Integration of $\dot{R} = RS(\omega)$

Definition of quaternion q in terms of Euler angles θ_x, θ_y, θ_z:

$$
\begin{aligned}
q_0 &= \cos(\frac{\theta_x}{2}) * \cos(\frac{\theta_y}{2}) * \cos(\frac{\theta_z}{2}) + \sin(\frac{\theta_x}{2}) * \sin(\frac{\theta_y}{2}) * \sin(\frac{\theta_z}{2}) && (1) \\
q_1 &= \sin(\frac{\theta_x}{2}) * \cos(\frac{\theta_y}{2}) * \cos(\frac{\theta_z}{2}) - \cos(\frac{\theta_x}{2}) * \sin(\frac{\theta_y}{2}) * \sin(\frac{\theta_z}{2}) && (2) \\
q_2 &= \cos(\frac{\theta_x}{2}) * \sin(\frac{\theta_y}{2}) * \cos(\frac{\theta_z}{2}) + \sin(\frac{\theta_x}{2}) * \cos(\frac{\theta_y}{2}) * \sin(\frac{\theta_z}{2}) && (3) \\
q_3 &= \cos(\frac{\theta_x}{2}) * \cos(\frac{\theta_y}{2}) * \sin(\frac{\theta_z}{2}) - \sin(\frac{\theta_x}{2}) * \sin(\frac{\theta_y}{2}) * \cos(\frac{\theta_z}{2}) && (4)
\end{aligned}
$$

Euler angles in terms of q:

$$
\begin{aligned}
\theta_x &= \operatorname{atan2}(2 * (q_2 * q_3 + q_0 * q_1), q_0 * q_0 - q_1 * q_1 - q_2 * q_2 + q_3 * q_3) && (5) \\
\theta_y &= \operatorname{asin}(-2 * (q_1 * q_3 - q_0 * q_2)) && (6) \\
\theta_z &= \operatorname{atan2}(2 * (q_1 * q_2 + q_0 * q_3), (q_0 * q_0 + q_1 * q_1 - q_2 * q_2 - q_3 * q_3)) && (7) \\
& && (8)
\end{aligned}
$$

Rotation matrix in terms of q:

$$
R = \begin{bmatrix} q_0 * q_0 + q_1 * q_1 - q_2 * q_2 - q_3 * q_3 & 2 * (q_1 * q_2 - q_0 * q_3) & 2 * (q_1 * q_3 + q_0 * q_2) \\ 2 * (q_1 * q_2 + q_0 * q_3) & q_0 * q_0 - q_1 * q_1 + q_2 * q_2 - q_3 * q_3 & 2 * (q_2 * q_3 - q_0 * q_1) \\ 2 * (q_1 * q_3 - q_0 * q_2) & 2 * (q_2 * q_3 + q_0 * q_1) & q_0 * q_0 - q_1 * q_1 - q_2 * q_2 + q_3 * q_3 \end{bmatrix}
$$

Integration in terms of q:

$$
\begin{aligned}
\dot{q} &= \frac{1}{2}\overline{w}q && (9) \\
&= \frac{1}{2} \begin{bmatrix} -\omega_x * q_1 - \omega_y * q_2 - \omega_z * q_3 \\ \omega_x * q_0 + \omega_z * q_2 - \omega_y * q_3 \\ \omega_y * q_0 - \omega_z * q_1 + \omega_x * q_3 \\ \omega_z * q_0 + \omega_y * q_1 - \omega_x * q_2 \end{bmatrix} && (10)
\end{aligned}
$$

where $\overline{\omega} = [0, w_x, w_y, w_z]^T$