The answers for HW3 problem are:

- $u_1 = -\dot{q}_2 \qquad u_2 = c_2\dot{q}_1 \qquad u_3 = s_2\dot{q}_1 + \dot{q}_3$

- $$\boxed{{}^A\boldsymbol{\omega}^B = u_1\hat{\mathbf{b}}_1 + u_2\hat{\mathbf{b}}_2 + u_2\tan q_2\hat{\mathbf{b}}_3}$$

- $$\boxed{\begin{aligned} \alpha_1 &= \dot{u}_1 + u_2\left(u_3 - u_2\tan q_2\right) \\ \alpha_2 &= \dot{u}_2 - u_1\left(u_3 - u_2\tan q_2\right) \\ \alpha_3 &= \dot{u}_3 \end{aligned}}$$

- $$\boxed{\begin{aligned} v_1 &= -Ru_2\tan q_2 + c_1u_4 + s_1u_5 \\ v_2 &= \left(-u_4s_1 + u_5c_1\right)s_2 \\ v_3 &= Ru_1 + (u_4s_1 - u_5c_1)c_2 \end{aligned}}$$

- $$\boxed{\begin{aligned} a_1 &= -\dot{u}_2R\tan q_2 + \dot{u}_4c_1 + \dot{u}_5s_1 + Ru_1u_2\left(1 + \sec^2 q_2\right) \\ a_2 &= \left(-\dot{u}_4s_1 + \dot{u}_5c_1\right)s_2 - Ru_1{}^2 - Ru_2{}^2\tan^2 q_2 \\ a_3 &= \dot{u}_1R + \left(\dot{u}_4s_1 - \dot{u}_5c_1\right)c_2 + u_2{}^2R\tan q_2 \end{aligned}}$$

- $$\boxed{\hat{v}_x = \left(-u_2\tan q_2 + u_3\right)Rc_1 + u_4 \qquad \hat{v}_y = \left(-u_2\tan q_2 + u_3\right)Rs_1 + u_5}$$