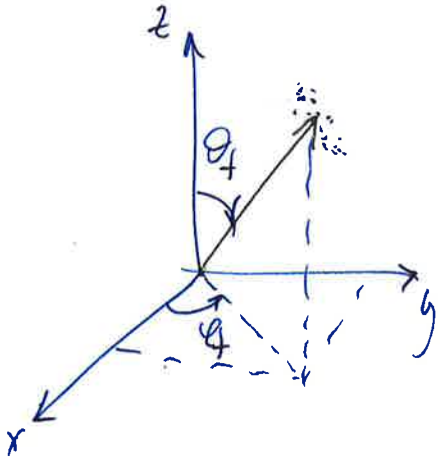

$$d_i = \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix}$$

$$d_f = R(\varphi_f, \hat{z})\, R(\theta_f, \hat{y})\, d_i$$

$$= \begin{pmatrix} \cos\varphi_f & -\sin\varphi_f & 0 \\ \sin\varphi_f & \cos\varphi_f & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos\theta_f & 0 & \sin\theta_f \\ 0 & 1 & 0 \\ -\sin\theta_f & 0 & \cos\theta_f \end{pmatrix} \begin{pmatrix} t_x \\ t_y \\ t_z \end{pmatrix}$$

$$= \begin{pmatrix} \cos\varphi_f & -\sin\varphi_f & 0 \\ \sin\varphi_f & \cos\varphi_f & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos\theta_f\, t_x + \sin\theta_f\, t_z \\ t_y \\ -\sin\theta_f\, t_x + \cos\theta_f\, t_z \end{pmatrix}$$

$\cos\vartheta$ -

$$= \begin{pmatrix} \cos\varphi_f \cdot \left[\cos\theta_f\, t_x + \sin\theta_f\, t_z\right] - \sin\varphi_f\, t_y \\ \sin\varphi_f \left[\cos\theta_f\, t_x + \sin\theta_f\, t_z\right] + \cos\varphi_f\, t_y \\ -\sin\theta_f\, t_x + \cos\theta_f\, t_z \end{pmatrix} \equiv \begin{pmatrix} t_x' \\ t_y' \\ t_z' \end{pmatrix}$$