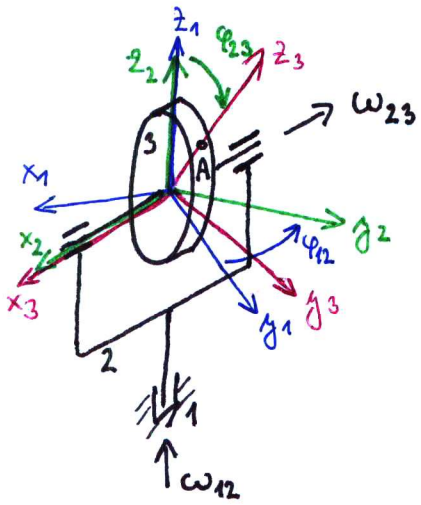


1 ... rám - nepohyblivý souřad. systém
2 ... „ vidlice "
3 ... setrvačník

Dáno: r ... poloměr
ω_{12} = konst., ω_{23} = konst.

Určete: ω_{13}, α_{13}, rychlost v_A a zrychlení a_A bodu A

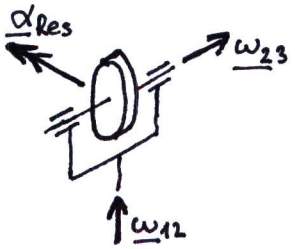
Řešení:

$\underline{\omega_{13}} = \underline{\omega_{12}} + \underline{\omega_{23}}$ $\qquad \omega_{12} = konst \rightarrow \alpha_{12} = \emptyset, \quad \omega_{23} = konst \rightarrow \alpha_{23} = \emptyset$

$\underline{\alpha_{13}} = \underline{\alpha_{12}} + \underline{\alpha_{23}} + \underline{\alpha_{Res}}$

$$\Rightarrow \underline{\omega_{13}} = \begin{bmatrix} -\omega_{23}\cdot\cos\varphi_{12} \\ -\omega_{23}\cdot\sin\varphi_{12} \\ \omega_{12} \end{bmatrix}$$

$$\underline{\alpha_{13}} = \dot{\underline{\omega}}_{13} = \begin{bmatrix} \omega_{12}\cdot\omega_{23}\cdot\sin\varphi_{12} \\ -\omega_{12}\cdot\omega_{23}\cdot\cos\varphi_{12} \\ \emptyset \end{bmatrix}$$



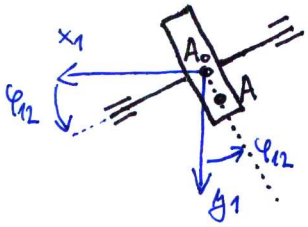
$\underline{\alpha_{Res}} \perp \underline{\omega_{12}}$

$\underline{\alpha_{Res}} \perp \underline{\omega_{23}}$

$\underline{\alpha_{13}} = \underline{\alpha_{Res}} = \omega_{12} \times \omega_{23}$

$|\underline{\alpha_{Res}}| = |\omega_{12}|\cdot|\omega_{23}|\cdot \underbrace{\sin\frac{\pi}{2}}_{1}$

Bod A:



$x_A = -r\cdot\sin\varphi_{23}\cdot\sin\varphi_{12}$

$y_A = r\cdot\sin\varphi_{23}\cdot\cos\varphi_{12}$

$z_A = r\cdot\cos\varphi_{23}$

$v_{Ax} = -r\cdot\omega_{23}\cdot\cos\varphi_{23}\cdot\sin\varphi_{12} - r\cdot\omega_{12}\cdot\sin\varphi_{23}\cdot\cos\varphi_{12}$

$v_{Ay} = r\cdot\omega_{23}\cdot\cos\varphi_{23}\cdot\cos\varphi_{12} - r\cdot\omega_{12}\cdot\sin\varphi_{23}\cdot\sin\varphi_{12}$

$v_{Az} = -r\cdot\omega_{23}\cdot\sin\varphi_{23}$

$$\rightarrow v_A = \sqrt{v_{Ax}^2 + v_{Ay}^2 + v_{Az}^2} = \sqrt{r^2\cdot\omega_{23}^2 + r^2\cdot\omega_{12}^2\cdot\sin^2\varphi_{12}}$$

$a_{Ax} = r\cdot\omega_{23}^2\cdot\sin\varphi_{23}\cdot\sin\varphi_{12} - 2\cdot r\cdot\omega_{12}\omega_{23}\cdot\cos\varphi_{23}\cdot\cos\varphi_{12} + r\cdot\omega_{12}^2\cdot\sin\varphi_{23}\cdot\sin\varphi_{12}$

$a_{Ay} = -r\cdot\omega_{23}^2\cdot\sin\varphi_{23}\cdot\cos\varphi_{12} - 2\cdot r\cdot\omega_{12}\cdot\omega_{23}\cdot\cos\varphi_{23}\cdot\sin\varphi_{12} - r\cdot\omega_{12}^2\cdot\sin\varphi_{23}\cdot\cos\varphi_{12}$

$a_{Az} = -r\cdot\omega_{23}^2\cdot\cos\varphi_{23}$

$$\rightarrow a_A = \sqrt{a_{Ax}^2 + a_{Ay}^2 + a_{Az}^2}$$