# Kalman filter:

$$L[k] = \bar{P}[k] C_D^T \left( C_D \bar{P}[k] C_D^T + R_D \right)^{-1}$$

$$\hat{x}[k] = \bar{x}[k] + L[k]\left(y[k] - C_D \bar{x}[k]\right)$$

$$\hat{P}[k] = (I - L[k] C_D) \bar{P}[k] (I - L[k] C_D)^T + L[k] R_D L^T[k]$$

$$\hat{x}[k+1] = A_D \hat{x}[k] + B_D u[k]$$

$$\bar{P}[k+1] = A_D \hat{P}[k] A_D^T + Q_D$$

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$$x[k+1] = A_d\, x[k] + B_d\, u[k] + w_d[k]$$

$$y[k] = C_d\, x[k] + v_d[k]$$

$$w_d[k] \sim N(0, Q_d) \quad v_d \sim N(0, R_d)$$

$$x = \begin{bmatrix} p \\ \dot{p} \\ e \\ \dot{e} \\ \lambda \\ \dot{\lambda} \end{bmatrix} \qquad \dot{x} = \begin{bmatrix} \dot{p} \\ \ddot{p} \\ \dot{e} \\ \ddot{e} \\ \dot{\lambda} \\ \ddot{\lambda} \end{bmatrix}$$

$\ddot{p}$ Avhenger ikke av andre tilstander, så får bare at $\dot{p} = \dot{p}$

$$\begin{array}{ccccccc} \dot{x} & & A & x & & B & u \\ \begin{bmatrix} \dot{p} \\ \ddot{p} \\ \dot{e} \\ \ddot{e} \\ \dot{\lambda} \\ \ddot{\lambda} \end{bmatrix} & = & \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ K_3 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} & \begin{bmatrix} p \\ \dot{p} \\ e \\ \dot{e} \\ \lambda \\ \dot{\lambda} \end{bmatrix} & + & \begin{bmatrix} 0 & 0 \\ 0 & K_1 \\ 0 & 0 \\ K_2 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} & \begin{bmatrix} \tilde{V}_s \\ V_D \end{bmatrix} \end{array}$$