VisNav Exercise 03

Solution

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PID control law

$$u(t) = K_P e(t) + K_I \int_0^t e(\tau)\mathrm{d}\tau + K_D \dot{e}(t)$$

Discrete error integral

$$e_{I,t} = e_t \Delta t + e_{I,t-1}$$

- If Δt constant

$$e_{I,t} = e_t + e_{I,t-1}$$

Discrete error derivative

$$e_{D,t} = \frac{e_t - e_{t-1}}{\Delta t}$$

Discrete PID control law

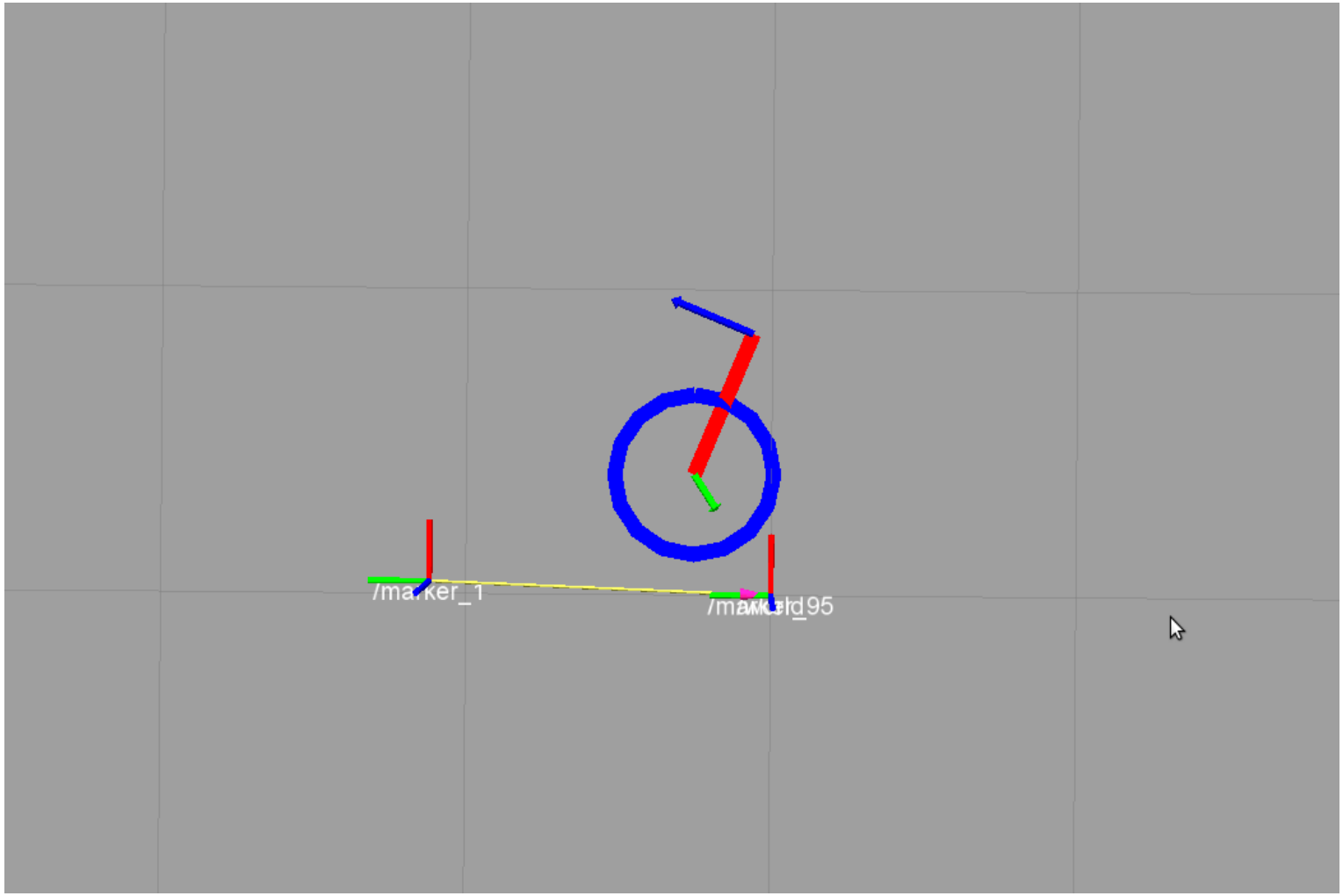
$$u_t = K_P e_t + K_I e_{I,t} + K_D e_{D,t}$$

Error for x, y, yaw

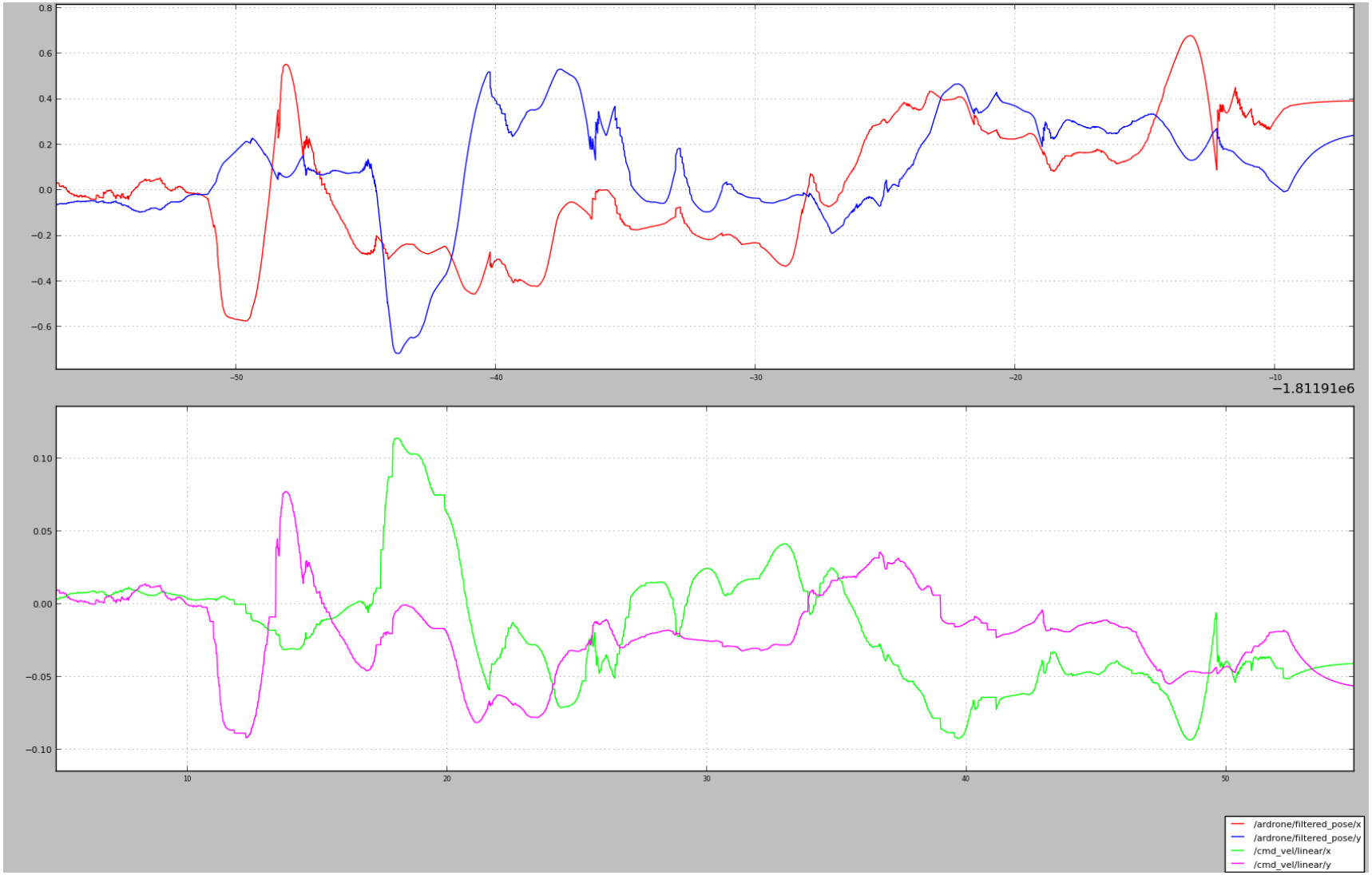
$$\mathbf{e} = \mathbf{g} - \mathbf{x}$$

$$x_e = x_g - x_x$$
$$y_e = y_g - y_x$$
$$\psi_e = \psi_g - \psi_x$$

RVIZ

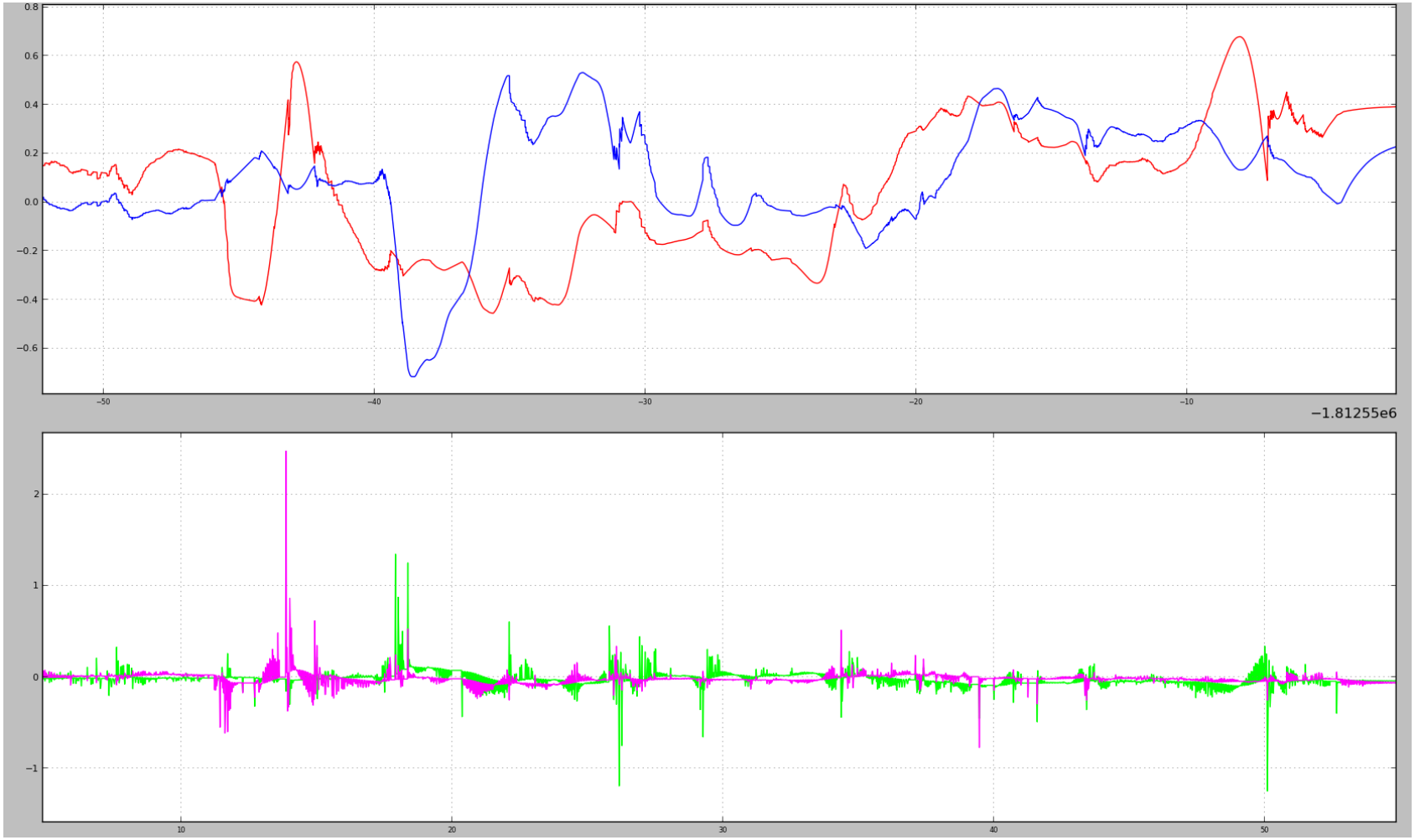


P controller



PD controller

- With numerical derivatives



PD controller

- With negative velocity

$$\mathbf{e} = \mathbf{g} - \mathbf{x}$$

$$\dot{\mathbf{e}} = \dot{\mathbf{g}} - \dot{\mathbf{x}}$$

- With $\dot{\mathbf{g}} = 0$

$$\dot{\mathbf{e}} = -\dot{\mathbf{x}}$$

PD controller

- With negative velocity