Kalman-Struktur:

$$\hat{x}(k) = \hat{x}^*(k) + h(\hat{y}(k) - y(k)) \; ; \; \hat{y}(k) = c^T \hat{x}^*(k) + du(k) \; ; \; y(k) = c^T x(k) + du(k)$$

$$\hat{x}^*(k+1) = A\hat{x}(k) + bu(k) \; ; \; x(k+1) = Ax(k) + bu(k)$$

$$e(k+1) = \hat{x}(k+1) - x(k+1)$$

$$e(k+1) = \hat{x}^*(k+1) + h(\hat{y}(k+1) - y(k+1)) - x(k+1)$$

$$e(k+1) = \hat{x}^*(k+1) + h(c^T\hat{x}^*(k+1) - y(k+1) + du(k+1)) - x(k+1)$$

$$e(k+1) = \hat{x}^*(k+1) + h(c^T\hat{x}^*(k+1) - c^T x(k+1)) - x(k+1)$$

$$e(k+1) = (A\hat{x}(k) + bu(k)) + h(c^T A\hat{x}(k) + c^T bu(k) - c^T Ax(k) - c^T bu(k)) - Ax(k) - bu(k)$$

$$e(k+1) = A(\hat{x}(k) - x(k)) + hc^T A(\hat{x}(k) - x(k))$$

$$\Rightarrow e(k+1) = (A + hc^T A)e(k)$$

Let $e(k) = A^{-1}\bar{e}(k) \Rightarrow e(k+1) = A^{-1}\bar{e}(k+1)$

$$\Rightarrow \bar{e}(k+1) = (AAA^{-1} + Ahc^T AA^{-1})\bar{e}(k)$$

$$\Rightarrow \bar{e}(k+1) = (A + Ahc^T)\bar{e}(k)$$

$\bar{h} = Ah$: $\bar{h}$ von Luenberger-Beobachter

$h = A^{-1}\bar{h}$ von Kalman-Struktur.

A32. (l): $\bar{h} = h_{Luenberger} = \begin{pmatrix} -2 \\ -1 \end{pmatrix}$ von A32 (k).

$h = h_{Kalman} = A^{-1}\bar{h}$

$A = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$; $\det(A) = 1$; $\operatorname{adj}(A) = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$

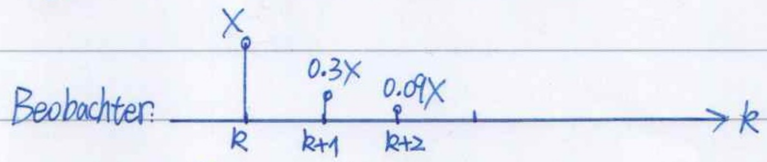
$$h = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} -2 \\ -1 \end{pmatrix} = \begin{pmatrix} -1 \\ -1 \end{pmatrix}$$

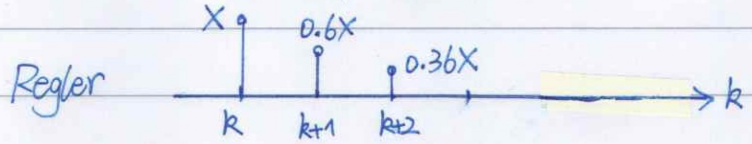
A32 (h): Regler: $z_{R1} = z_R = 0.6$

Beobachter: $z_{B1} = z_{B2} = 0.3$

für Beobachter: $\begin{pmatrix} \hat{x}_1(k+1) \\ \hat{x}_2(k+1) \end{pmatrix} = \begin{pmatrix} 0.3 & 0 \\ 0 & 0.3 \end{pmatrix}\begin{pmatrix} \hat{x}_1(k) \\ \hat{x}_2(k) \end{pmatrix}$

für Regler: $\begin{pmatrix} x_1(k+1) \\ x_2(k+1) \end{pmatrix} = \begin{pmatrix} 0.6 & 0 \\ 0 & 0.6 \end{pmatrix}\begin{pmatrix} x_1(k) \\ x_2(k) \end{pmatrix}$





Beobachter

$k+1$: $\hat{x}(k+1) = 0.3X$

Regler

$k+2$: $x(k+2) = 0.36X$

$0.3 < 0.36$

mindestens doppelt schnell.