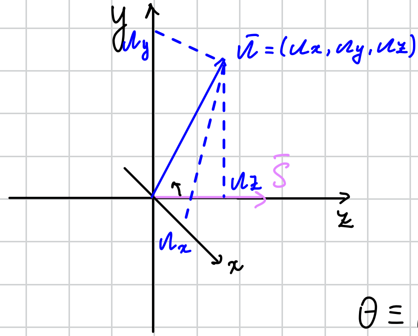
3) $\bar{\Omega} = (\Omega x, \Omega y, \Omega z)$

$\bar{S} = (0, 0, S_z)$

$$\begin{pmatrix} S_x' \\ S_y' \\ S_z' \end{pmatrix} = M \begin{pmatrix} S_x \\ S_y \\ S_z \end{pmatrix}$$



$\theta \equiv \Omega t$

$$M\left(\frac{\bar{\Omega}}{|\bar{\Omega}|}, \theta\right) = \begin{pmatrix} \cos\theta + (1-\cos\theta)x^2 & (1-\cos\theta)xy - \sin\theta \cdot z & (1-\cos\theta)xz + (\sin\theta)y \\ (1-\cos\theta)yx + (\sin\theta)z & \cos\theta + (1-\cos\theta)y^2 & (1-\cos\theta)yz - (\sin\theta)x \\ (1-\cos\theta)zx - (\sin\theta)y & (1-\cos\theta)zy + (\sin\theta)x & \cos\theta + (1-\cos\theta)z^2 \end{pmatrix}$$

$$S_x' = (\cos\theta + (1-\cos\theta)x^2)S_x + ((1-\cos\theta)xy - \sin\theta \cdot z)S_y + ((1-\cos\theta)xz + (\sin\theta)y)S_z$$

$$S_y' = ((1-\cos\theta)yx + (\sin\theta)z)S_x + (\cos\theta + (1-\cos\theta)y^2)S_y + ((1-\cos\theta)yz - (\sin\theta)x)S_z$$

$$S_z' = ((1-\cos\theta)zx - (\sin\theta)y)S_x + ((1-\cos\theta)zy + (\sin\theta)x)S_y + (\cos\theta + (1-\cos\theta)z^2)S_z$$

$S_x = 0, \; S_y = 0, \; S_z = 1$ $\qquad |\bar{\Omega}| = \sqrt{\Omega x^2 + \Omega y^2 + \Omega z^2}$

$\bar{\Omega} = (\Omega x, \Omega y, \Omega z)$

$$\frac{\bar{\Omega}}{|\bar{\Omega}|} = \left\{ \overset{\equiv x}{\frac{\Omega x}{\Omega}}, \overset{\equiv y}{\frac{\Omega y}{\Omega}}, \overset{\equiv z}{\frac{\Omega z}{\Omega}} \right\}$$ – единичный вектор, задающий ось вращение

$S_x' = (1-\cos\theta)xz + (\sin\theta)y$

$S_y' = (1-\cos\theta)yz - (\sin\theta)x$ $\qquad \overset{\theta = \Omega t}{\Longrightarrow}$

$S_z' = \cos\theta + (1-\cos\theta)z^2$

?

$$S_x' = \frac{\Omega x \Omega z}{\Omega^2}(1-\cos\Omega t) + \frac{\Omega y}{\Omega}\sin\Omega t$$

$$S_y' = \frac{\Omega y \Omega z}{\Omega^2}(1-\cos\Omega t) - \frac{\Omega x}{\Omega}\sin\Omega t$$

$$S_z' = \frac{\Omega z^2}{\Omega^2}(1-\cos\Omega t) + \cos\Omega t$$

$$\frac{d\bar{S}}{dt} = \bar{S} \times \bar{\Omega} = \begin{vmatrix} \bar{e}_x & \bar{e}_y & \bar{e}_z \\ S_x' & S_y' & S_z' \\ \Omega x & \Omega y & \Omega z \end{vmatrix} \Rightarrow$$

$$\Rightarrow \frac{d\bar{S}_x}{dt} = S_y' \Omega_z - \Omega_y S_z' = \cancel{\frac{\Omega_y \Omega_z^2}{\Omega^2}(1-\cos\Omega t)} - \frac{\Omega_x}{\Omega}\sin\Omega t \cdot \Omega_z -$$

$$-\left(\cancel{\Omega_y \frac{\Omega_z^2}{\Omega^2}(1-\cos\Omega t)} + \cos\Omega t \cdot \Omega_y\right) = -\frac{\Omega_x \Omega_z}{\Omega}\sin\Omega t - \Omega_y \cos\Omega t$$

$$\frac{d\bar{S}_y}{dt} = -\left(S_x' \Omega_z - \Omega_x S_z'\right) = \Omega_x S_z' - S_x' \Omega_z =$$

$$= \Omega_x\left(\frac{\Omega_z^2}{\Omega^2}(1-\cos\Omega t) + \cos\Omega t\right) - \Omega_z\left(\frac{\Omega_x \Omega_z}{\Omega^2}(1-\cos\Omega t) + \frac{\Omega_y}{\Omega}\sin\Omega t\right) =$$

$$= \cancel{\frac{\Omega_x \Omega_z^2}{\Omega^2}(1-\cos\Omega t)} + \Omega_x \cos\Omega t - \cancel{\frac{\Omega_x \Omega_z^2}{\Omega^2}(1-\cos\Omega t)} -$$

$$- \frac{\Omega_z \Omega_y}{\Omega}\sin\Omega t = \Omega_x \cos\Omega t - \frac{\Omega_z \Omega_y}{\Omega}\cdot\sin\Omega t$$

$$\frac{d\bar{S}_z}{dt} = S_x' \Omega_y - \Omega_x S_y' = \left(\cancel{\frac{\Omega_x \Omega_z}{\Omega^2}(1-\cos\Omega t)} + \frac{\Omega_y}{\Omega}\sin\Omega t\right)\Omega_y -$$

$$- \Omega_x\left(\cancel{\frac{\Omega_y \Omega_z}{\Omega^2}(1-\cos\Omega t)} - \frac{\Omega_x}{\Omega}\sin\Omega t\right) = \frac{\Omega_y^2}{\Omega}\sin\Omega t + \frac{\Omega_x^2}{\Omega}\sin\Omega t$$