MP 1 − 2D Kalman Filter

System

$$x_k = \begin{pmatrix} x_{1,k-1} \\ x_{2,k-1} \end{pmatrix} + \begin{pmatrix} u_{1,k-1} \\ u_{2,k-1} \end{pmatrix} + w_{k-1} \quad \text{and} \quad z_k = \begin{pmatrix} z_{1,k} \\ z_{2,k} \end{pmatrix} = \begin{pmatrix} x_{1,k} \\ x_{2,k} \end{pmatrix} + v_k$$

$$Q = \begin{pmatrix} 10^{-4} & 2 \times 10^{-5} \\ 2 \times 10^{-5} & 10^{-4} \end{pmatrix}$$

$$R = \begin{pmatrix} 10^{-2} & 5 \times 10^{-3} \\ 5 \times 10^{-3} & 2 \times 10^{-2} \end{pmatrix}$$

$A = B = H = I$.

Time Update

$$\hat{x}_k^- = \hat{x}_{k-1} + u_{k-1} \tag{1}$$
$$P_k^- = P_{k-1} + Q \tag{2}$$

Measurement Update

$$\hat{x}_k = \hat{x}_k^- + K_k(z_k - \hat{x}_k^-) \tag{3}$$

$$K_k = \frac{P_k^-}{P_k^- + R} \tag{4}$$

$$P_k = (I - K_k)P_k^- \tag{5}$$