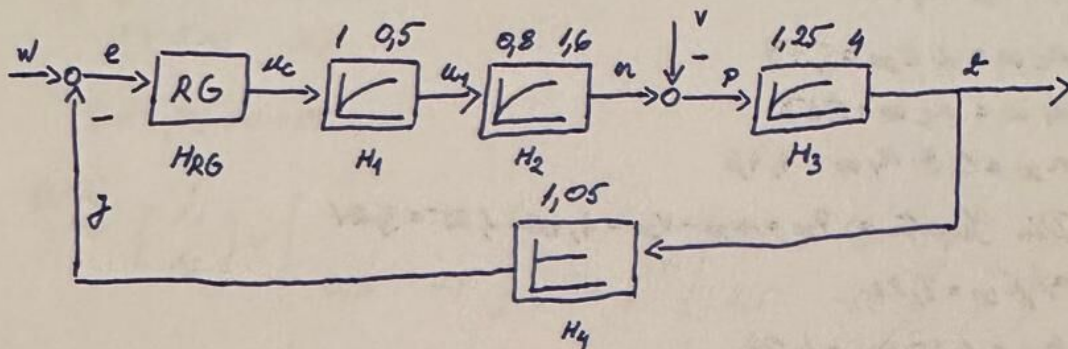


TEMĂ TS NR 5

. PARTEA 1.



Cazul 1) RG de tip PDT_1 ,

$$w_\infty = 7, v_\infty = 1,25,$$

$$H_{PDT_1}(s) = \frac{k(1+s \cdot T_d)}{1+s \cdot T_f} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \Rightarrow K=2$$

$$H_{RG}(s) = \frac{2(1+2s)}{1+0,5s}$$

$$H_{RG} \Rightarrow ET-PDT_1 \Rightarrow u_{c\infty} = K \cdot e_\infty = 2 \cdot e_\infty, \quad \left. \begin{array}{l} \\ \text{Din Generator} \Rightarrow e_\infty = w_\infty - z_\infty = 7 - z_\infty \end{array} \right\} \Rightarrow u_{c\infty} = 14 - 2z_\infty$$

$$H_1 \Rightarrow ET-PT_1 \Rightarrow u_{1\infty} = 1 \cdot u_{c\infty} = u_{c\infty} = 14 - 2z_\infty$$

$$H_2 \Rightarrow ET-PT_1 \Rightarrow n_\infty = 0,8 \cdot u_{1\infty} = 11,2 - 1,6z_\infty$$

$$\text{Din Generator} \Rightarrow p_\infty = n_\infty - v_\infty = 11,2 - 1,6z_\infty - 1,25 = 9,95 - 1,6z_\infty$$

$$H_3 \Rightarrow ET-PT_1 \Rightarrow z_\infty = 1,25 \cdot p_\infty = 12,44 - 2z_\infty$$

$$H_4 \Rightarrow ET-P \Rightarrow z_\infty = 1,05 \cdot z_\infty = 13,06 - 2,1z_\infty$$

$$\Rightarrow 3,1z_\infty = 13,06 \Rightarrow z_\infty = \frac{13,06}{3,1} = 4,21$$

$$\text{Dacă } j_{\infty} = 4,21$$

$$\text{Din Generator} \Rightarrow e_{\infty} = w_{\infty} - j_{\infty} = 7 - 4,21 = 2,79$$

$$\Rightarrow e_{\infty} = 2,79$$

$$u_{c\infty} = 2 \cdot e_{\infty} = 5,58$$

$$u_{1\infty} = u_{c\infty} = 5,58$$

$$m_{\infty} = 0,8 \cdot u_{1\infty} = 4,46$$

$$\text{Din Generator} \Rightarrow p_{\infty} = m_{\infty} - v_{\infty} = 4,46 - 1,25 = 3,21$$

$$\Rightarrow p_{\infty} = 3,21$$

$$z_{\infty} = 1,25 \cdot p_{\infty} = 4,02$$

\Rightarrow Pentru Coșul 1 VRSC sunt:

$$e_{\infty} = 2,79,$$

$$u_{c\infty} = 5,58,$$

$$u_{1\infty} = 5,58,$$

$$m_{\infty} = 4,46,$$

$$p_{\infty} = 3,21,$$

$$z_{\infty} = 4,02; \quad j_{\infty} = 4,21;$$

Coșul 2) RG de tip Pi

$$w_{\infty} = 7, \quad v_{\infty} = 1,25,$$

$$H_{Pi}(s) = \frac{K(s \cdot T + 1)}{s \cdot T}$$

$$H_{RG}(s) = \frac{2(1+2s)}{s}$$

$$\left. \begin{array}{l} H_{Pi}(s) = \frac{K(s \cdot T + 1)}{s \cdot T} \\ H_{RG}(s) = \frac{2(1+2s)}{s} \end{array} \right\} \Rightarrow K = 4$$

$$H_{RG} \rightarrow ET-Pi \Rightarrow e_{\infty} = 0, \quad u_{c\infty} = ct$$

$$\text{Din Generator} \Rightarrow e_{\infty} = w_{\infty} - j_{\infty} \Rightarrow j_{\infty} = w_{\infty} = 7$$

$$H_4 \rightarrow ET-P \Rightarrow j_{\infty} = 1,05 \cdot z_{\infty} \Rightarrow z_{\infty} = \frac{j_{\infty}}{1,05} = \frac{7}{1,05} = 6,66$$

$$H_3 \rightarrow ET-PT_1 \Rightarrow z_{\infty} = 1,25 \cdot p_{\infty} \Rightarrow p_{\infty} = \frac{z_{\infty}}{1,25} = \frac{6,66}{1,25} = 5,33$$

$$\text{Din Generator} \Rightarrow p_{\infty} = m_{\infty} - v_{\infty} \Rightarrow m_{\infty} = 5,33 + 1,25 = 6,58$$

$$H_2 \rightarrow ET-PT_1 \Rightarrow m_{\infty} = 0,8 \cdot u_{1\infty} \Rightarrow u_{1\infty} = \frac{m_{\infty}}{0,8} = \frac{6,58}{0,8} = 8,225$$

$$H_1 \rightarrow ET-PT_1 \Rightarrow u_{1\infty} = 1 \cdot u_{c\infty} \Rightarrow u_{c\infty} = 8,225$$

\Rightarrow Pentru Coșul 2 VRSC sunt:

$$e_{\infty} = 0, \quad m_{\infty} = 6,58, \quad j_{\infty} = 7;$$

$$u_{c\infty} = 8,225, \quad p_{\infty} = 5,33,$$

$$u_{1\infty} = 8,225, \quad z_{\infty} = 6,66,$$

PARTEA 2

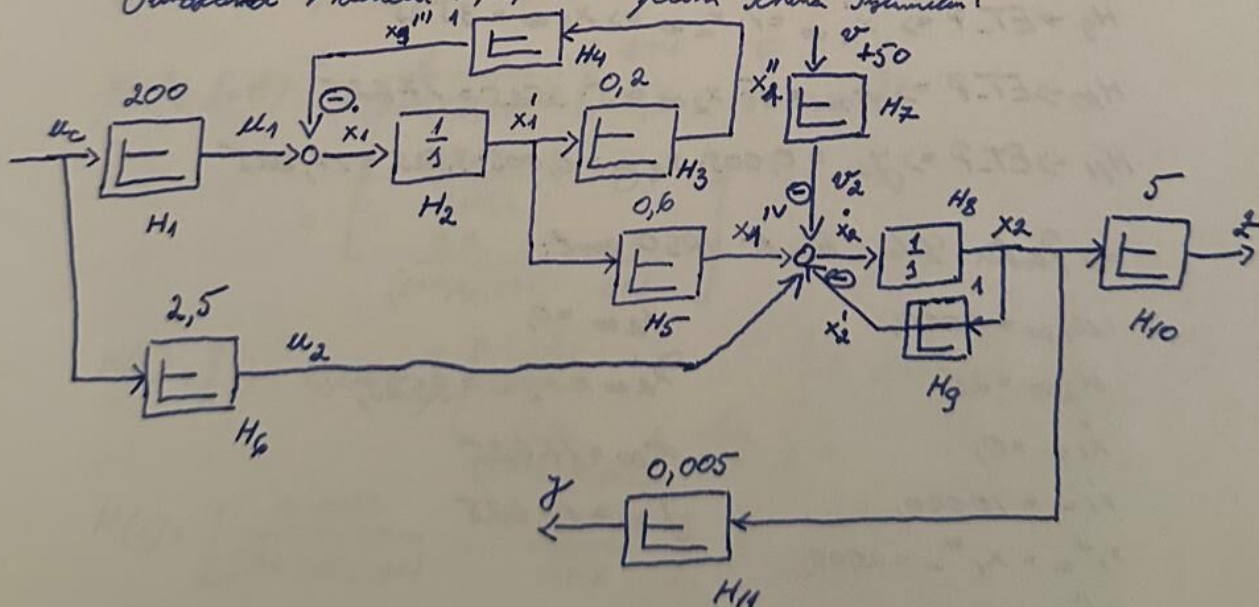
$$\begin{cases} \dot{x}_1 = -0,2x_1 + 200u_c & (1) \\ \dot{x}_2 = 0,6x_1 - x_2 + 2,5u_c - 50v & (2) \\ y = 0,005x_2 & (3) \\ z = 5x_2 & (4) \end{cases}$$

$$u_{c0} = 10, v_0 = 50$$

$$(1)(2) \Rightarrow \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \underbrace{\begin{bmatrix} -0,2 & 0 \\ 0,6 & -1 \end{bmatrix}}_A \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \underbrace{\begin{bmatrix} 200 & 0 \\ 2,5 & -50 \end{bmatrix}}_B \begin{bmatrix} u_c \\ v \end{bmatrix}$$

$$(3) \Rightarrow [y] = \underbrace{\begin{bmatrix} 0 & 0,005 \end{bmatrix}}_C \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}; \quad \Delta = \begin{bmatrix} 0 & 0 \end{bmatrix}$$

Construind Matricele A, B, C, Δ pentru Schema Sistemului:



(*) $H_4, H_9 \rightarrow$ pot fi lipsi din Schema, cum ar fi să le dăm totuși.

$$\mu_{C\infty} = 10, v_{C\infty} = 50$$

$$H_1 \rightarrow ET-P \Rightarrow \mu_{1\infty} = 200 \cdot \mu_{C\infty} = 2000$$

$$H_6 \rightarrow ET-P \Rightarrow \mu_{2\infty} = 2,5 \cdot \mu_{C\infty} = 25$$

$$\text{Din Generator} \Rightarrow \dot{x}_{1\infty} = \mu_{1\infty} - x_1''_{\infty} = 2000 - x_1''_{\infty} \quad \left. \vphantom{\dot{x}_{1\infty}} \right\} \Rightarrow x_1'''_{\infty} = 2000$$

$$H_2 \rightarrow ET-I \Rightarrow \dot{x}_{1\infty} = 0$$

$$x_1'_{\infty} = ct$$

$$H_3 \rightarrow ET-P \Rightarrow x_1''_{\infty} = 0,2 \cdot x_1'_{\infty}$$

$$H_4 \rightarrow ET-P \Rightarrow x_1''_{\infty} = 1 \cdot x_1''_{\infty} \Rightarrow x_1''_{\infty} = 2000 \quad \left. \vphantom{x_1''_{\infty}} \right\} \Rightarrow x_1'_{\infty} = \frac{2000}{0,2} = 10.000$$

$$H_5 \rightarrow ET-P \Rightarrow x_1''_{\infty} = 0,6 \cdot x_1'_{\infty} = 6000$$

$$H_7 \rightarrow ET-P \Rightarrow v_{2\infty} = 50 \cdot v_{\infty} = 2500$$

$$\text{Din Generator} \Rightarrow \dot{x}_{2\infty} = x_1''_{\infty} + \mu_{2\infty} - v_{2\infty} - x_2'_{\infty} = 6000 + 25 - 2500 - x_2'_{\infty}$$

$$x_{2\infty} = 3525 - x_2'_{\infty} \quad \left. \vphantom{x_{2\infty}} \right\} \Rightarrow x_2'_{\infty} = 3525$$

$$H_8 \rightarrow ET-I \Rightarrow \dot{x}_{2\infty} = 0$$

$$x_{2\infty} = ct$$

$$H_9 \rightarrow ET-P \Rightarrow x_2'_{\infty} = 1 \cdot x_{2\infty} \Rightarrow x_{2\infty} = 3525$$

$$H_{10} \rightarrow ET-P \Rightarrow \dot{x}_{2\infty} = 5 \cdot x_{2\infty} = 5 \cdot 3525 = 17625$$

$$H_{11} \rightarrow ET-P \Rightarrow \dot{x}_{2\infty} = 0,005 \cdot x_{2\infty} = 0,005 \cdot 3525 = 17,625$$

\Rightarrow Pentru Schema Focului VRSC rezultă:

$$\mu_{1\infty} = 2000,$$

$$\dot{x}_{2\infty} = 0,$$

$$\mu_{2\infty} = 25,$$

$$x_2'_{\infty} = x_{2\infty} = 3525,$$

$$\dot{x}_{1\infty} = 0,$$

$$\dot{x}_{2\infty} = 17625$$

$$x_1'_{\infty} = 10000,$$

$$\dot{x}_{2\infty} = 17,625$$

$$x_1''_{\infty} = x_1'''_{\infty} = 2000,$$

$$x_1''_{\infty} = 6000,$$

Pentru intrarea uc, ai igiura 7:

$$H(s) = c^T (sI - A)^{-1} \cdot b + d,$$

$c^T \rightarrow$ vector linie conjugata igiura 7

$$c^T = c = [0 \quad 0,005];$$

$b \rightarrow$ vector coloara al intrarii uc

$$b = \begin{bmatrix} 200 \\ 2,5 \end{bmatrix}$$

$A \rightarrow$ matrice sistemului

$$A = \begin{bmatrix} -0,2 & 0 \\ 0,6 & 1 \end{bmatrix},$$

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad d = 0$$

$$sI - A = \begin{bmatrix} s+0,2 & 0 \\ -0,6 & s+1 \end{bmatrix}$$

$$\det(sI - A) = (s+0,2) \cdot (s+1) - 0 = s^2 + 1,2s + 0,2 \neq 0$$

$$\Rightarrow (sI - A)^{-1} = \frac{1}{(s+0,2)(s+1)} \begin{bmatrix} s+1 & 0 \\ 0,6 & s+0,2 \end{bmatrix}$$
$$= \begin{bmatrix} \frac{1}{s+0,2} & 0 \\ \frac{0,6}{(s+0,2)(s+1)} & \frac{1}{s+1} \end{bmatrix}$$

$$H(s) = [0 \quad 0,005] \begin{bmatrix} \frac{1}{s+0,2} & 0 \\ \frac{0,6}{(s+0,2)(s+1)} & \frac{1}{s+1} \end{bmatrix} \begin{bmatrix} 200 \\ 2,5 \end{bmatrix}$$

$$H(s) = \begin{bmatrix} \frac{0,003}{(s+0,2)(s+1)} & \frac{0,005}{s+1} \end{bmatrix} \begin{bmatrix} 200 \\ 2,5 \end{bmatrix}$$

$$H(s) = \frac{0,6}{(s+0,2)(s+1)} + \frac{0,0125}{s+1} = \frac{0,0125s + 0,6025}{(s+0,2)(s+1)}$$

$$= \frac{0,0125s + 0,6025}{s^2 + 1,2s + 0,2} = \frac{s + 48,2}{80s^2 + 96s + 16} \quad (\text{am inmultit cu 80})$$

Pentru intrarea v_n iese z :

$$b = \begin{bmatrix} 0 \\ -50 \end{bmatrix}$$

$$H(s) = \begin{bmatrix} \frac{0,003}{(s+0,2)(s+1)} & \frac{0,005}{s+1} \end{bmatrix} \begin{bmatrix} 0 \\ -50 \end{bmatrix}$$

$$H(s) = \frac{-0,25}{s+1} = \frac{-1}{4s+4} \quad (\text{am simplificat cu 4})$$

+ Am făcut verificarea în Simulink!