Drehung um eine Gerade durch den Ursprung

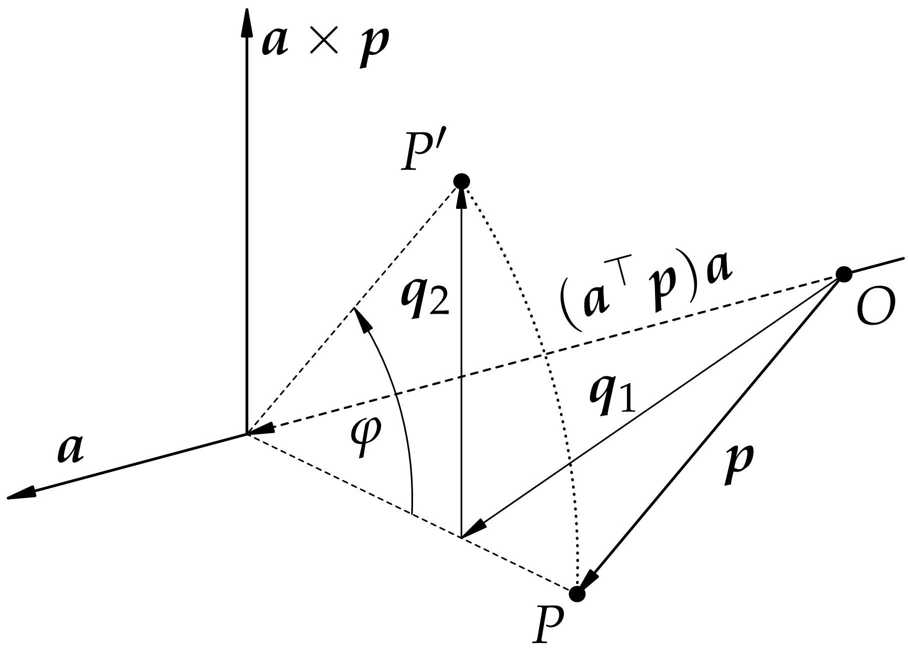
$$g : \left\{ \boldsymbol{p} = t \cdot \boldsymbol{a} \;:\; \boldsymbol{a} = \begin{bmatrix} a_x \\ a_y \\ a_z \end{bmatrix},\; t \in \mathbb{R},\; a_x^2 + a_y^2 + a_z^2 = 1 \right\}$$

Drehwinkel: φ mit $c = \cos\varphi,\; s = \sin\varphi$

$$\boldsymbol{T} = \begin{bmatrix} c + (1-c)a_x^2 & (1-c)a_x a_y - s a_z & (1-c)a_z a_x + s a_y \\ (1-c)a_x a_y + s a_z & c + (1-c)a_y^2 & (1-c)a_y a_z - s a_x \\ (1-c)a_z a_x - s a_y & (1-c)a_y a_z + s a_x & c + (1-c)a_z^2 \end{bmatrix}$$

$$= c\boldsymbol{I} + (1-c)\boldsymbol{a}\boldsymbol{a}^\top + s \begin{bmatrix} 0 & -a_z & a_y \\ a_z & 0 & -a_x \\ -a_y & a_x & 0 \end{bmatrix}$$

$$\boldsymbol{T} \cdot \boldsymbol{p} \;=\; c \cdot \boldsymbol{p} + (1-c)\boldsymbol{a}\boldsymbol{a}^\top \boldsymbol{p} + s(\boldsymbol{a} \times \boldsymbol{p})$$



$$\begin{aligned} \boldsymbol{q}_1 &= \cos\varphi \cdot \boldsymbol{p} + (1-\cos\varphi)\boldsymbol{a}^\top \boldsymbol{p} \cdot \boldsymbol{a} \\ &= \boldsymbol{a}^\top \boldsymbol{p} \cdot \boldsymbol{a} + \cos\varphi \cdot (\boldsymbol{p} - (\boldsymbol{a}^\top \boldsymbol{p})\boldsymbol{a}) \\ \boldsymbol{q}_2 &= \sin\varphi \cdot (\boldsymbol{a} \times \boldsymbol{p}) \end{aligned}$$