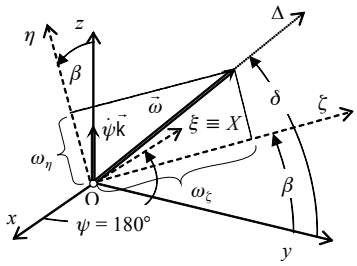


Slika 5.12 *Smjerovi kutnih brzina uz primjer 5.1*

b) Kutno ubrzanje diska

$$\vec{\alpha} = \dot{\vec{\omega}} = \dot{\omega}_x \vec{\imath} + \dot{\omega}_y \vec{\jmath} + \dot{\omega}_z \vec{k} = \dot{\psi}\vec{k} \times \vec{\omega} = \dot{\psi}\vec{k} \times \left(\dot{\omega}_y \vec{\jmath} + \dot{\omega}_z \vec{k}\right),$$

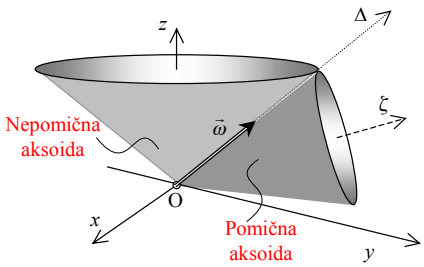
$$\vec{\alpha} = \dot{\psi}\vec{k} \times \dot{\omega}_y \vec{\jmath} + \dot{\psi}\vec{k} \times \dot{\omega}_z \vec{k} = -\dot{\psi} \cdot \dot{\omega}_y \vec{\imath} + \vec{0} = -4\pi^2 \sqrt{3}\vec{\imath} \ ,$$

$$\alpha = \alpha_x = -68{,}38 \text{ rad/s}^2 \ .$$

c) Nepomična i pomična aksoida, slika 5.13.

Nepomična je aksoida uspravni kružni stožac s osi z i izvodnicom osi Δ. Pomična je aksoida uspravni kružni stožac s osi ζ i izvodnicom osi Δ. Nagib osi Δ određen je kutom δ:

$$\tan\delta = \frac{\omega_z}{\omega_y} = \frac{2\pi\sqrt{3}}{4\pi} = \frac{\sqrt{3}}{2} \quad \Rightarrow \quad \delta = 40{,}89° \ .$$



Slika 5.13 *Pomična i nepomična aksoida uz primjer 5.1*

d) Brzina točke A diska

Iznos je vektora položaja točke A: $r = \sqrt{0{,}25^2 + 0{,}125^2} = 0{,}27951 \text{ m}$.

Brzina je točke A diska:

$\vec{v}_A = \vec{\omega} \times \vec{r}$, ovdje $\vec{r}$ leži u y,z-koordinatnom sustavu: $\vec{r} = r\cos(\gamma+\beta)\vec{\jmath} + r\sin(\gamma+\beta)\vec{k}$,

$$\vec{v}_A = \left[\omega_y \vec{\jmath} + \omega_z \vec{k}\right] \times \left[r\cos(\gamma+\beta)\vec{\jmath} + r\sin(\gamma+\beta)\vec{k}\right] = \omega_y r \sin(\gamma+\beta)\vec{\imath} - \omega_z r\cos(\gamma+\beta)\vec{\imath} \ .$$

Nakon uvrštavanja:

$$\vec{v}_A = \left(2\pi\sqrt{3} \cdot 0{,}27951 \cdot \sin 56{,}565° - 4\pi \cdot 0{,}27951 \cdot \cos 56{,}565°\right)\vec{\imath} \ ,$$

$$\vec{v}_A = \left(2{,}5385 - 1{,}9353\right)\vec{\imath} = 0{,}6032\vec{\imath} \ ,$$

$$v_A = v_{Ax} = 0{,}6032 \text{ m/s} \ .$$

e) Ubrzanje točke A diska

$$\vec{a}_A = \vec{\alpha} \times \vec{r} + \vec{\omega} \times \vec{v}_A = -68{,}38\vec{\imath} \times \left(0{,}15401\vec{\jmath} + 0{,}23325\vec{k}\right) + \left(10{,}883\vec{\jmath} + 12{,}566\vec{k}\right) \times 0{,}6032\vec{\imath} \ ,$$

$$\vec{a}_A = -10{,}53\vec{k} + 15{,}95\vec{\jmath} \text{ -}6{,}5651\vec{k} + 7{,}5798\vec{\jmath} = 23{,}53\vec{\jmath} - 17{,}095\vec{k} \ ,$$

$$a_A = \sqrt{a_{Ay}^2 + a_{Az}^2} = \sqrt{23{,}53^2 + 17{,}095^2} = 29{,}08 \text{ m/s}^2 \ .$$