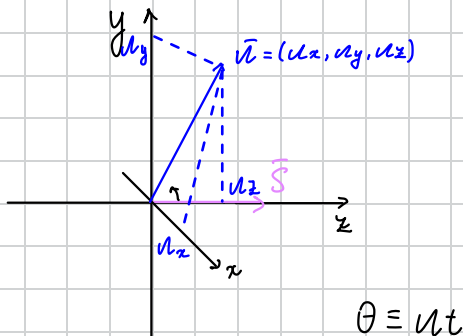


$$3) \vec{n} = (n_x, n_y, n_z)$$

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

$$\begin{pmatrix} S'_x \\ S'_y \\ S'_z \end{pmatrix} = M \begin{pmatrix} S_x \\ S_y \\ S_z \end{pmatrix}$$



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

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

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

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

$$S_x = 0, S_y = 0, S_z = 1$$

$$|\vec{n}| = \sqrt{n_x^2 + n_y^2 + n_z^2}$$

$$\vec{n} = (n_x, n_y, n_z)$$

$$\frac{\vec{n}}{|\vec{n}|} = \left\{ \frac{n_x}{n}, \frac{n_y}{n}, \frac{n_z}{n} \right\} - \text{единичный вектор, задающий ось вращения}$$

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

$$S'_x = \frac{n_x n_z}{n^2} (1 - \cos nt) + \frac{n_y}{n} \sin nt$$

$$S'_y = (1 - \cos \theta) yz - (\sin \theta) x$$

$$\theta = nt \Rightarrow$$

$$S'_y = \frac{n_y n_z}{n^2} (1 - \cos nt) - \frac{n_x}{n} \sin nt$$

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

$$S'_z = \frac{n_z^2}{n^2} (1 - \cos nt) + \cos nt$$

$$\frac{d\vec{S}}{dt} = \vec{S} \times \vec{n} = \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ S'_x & S'_y & S'_z \\ n_x & n_y & n_z \end{vmatrix} \Rightarrow$$

$$\Rightarrow \frac{d\bar{S}_x}{dt} = S'_y \mathcal{U}_z - \mathcal{U}_y S'_z = \frac{\mathcal{U}_y \mathcal{U}_z^2}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) - \frac{\mathcal{U}_x}{\mathcal{U}} \sin \mathcal{U}t \cdot \mathcal{U}_z -$$

$$\left(\mathcal{U}_y \frac{\mathcal{U}_z^2}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) + \cos \mathcal{U}t \cdot \mathcal{U}_y \right) = -\frac{\mathcal{U}_x \mathcal{U}_z}{\mathcal{U}} \sin \mathcal{U}t - \mathcal{U}_y \cos \mathcal{U}t$$

$$\frac{d\bar{S}_y}{dt} = - (S'_x \mathcal{U}_z - \mathcal{U}_x S'_z) = \mathcal{U}_x S'_z - S'_x \mathcal{U}_z =$$

$$= \mathcal{U}_x \left(\frac{\mathcal{U}_z^2}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) + \cos \mathcal{U}t \right) - \mathcal{U}_z \left(\frac{\mathcal{U}_x \mathcal{U}_z}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) + \frac{\mathcal{U}_y}{\mathcal{U}} \sin \mathcal{U}t \right) =$$

$$= \frac{\mathcal{U}_x \mathcal{U}_z^2}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) + \mathcal{U}_x \cos \mathcal{U}t - \frac{\mathcal{U}_x \mathcal{U}_z^2}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) -$$

$$- \frac{\mathcal{U}_z \mathcal{U}_y}{\mathcal{U}} \sin \mathcal{U}t = \mathcal{U}_x \cos \mathcal{U}t - \frac{\mathcal{U}_z \mathcal{U}_y}{\mathcal{U}} \sin \mathcal{U}t$$

$$\frac{d\bar{S}_z}{dt} = S'_x \mathcal{U}_y - \mathcal{U}_x S'_y = \left(\frac{\mathcal{U}_x \mathcal{U}_z}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) + \frac{\mathcal{U}_y}{\mathcal{U}} \sin \mathcal{U}t \right) \mathcal{U}_y -$$

$$- \mathcal{U}_x \left(\frac{\mathcal{U}_y \mathcal{U}_z}{\mathcal{U}^2} (1 - \cos \mathcal{U}t) - \frac{\mathcal{U}_x}{\mathcal{U}} \sin \mathcal{U}t \right) = \frac{\mathcal{U}_y^2}{\mathcal{U}} \sin \mathcal{U}t + \frac{\mathcal{U}_x^2}{\mathcal{U}} \sin \mathcal{U}t$$