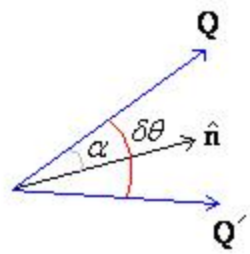

We can write $\mathbf{Q}'$ in terms of $\mathbf{Q}$ as approximately

$$\begin{aligned}\mathbf{Q}' &\approx \mathbf{Q} + (Q\sin\alpha)\delta\theta(\text{in direction of } \hat{\mathbf{n}}\times\mathbf{Q}) \\ &\approx \mathbf{Q} + |\hat{\mathbf{n}}\times\mathbf{Q}|(\text{in direction of } \hat{\mathbf{n}}\times\mathbf{Q})\delta\theta \\ &\approx \mathbf{Q} + \hat{\mathbf{n}}\times\mathbf{Q}\delta\theta \\ &\approx \mathbf{Q} + \delta\boldsymbol{\theta}\times\mathbf{Q}\end{aligned}$$

This means that we can express the derivative of this vector as:

$$\frac{\mathbf{Q}'-\mathbf{Q}}{dt} = \frac{\delta\boldsymbol{\theta}\times\mathbf{Q}}{dt}$$

$$\frac{d\mathbf{Q}}{dt} = \frac{\delta\boldsymbol{\theta}}{dt}\times\mathbf{Q}$$

and so we have:

$$\frac{d\mathbf{Q}}{dt} = \boldsymbol{\Omega}\times\mathbf{Q}$$ rate of change of vector rotating at constant rate $\boldsymbol{\omega}$