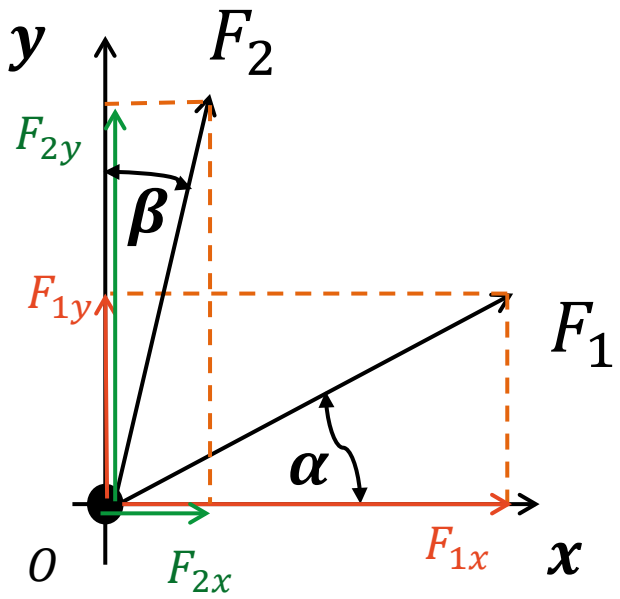
ANALITIČKI NAČIN ODREĐIVANJE REZULTANTE SISTEMA SUČELJENIH SILA

SUČELJENE SILE



$$F_{1x} = F_1 * cos\alpha \qquad F_{2x} = F_2 * sin\beta$$

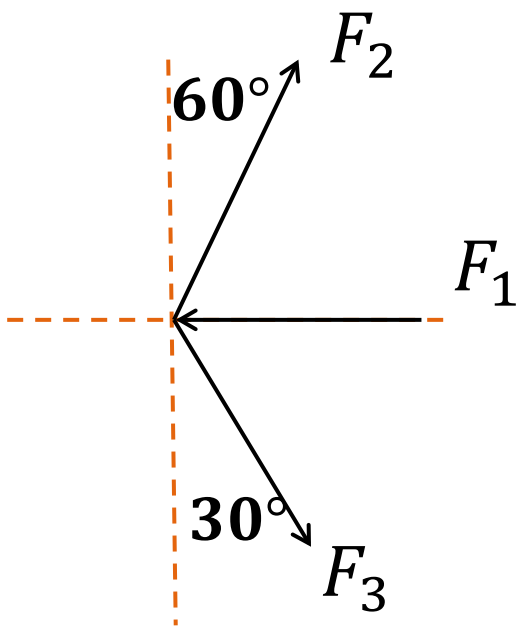
$$F_{1y} = F_1 * sin\alpha \qquad F_{2y} = F_2 * cos\beta$$

$$X_R = \sum_{i=1}^{n} X_i = F_{1x} + F_{2x} \qquad F_R = \sqrt{X_R^2 + Y_R^2}$$

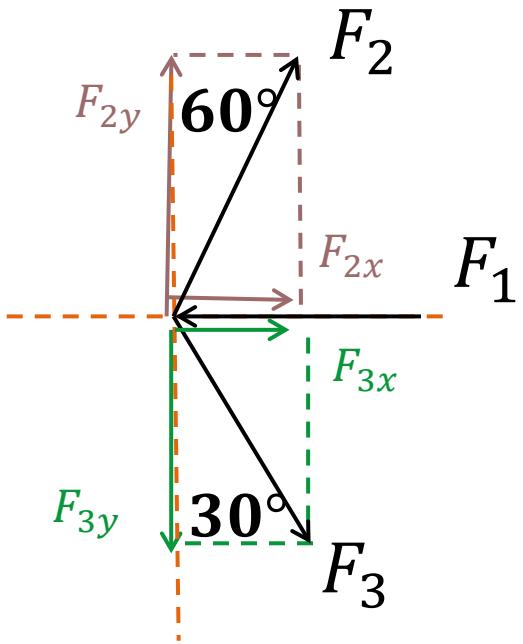
$$Y_R = \sum_{i=1}^{n} Y_i = F_{1y} + F_{2y} \qquad tg\alpha_R = \frac{Y_R}{X_R}$$

ZADATAK 1.

- Dat je sistem sila prikazan na slici. Odrediti intenzitete komponenti rezultante. $F_1 = 8\ N, F_2 = 12\ N\ i\ F_3 = 16N$.



ZADATAK 1.



$$F_R = \sqrt{X_R^2 + Y_R^2}$$

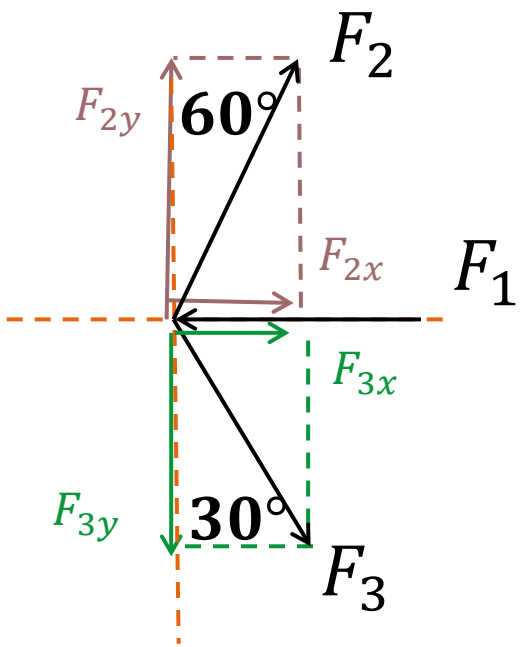
$$F_{2x} = F_2 * sin60 = 12 * sin60 = 10.39\ N$$

$$F_{2y} = F_2 * cos60 = 12 * cos60 = 6\ N$$

$$F_{3x} = F_3 * sin30 = 16 * sin30 = 8\ N$$

$$F_{3y} = F_3 * cos30 = 16 * cos30 = 13.86\ N$$

ZADATAK 1.



$$X_R = \sum_{i=1}^{n} X_i = F_{2x} + F_{3x} - F_1 \qquad Y_R = \sum_{i=1}^{n} Y_i = F_{2y} - F_{3y}$$

$$X_R = 10.39 + 8 - 8 \qquad Y_R = 6 - 13.86$$

$$X_R = 10.39N \qquad Y_R = -7{,}86\ N$$

$$F_R = \sqrt{X_R^2 + Y_R^2} = \sqrt{10.39^2 + (-7{,}86)^2} = 13.028\ N$$

$$tg\alpha_R = \frac{Y_R}{X_R} = \frac{-7{,}86}{10{,}39} = -0{,}7565$$

$$\alpha_R = \text{arctg}(-0{,}7565) = -37{,}1°$$

SISTEM SUČELJENIH SILA - RAVNOTEŽA

- Da bi obezbedili ravnotežu – sama sila koja deluje na telo mora biti jednaka nuli.

$$\sum_{i=1}^{n} F_i = 0$$

SISTEM SUČELJENIH SILA - RAVNOTEŽA

- ANALITIČKI USLOV RAVNOTEŽE

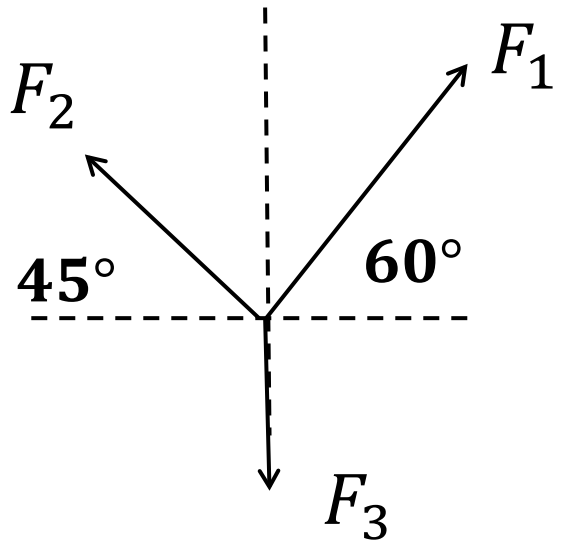
$$\sum_{i=1}^{n} F_i = 0 \longrightarrow \text{može se zameniti rezultantom}$$

$$F_R = 0 \longrightarrow X_R = 0 \quad Y_R = 0$$

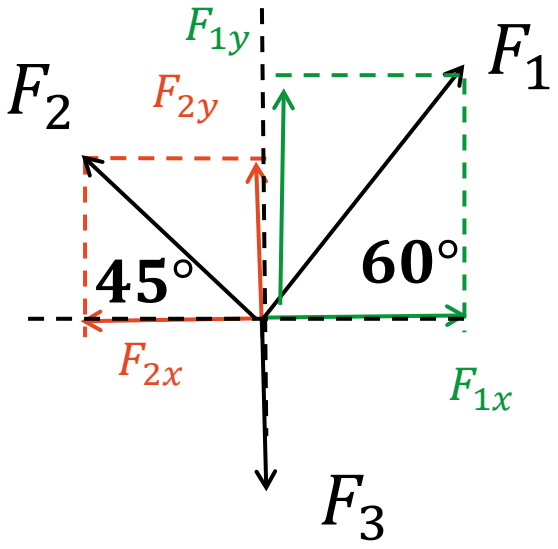
$$\sum_{i=1}^{n} X_i = 0 \qquad \sum_{i=1}^{n} Y_i = 0$$

ZADATAK 2.

- Odrediti intenzitet sila F_1 i F_2 ako je data sila $F_3 = 20\text{N}$.



ZADATAK 2.



$$F_{1x} = F_1 * cos60 = \frac{1}{2}F_1$$

$$F_{1y} = F_1 * sin60 = \frac{\sqrt{3}}{2}F_1$$

$$\sum_{i=1}^{n} X_i = 0$$

$$F_{1x} - F_{2x} = 0$$

$$\frac{1}{2}F_1 - \frac{\sqrt{2}}{2}F_2 = 0 \quad / * 2$$

$$F_1 - \sqrt{2}F_2 = 0$$

$$F_1 = \sqrt{2}F_2$$

$$F_{2x} = F_2 * cos45 = \frac{\sqrt{2}}{2}F_2$$

$$F_{2y} = F_2 * \sin 45 = \frac{\sqrt{2}}{2}F_2$$

$$\sum_{i=1}^{n} Y_i = 0$$

$$F_{1y} + F_{2y} - F_3 = 0$$

$$\frac{\sqrt{3}}{2}F_1 + \frac{\sqrt{2}}{2}F_2 - F_3 = 0 \quad / * 2$$

$$\sqrt{3}F_1 + \sqrt{2}F_2 - 2F_3 = 0$$

$$\sqrt{3}F_1 + F_1 - 2F_3 = 0$$

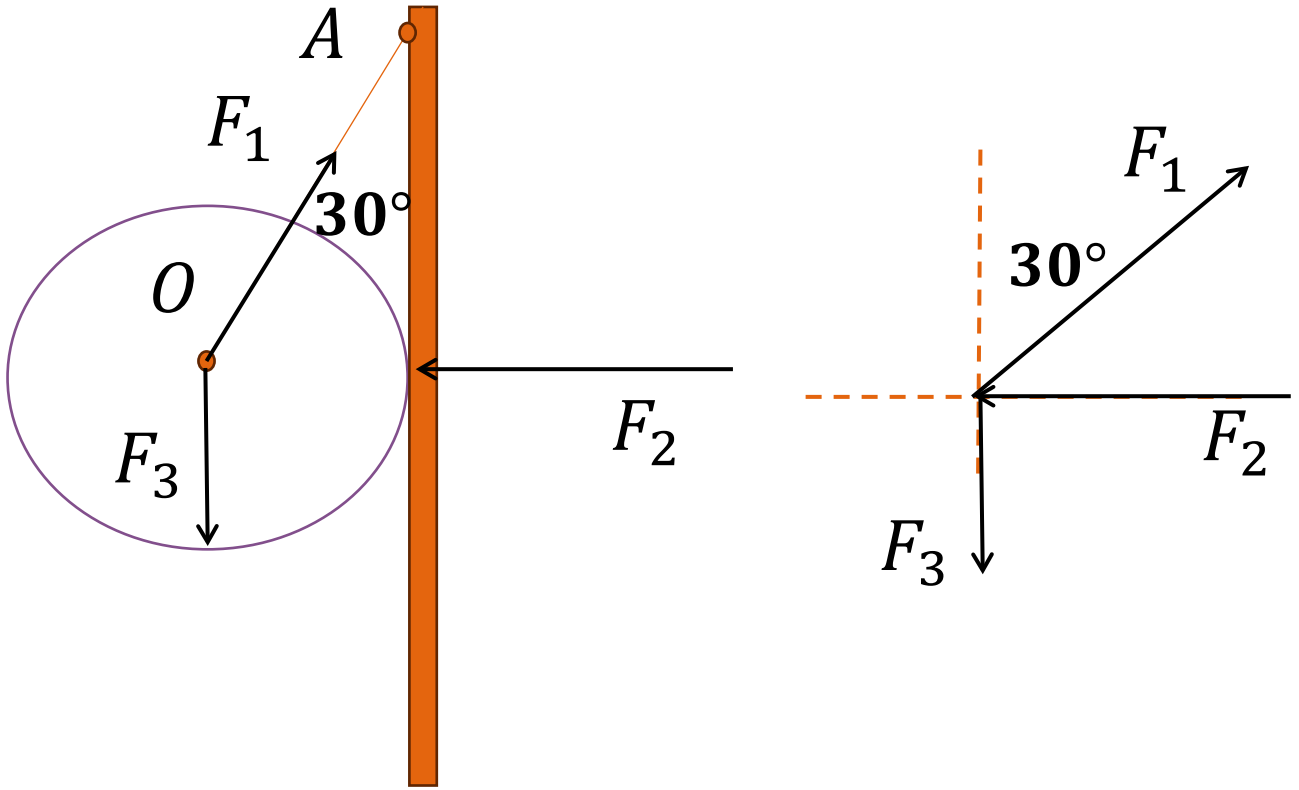
$$F_1 = 14.65N$$

$$F_2 = \frac{F_1}{\sqrt{2}}$$

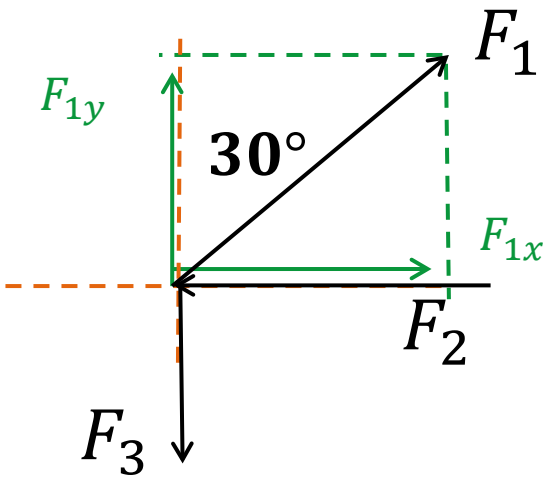
$$F_2 = 10.36N$$

ZADATAK 3.

- O vertikalni glatki zid AB oslonjena je kugla O, obešena o konac AC. Ugao koji konac zaklapa sa zidom je 30°, težina kugle je F_3=10N. Odrediti silu u koncu i pritisak kugle na zid.



ZADATAK 3.



$$F_{1x} = F_1 * sin30 = \frac{1}{2} F_1$$

$$F_{1y} = F_1 * cos30 = \frac{\sqrt{3}}{2} F_1$$

$$\sum_{i=1}^{n} X_i = 0$$

$$F_{1x} - F_2 = 0$$

$$\frac{1}{2} F_1 - F_2 = 0 \quad / * 2$$

$$F_1 - 2F_2 = 0$$

$$F_1 = 2F_2$$

$$F_2 = \frac{F_1}{2}$$

$$F_2 = 5.78N$$

$$\sum_{i=1}^{n} Y_i = 0$$

$$F_{1y} - F_3 = 0$$

$$\frac{\sqrt{3}}{2} F_1 - F_3 = 0 \quad / * 2$$

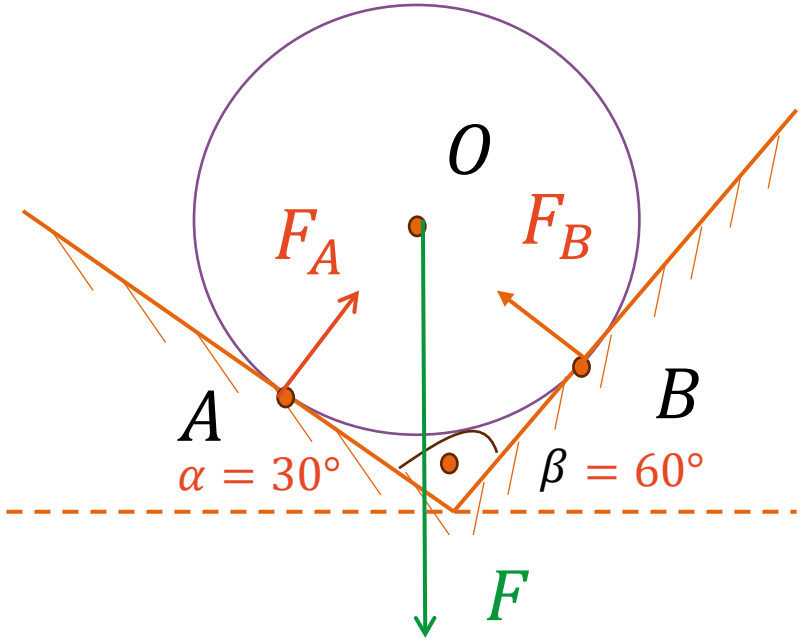
$$\sqrt{3} F_1 - 2 * 10 = 0$$

$$F_1 = \frac{20}{\sqrt{3}}$$

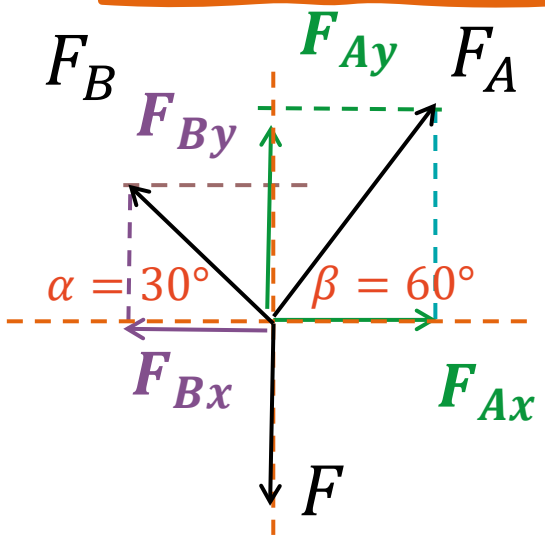
$$F_1 = 11.56N$$

ZADATAK 4.

- Kugla O težine $F = 60\ N$, oslanja se dvema tačkama D i E o dve glatke strme ravni AB i BC. Ravni su nagnute pod uglovima $\alpha\ i\ \beta = 60°$, prema horizontali. Odrediti otpore ravni u tačkama D i E, ako ravni stoje jedna na drugu uspravno.



ZADATAK 4.



$$F_{Ax} = F_A * cos60 = F_A \frac{1}{2}$$

$$F_{Ay} = F_A * sin60 = F_A \frac{\sqrt{3}}{2}$$

$$F_{Bx} = F_B * cos30 = F_B \frac{\sqrt{3}}{2}$$

$$F_{By} = F_B * sin30 = F_B \frac{1}{2}$$

$$\sum_{i=1}^{n} X_i = 0$$

$$F_{Ax} - F_{BX} = 0$$

$$F_A \frac{1}{2} - F_B \frac{\sqrt{3}}{2} = 0 \quad / * 2$$

$$F_A - F_B\sqrt{3} = 0$$

$$F_A = \sqrt{3}F_B$$

$$\sum_{i=1}^{n} Y_i = 0$$

$$F_{Ay} + F_{By} - F = 0$$

$$F_A \frac{\sqrt{3}}{2} + F_B \frac{1}{2} - F = 0 \quad / * 2$$

$$F_A\sqrt{3} + F_B - 120 = 0$$

$$F_B\sqrt{3} * \sqrt{3} + F_B - 120 = 0$$

$$F_B = 30N$$

$$F_A = 30\sqrt{3}\ N$$

HVALA NA PAŽNJI!

PITANJA?