$$\times \quad \frac{R^{n+1} - R^n}{\Delta t} = (\omega^*)^n R^n$$

$$R^{n+1} = R^n + \Delta t\,(\omega^*)^n R^n \leftarrow = \underbrace{\left(\delta + \Delta t\,(\omega^n)^*\right)}_{\text{replace with rotation}} R^n$$

(identity)

$$= R_e^{n+1} + O(\Delta t^2)$$

replace with $R^{n+1} = g(\Delta t\,\omega^n)\,R^n$

$$\rightarrow g(u)\,g(u)^T = \delta$$

$$g(\Delta t\,u) = \delta + \Delta t\,u^* + O(\Delta t^2)$$

$$g(u) = \exp(u^*) = \delta + u^* + \frac{1}{2}(u^*)^2 + \frac{1}{6}(u^*)^3 + \frac{1}{24}(u^*)^4 + \cdots$$

$$\boxed{g(u) = \delta + (\sin\theta)\,z^* + (1-\cos\theta)(z^*)^2}$$

$$\boxed{\theta = \|u\| \quad z = \frac{u}{\|u\|}}$$

$$e^x = 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \cdots$$

$$\sin\theta \approx \theta - \frac{1}{6}\theta^3 + \frac{1}{120}\theta^5 - \cdots$$

$$g(\Delta t\,\omega) = \delta + \sin\|\Delta t\,\omega\| \left(\frac{\Delta t\,\omega}{\|\Delta t\,\omega\|}\right)^* + (1 - \cos\|\Delta t\,\omega\|)\left[\left(\frac{\Delta t\,\omega}{\|\Delta t\,\omega\|}\right)^*\right]^2$$

$$\approx \delta + \Delta t\,\omega^* + O(\Delta t^3) + O(\Delta t^4)$$

$$\cos\theta \approx 1 - \frac{1}{2}\theta^2 + \frac{1}{24}\theta^4 - \cdots$$