$$\begin{bmatrix} X_t + \Delta t \, (\dot{X}_t \cos\psi_t - \dot{y}_t \sin\psi_t) \\ Y_t + \Delta t \, (\dot{X}_t \sin\psi_t + \dot{y}_t \cos\psi_t) \\ \psi_t + \Delta t \; \dot{\psi}_t \end{bmatrix}$$

$$\therefore A_t = \frac{\partial f}{\partial x} = \begin{bmatrix} 1 & 0 & -\Delta t \, (\dot{X}_t \sin\psi_t + \dot{y}_t \cos\psi_t) \\ 0 & 1 & \Delta t \, (\dot{X}_t \cos\psi_t - \dot{y}_t \sin\psi_t) \\ 0 & 0 & 1 \end{bmatrix}$$

$$F_t = \begin{bmatrix} A_t & O_{[3, \, 2n]} \\ O_{[2n, \, 3]} & I_{[2n, \, 2n]} \end{bmatrix}$$

$$y_t = \begin{bmatrix} \|m^n - P_t\| \\ \vdots n \\ \text{atan2}(my^n - Y_t, mx^n - X_t) - \psi_t \\ \vdots n \end{bmatrix}$$

$$H = \frac{\partial h}{\partial X}$$

$$= \begin{bmatrix} H_{11} & H_{12} & 0 & -H_{11} & -H_{12} & 0 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & 0 & 0 & & & \vdots & \vdots \\ H_{n11} & H_{n12} & 0 & \vdots & & & & -H_{n1} & -H_{n2} \\ H_{21} & H_{22} & -1 & -H_{21} & -H_{22} & 0 & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & 0 & & & & \vdots & \vdots \\ H_{n21} & H_{n22} & -1 & \vdots & \vdots & & & -H_{n21} & -H_{n22} \end{bmatrix}$$
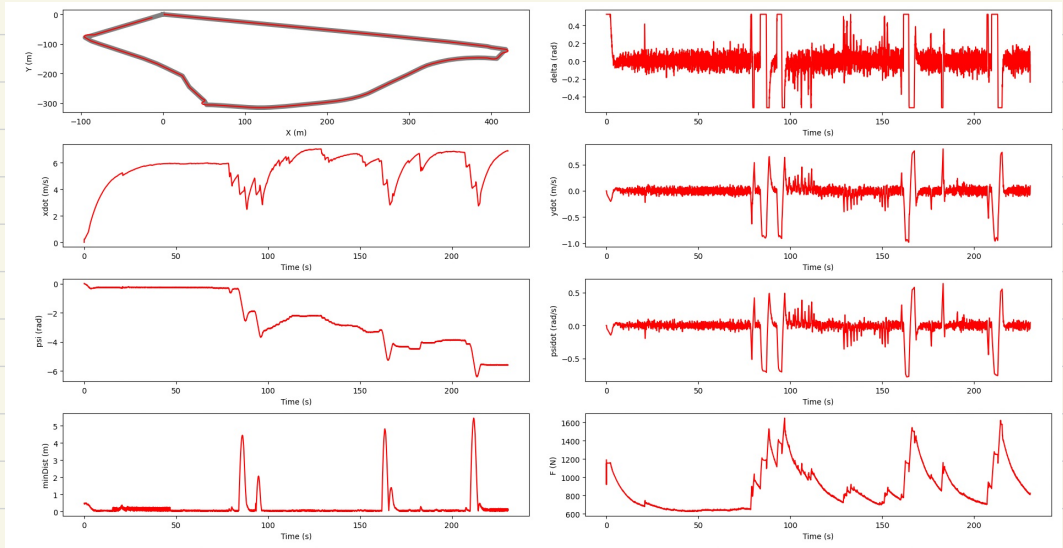
$$H_{n11} = \frac{-(mx^n - X_t)}{\sqrt{(m^n x - X_t)^2 + (m^n y - y_t)^2}} \qquad n \text{ in range } [1, \text{self.n}]$$

$$H_{n21} = \frac{-(my^n - X_t)}{\sqrt{(m^n x - X_t)^2 + (m^n y - y_t)^2}}$$
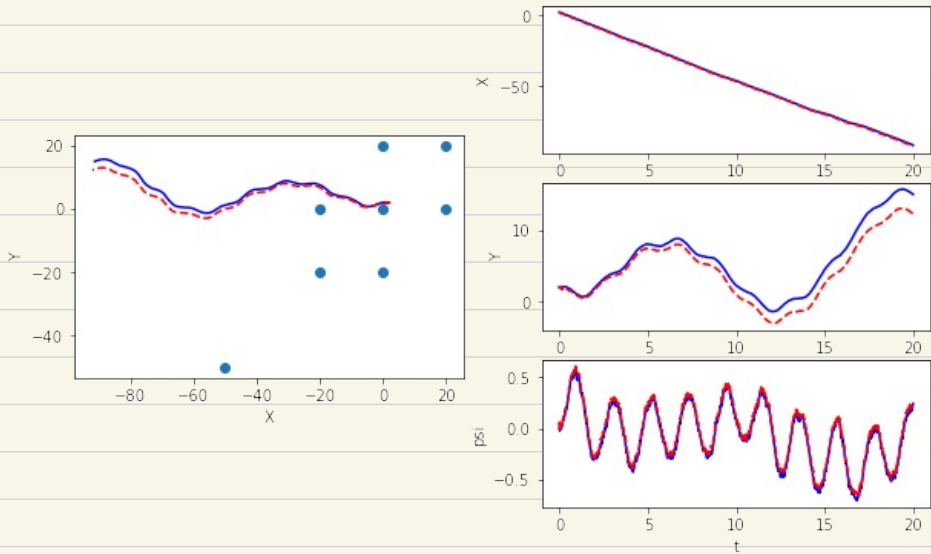
$$H_{n21} = \frac{(my^o - yt)}{(m'x - xt)^2 + (m'y - yt)^2}$$

$$H_{n22} = \frac{-(mx^o - xt)}{(m'x - xt)^2 + (m'y - yt)^2}$$

Exercise 2

Your - controller _ ekf _ slam

ekf _ slam