Kalman Filter - equations

- Model: linear, discrete time
  \[ x(k) = A(k) x(k-1) + B(k) u(k) + v(k) \]
  \[ z(k) = H(k) x(k) + w(k) \]

- Initialization:
  can be viewed as design parameters
  \[
  P_0(0), \quad R_0(0), \quad Q(k) = E[v(k)u(k)'],
  \quad R(k) = E[w(k)w(k)']
  \]

- Kalman gain calculation:
  \[
  P_0(k) = A(k) P_0(k-1) A(k)' + Q(k)
  \]
  \[
  K(k) = P_0(k) H'(k) (H(k) P_0(k) H'(k) + R(k))^{-1}
  \]
  \[
  P_0(k) = (I - K(k) H(k)) P_0(k)
  \]

- Estimation:
  can be done ahead of time

- Equations:
  \[
  \begin{cases}
    S1: & \hat{x}_p(k) = A(k) \hat{x}_m(k-1) + B(k) u(k) \\
    S2: & \hat{x}_m(k) = \hat{x}_p(k) + K(k) (z(k) - H(k) \hat{x}_p(k))
  \end{cases}
  \]