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Kalman Filter

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The Kalman filter equations are.

System model: $x_K = \Phi_{K-1} x_{K-1} + w_{K+1}$

Measurement model: $z_K = H_K x_K + v_K$

x_K: state of the system at step K.

Φ_{K-1} A matrix which transforms the system state at time $K-1$ to K.

w_K: noise in the system model

z_K: measurement

H_K: transforms the system state into the measurem

v_K: measurement noise.

State estimate extrapolation.

$$\hat{x}_{K(-)} = \Phi_{K-1} x_{K-1(+)} \quad *$$

State estimate update:

$$\hat{x}_{K(+)} = \hat{x}_{K(-)} + K_K \left[z_K - H_K \hat{x}_{K(-)} \right] \quad *^2$$

Error covariance extrapolation.

$$P_{K(-)} = \Phi_{K-1} P_{K-1(+)} \Phi^T_{K-1} + Q_{K-1}$$

Error covariance update

$$P_{K(+)} = [I - K_K H_K] P_{K(-)}$$

Kalman gain matrix

$$K_K = P_{K(-)} H_K^T \left[H_K P_{K(-)} H_K^T + R_K \right]^{-1}$$