Eulerjevi koti.
φ je kot precesije:

$$R_\varphi = \begin{bmatrix} \cos\varphi & \sin\varphi & 0 \\ -\sin\varphi & \cos\varphi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

θ je kot nutacije:

$$R_\theta = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix}$$

ψ je kot zasuka:

$$R_\psi = \begin{bmatrix} \cos\psi & \sin\psi & 0 \\ -\sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Vrtenje telesa tedaj opišemo kot

$$\overrightarrow{\omega} = \dot{\varphi}\widehat{k} + \dot{\theta}\widehat{x}'' + \dot{\psi}\widehat{k}' = \omega'_x\widehat{x}' + \omega'_y\widehat{y}' + \omega'_z\widehat{k}'$$

Izraziti moramo bazne vektorje ($\widehat{k}$, $\widehat{x}''$):

$$k = R_\psi R_\theta R_\varphi \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = ... = \begin{bmatrix} \sin\psi\sin\theta \\ \cos\psi\sin\theta \\ \cos\theta \end{bmatrix}$$

$$\widehat{x}'' = R_\psi R_\theta \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = ... = \begin{bmatrix} \cos\psi \\ -\sin\psi \\ 0 \end{bmatrix}$$

$$\omega'_x = \dot{\varphi}\sin\psi\sin\theta + \dot{\theta}\cos\psi$$

$$\omega'_y = \dot{\varphi}\cos\psi\sin\theta - \dot{\theta}\sin\psi$$

$$\omega'_z = \dot{\varphi}\cos\theta + \dot{\psi}$$

Kinetična energija simetrične vrtavke.

$$T = \frac{1}{2}\overrightarrow{\omega}\underline{\underline{J}}\overrightarrow{\omega}$$

$$\underline{\underline{J}} = \begin{bmatrix} J_\parallel & & \\ & J_\perp & \\ & & J_\perp \end{bmatrix}$$

Stožec na nagnjeni podlagi.

$$J_x = J_y = \int (y^2 + z^2)\,\mathrm{d}m$$

Uporabimo cilindrične koordinate:

$$x = r\cos\varphi, \quad y = r\sin\varphi, \quad \mathrm{d}V = r\,\mathrm{d}r\,\mathrm{d}\varphi\,\mathrm{d}z$$

$$J_x = \int_0^{2\pi}\int_0^R\int_0^h \rho\left(r^2\sin^2\varphi + z^2\right) r\,\mathrm{d}r\,\mathrm{d}\varphi\,\mathrm{d}z$$