6. Kalman Filter

F_k : state-transition model $\qquad z_k$: observation

H_k : observation model

Q_k : covariance of process noise

R_k : covariance of observation noise

B_k : control-input model

u_k : control vector

Predict

$$\hat{x}_{k|k-1} = F_k x_{k-1|k-1} + B_k u_k$$

$$\hat{P}_{k|k-1} = F_k P_{k-1|k-1} F_k^T + Q_k$$

update

$$\tilde{y}_k = z_k - H_k \hat{x}_{k|k-1}$$ ~ residual prefit

$$S_k = H_k \hat{P}_{k|k-1} H_k^T + R_k$$ ~ covariance prefit

$$K_k = \hat{P}_{k|k-1} H_k^T S_k^{-1}$$ - Kalman gain

~~see wt~~ depends on which is more noisy

$$\Rightarrow x_{k|k} = \hat{x}_{k|k-1} + K_k \tilde{y}_k$$ → update baseon Kalman gain

$$P_{k|k} = (I - K_k H_k) \hat{P}_{k|k-1}$$

main assumptions.

1. Linearity + time-invariant
2. state-space form
3. state and measurement noises are zero-mean and independent of another

pwc