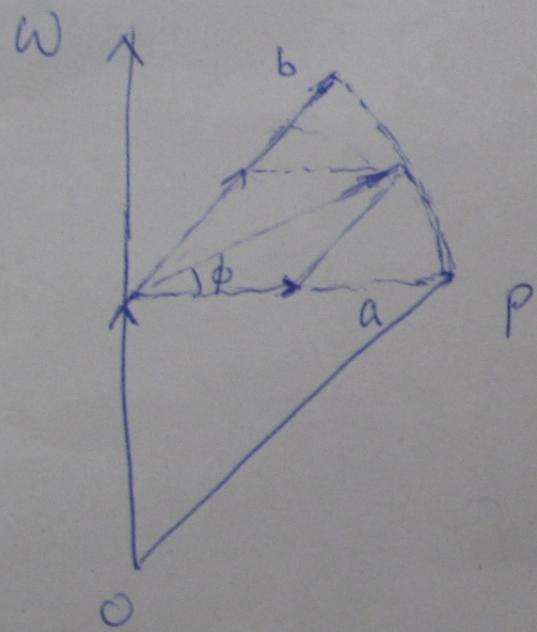


Alternative Representations

- Specify the axis and the angle (OpenGL method)
 - Hard to compose multiple rotations
 - Axis ω , angle θ

$\omega_1, \omega_2, \omega_3$
 P_1, P_2, P_3

$$\hat{\omega} = \frac{\omega}{|\omega|}$$



~~$$P \cdot \hat{\omega} \hat{\omega}$$~~

$$a = P - (P \cdot \hat{\omega}) \hat{\omega}$$

$$b = \hat{\omega} \times a = \hat{\omega} \times (P - (P \cdot \hat{\omega}) \hat{\omega})$$

} = same length

$$P' = a \cos \theta + b \sin \theta + (P \cdot \hat{\omega}) \hat{\omega}$$

$$= (P - (\hat{\omega} \hat{\omega}^T) P) \cos \theta + \hat{\omega} \times P \sin \theta + (\hat{\omega} \hat{\omega}^T) P$$

$$= \cos \theta I + (1 - \hat{\omega} \hat{\omega}^T) \cos \theta + [\hat{\omega}]_x P \sin \theta$$

~~$$= I + \hat{\omega} \hat{\omega}^T \cos \theta + [\hat{\omega}]_x P \sin \theta$$~~

$$[\hat{\omega}]_x = \begin{bmatrix} 0 & -\omega_z & \omega_y \\ \omega_z & 0 & -\omega_x \\ -\omega_y & \omega_x & 0 \end{bmatrix}$$

$\cos \theta I$