RAWICKI PAWEŁ 283 529 TAP

ZADANIE 1

$$A=\begin{bmatrix}0.4 & 0.2\\ 0 & 0.6\end{bmatrix}\quad B=\begin{bmatrix}0\\1\end{bmatrix}\quad C=\begin{bmatrix}4 & 0\end{bmatrix}\quad F=\begin{bmatrix}0.2\\0\end{bmatrix}$$

$$\Delta u(k) = k^e\left(y^{zad}(k) - \sum_{p=1}^{N}\left[k_{1,p}CA^p\right]x(k) - \sum_{p=1}^{N}\left[k_{1,p}CV_p\right]\left(Bu(k-1)+F_z(k)+V(k)\right)\right)$$

MACIERZ $M=\begin{bmatrix}0\\0.8\end{bmatrix}$

$$K = (M^T\cdot\Psi\cdot M+\Lambda)^{-1}\cdot M^T\cdot\Psi$$

$\Lambda=0.36 \quad \Psi=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

$K=\begin{bmatrix}0. & 0.8\end{bmatrix} \quad K1=4 \quad K_e=0.8$

$$\sum_{p=1}^{N} k_{1,p}\,CA^p = k_1 CA + \dots = k_1\cdot\begin{bmatrix}1.6 & 0.8\\ 0.64 & 0.8\end{bmatrix}=\begin{bmatrix}0.512 & 0.64\end{bmatrix}$$

$$\sum_{p=1}^{N} k_{1,p}\,CV_p = k_{1p}\cdot CV = k_1\cdot\begin{bmatrix}4 & 0\\ 5.6 & 0.8\end{bmatrix}=\begin{bmatrix}4.48 & 0.64\end{bmatrix}$$

$\begin{bmatrix}4.48 & 0.64\end{bmatrix}\cdot B = 0.64 \qquad \begin{bmatrix}0.512 & 0.64\end{bmatrix}\cdot F = 0.1024$

$$\rightarrow \Delta u(k) = 0.8\,y^{zad} - 0.512\,x_1(k) - 0.64\,x_2(k) - 0.64\,u_1(k) -$$

$$4.48\,v_1(k) - 0.64\,v_2(k) - 0.1024\,z(k)$$

ZGODNIE ZE SLAJDEM 9 PREZENTACJI 5 :: regulatory model zlinearyzowany w punkcie pracy trzeba uwzględnić → dla analitycznego dodać ograniczenia

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PK

ZADANIE 2

$$y(k+1) = 0.4\,y(k-1) + 0.5\,u(k-2) + 0.2\,z(k)$$

WEKTOR STANU

$$x(k) = [\; y(k) \;\; u(k-1) \;\; u(k-2) \;\; z(k) \;]^T =$$

RÓWNANIA STANU

$$x(k+1) = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0.5 \end{bmatrix} u(k)$$

$$x(k+1) = \begin{bmatrix} y(k+1) \\ u(k) \\ u(k-1) \\ z(k+1) \end{bmatrix} = \begin{bmatrix} 0.4 & 0 & 0.5 & 0.2 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} y(k-1) \\ u(k-1) \\ u(k-2) \\ z(k) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} u(k)$$

$$+ \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} z(k+1)$$

ZADANIE 3

$x_1(k+1) = 0.4\,(x_1(k))^2 + 0.2\,x_1(k)\,x_2(k)$

$x_2(k+1) = 0.5\,x_2 + x_2(k)\,u(k)$

$d_1 = x_1 - x_1(k|k-1)$

$d_2 = x_2 - x_2(k|k-1)$

$d_1 = 2 - (0.4 \cdot 1^2 + 0.2 \cdot 1 \cdot 0.5) = 2 - (0.4 + 0.1) = 1.5$

$d_2 = 1 - (0.5 \cdot 0.5 + 0.5 \cdot 0.5) = 1 - (0.25 + 0.25) = 0.5$

$u^0(k) = [-0.5 \;\; -1 \;\; -10]^T$

$y(k+1|k) = x_1(k+1|k)$

$x_1(k+1|k) = 0.4 \cdot 2^2 + 0.2 \cdot 2 \cdot 1 = 0.4 \cdot 4 + 0.4 = 5 \cdot 0.4 = 2 + d_1 = 3.5$ (+d_1)

$y(k+1|k) = 3.5$

$x_2(k+1|k) = 0.5 \cdot 1 + 1 \cdot (-0.5) + d_2 = 0 + 0.5 = 0.5$

$y(k+2|k) = x_1(k+2|k)$

$x_1(k+2|k) = 0.4 \cdot 3.5^2 + 0.2 \cdot 0.5 + d_1 = 5.9 + 1.5 = 7.4$

$x_2(k+2|k) = 0.5 \cdot 0.5 + 0.5 \cdot (-1) + d_2 = 0.25$

$y(k+3|k) = x_1(k+3|k)$

PEWNIE COŚ [illegible]

$x_1(k+3|k) = 0.4 \cdot 7.4^2 + 0.2 \cdot 7.4 \cdot 0.25 + d_1 =$ [illegible] $+ d_1 = 57.03$

$$A = \begin{bmatrix} \frac{\partial f_1}{\partial x_1} & \frac{\partial f_1}{\partial x_2} \\ \frac{\partial f_2}{\partial x_1} & \frac{\partial f_2}{\partial x_2} \end{bmatrix} = \begin{bmatrix} 2x_1(k_0) + 0.2x_2(k_0) & 0.2x_1(k_0) \\ 0.5 + u_0(k_0) & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 4 + 0.2 & 0.4 \\ 0.5 - 0.5 & 0 \end{bmatrix} = \begin{bmatrix} 4.2 & 0.4 \\ 0 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} \frac{\partial f_1}{\partial u_1} \\ \frac{\partial f_2}{\partial u_1} \end{bmatrix} = \begin{bmatrix} 0 \\ x_2(k_0) \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$n = \begin{bmatrix} CB & 0 \\ (1+A)\cdot B & (B \\ ((1+A^2)B & ((1+A)B \end{bmatrix} \quad (= [1 \; 0]$$