

Aplicatie consultatii TS.

Este considerat sistemul de reglare automata cu schema bloc prezentata in figura 1, in care $r(t)$ este referinta si $e(t)$ este eroarea de reglare. Sunt considerate 2 variante de regulator (R) cu HM-isi:

$$[R_1]: k \dot{e}(t) + \frac{k}{T_1} e(t) - u(t) = 0$$

$$[R_2]: k T_1 \dot{e}(t) + k e(t) - T_2 \dot{u}(t) - u(t) = 0$$

Se cere:

① Calculati caracteristicile de transfer, adica functia de transfer $H_{z,r}(s)$ in raport cu referinta, functia de transfer $H_{z,d}(s)$ in raport cu perturbatia $d(t)$, considerand ieșirea $z(t)$ și functia de transfer a sistemului deschis $H(s)$ ($e(t)$ este intrarea și $y(t)$ este ieșirea) pentru:

$$- R_1: T_1 = 2,5 \text{ sec}$$

$$- R_2: T_1 = 2,5 \text{ sec}, T_2 = 0,1 \text{ sec}$$

② Gasiti valorile parametrului $k > 0$ pentru care SRA este stabil.

③ Acceptand ca sistemul este stabil, alegand o valoare arbitrară a lui $k > 0$, pentru $r_{\infty} = 8$ și $d_{\infty} = 100$, calculati VRSC $\{e_{\infty}, u_{\infty}, m_{\infty}, y_{\infty}, z_{\infty}\}$

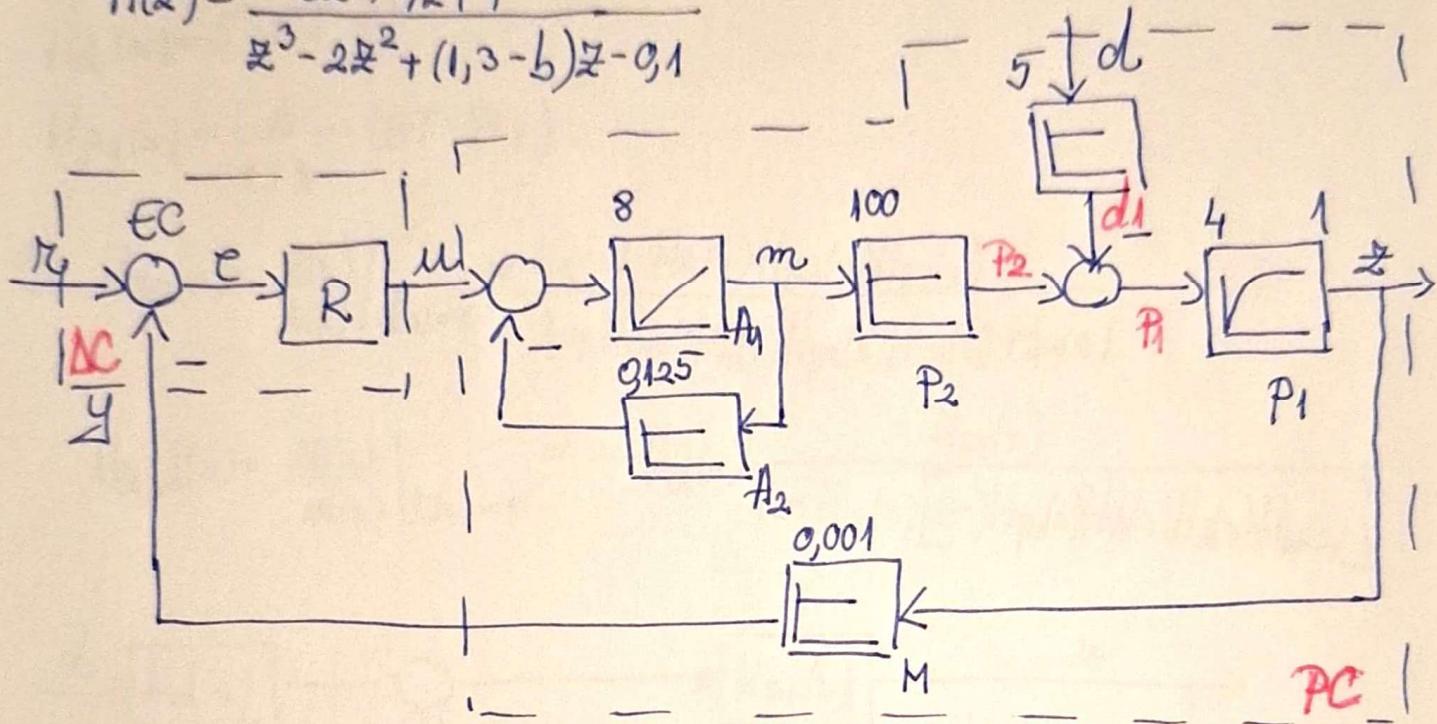
④ Calculati valorile celor 2 parametri k_x și k_d ai caracteristicilor statice $z_{\infty} = k_x r_{\infty} + k_d d_{\infty}$

⑤ Daca intram un defect in functionarea sistemului, caracterizat prin scoaterea din functionare a blocului A_2 , analizati efectele acestui defect asupra punctului ② (stabilitatea sistemului) și asupra punctului ④ (caracteristicile statice)

B

⑥ Determinați valoarea parametrului real b care garantează stabilitatea sistemului liniar în timp discret cu funcția de transfer:

$$H(z) = \frac{-3z^2 + 4z + 1}{z^3 - 2z^2 + (1,3 - b)z - 0,1}$$



P1 $k_e e(t) + \frac{k_e}{T_1} e(t) - u(t) = 0 \rightarrow k_e s e(s) + \frac{k_e}{T_1} e(s) - s u(s) = 0$

$$\Rightarrow \Delta u(s) = k_e \left(s + \frac{1}{T_1} \right) e(s) = \Delta u(s) = \frac{k_e (1 + \Delta T_1)}{T_1} e(s) \Rightarrow H_R(s) = \frac{u(s)}{e(s)} = \frac{k_e (1 + \Delta T_1)}{\Delta T_1}$$

$$\Rightarrow H_R(s) = \frac{u(s)}{e(s)} = \frac{k_e (1 + \Delta T_1)}{\Delta T_1} (ET - PI)$$

R2 $k_e T_1 \dot{e}(t) + k_e e(t) - T_2 \dot{u}(t) - u(t) = 0 \rightarrow k_e T_1 s e(s) + k_e e(s) = T_2 \Delta u(s) + u(s)$

$$\Rightarrow u(s)(1 + \Delta T_2) = k_e (1 + \Delta T_1) e(s) \Rightarrow H_R(s) = \frac{u(s)}{e(s)} = \frac{k_e (1 + \Delta T_1)}{1 + \Delta T_2} (ET - PI)$$

① $H_{A_1}(s) = \frac{8}{s} (ET - i)$

$$H_{A_2}(s) = 0,125 (ET - P)$$

$$\Rightarrow H_A(s) = \frac{H_{A_1}(s)}{1 + H_{A_1}(s)H_{A_2}(s)} = \frac{\frac{8}{s}}{1 + \frac{8}{s} \cdot 0,125} \Rightarrow$$

(2)

$$\Rightarrow H_A(s) = \frac{\frac{8}{\Delta}}{1 + \frac{1}{\Delta}} = \frac{8}{\Delta} \cdot \frac{\Delta}{\Delta+1} \rightarrow H_A(s) = \frac{8}{1+\Delta} (ET - PT_1)$$

$$H_{P2}(s) = 100(ET - P)$$

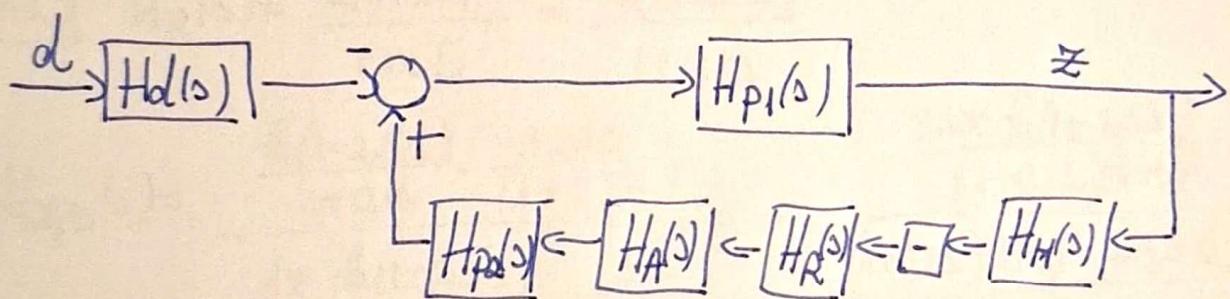
$$H_H(s) = 0,001(ET - P)$$

$$H_D(s) = 5(ET - P)$$

$$H_{P1}(s) = \frac{4}{1+\Delta} (ET - PT_1)$$

$$\textcircled{1} \quad H_{Z,R}(s) = \left. \frac{Z(s)}{d(s)} \right|_{d(s)=0} = \frac{H_R(s) \cdot H_A(s) H_{P2}(s) H_{P1}(s)}{1 + H_R(s) H_A(s) H_{P2}(s) H_{P1}(s) + H_H(s)}$$

$$H_{Z,d}(s) = \left. \frac{Z(s)}{d(s)} \right|_{d(s)=0} = - H_D(s) \frac{H_{P1}(s)}{1 - H_{P1}(s) [(-) H_{P2}(s) H_A(s) H_R(s) H_H(s)]}$$



$$\Rightarrow H_{Z,d}(s) = - H_D(s) \cdot \frac{H_{P1}(s)}{1 + H_R(s) H_A(s) H_{P2}(s) H_{P1}(s) H_H(s)}$$

$$H_D(s) = H_R(s) \cdot H_{P1}(s) = H_R(s) H_A(s) H_{P2}(s) H_{P1}(s) H_H(s)$$

$$H_{P1}(s) = H_A(s) H_{P2}(s) H_{P1}(s) H_H(s) = \frac{8}{1+\Delta} \cdot 100 \cdot \frac{4}{1+\Delta} \cdot 0,001 = \frac{3,2}{(1+\Delta)(1+\Delta)} (ET - PT_1)$$

$$\boxed{R_1}: H_R(s) = \underline{k(1+\Delta T_1)} = \underline{k(1+2,5\Delta)}$$

$$H_{Z,R}(s) = \frac{\underline{k(1+2,5\Delta)} \cdot \underline{\frac{3200}{(1+\Delta)^2}}}{1 + \underline{k(1+2,5\Delta)} \cdot \underline{\frac{3,2}{(1+\Delta)^2}}} = \frac{\underline{1280k(1+2,5\Delta)}}{\underline{\Delta(1+\Delta)^2} + \underline{1,28k(1+2,5\Delta)}} \quad \textcircled{3}$$

$$H_{Z,R}(s) = \frac{1280 k(1+2,5s)}{s(s^2 + 2s + 1) + 1,28k + 3,2k s} \Rightarrow H_{Z,R}(s) = \frac{1280 k(1+2,5s)}{s^3 + 2s^2 + s(3,2k + 1) + 1,28k}$$

$$H_{Z,d}(s) = -5 \cdot \frac{\frac{4}{1+s}}{1 + \frac{k(1+2,5s)}{2,5s} \cdot \frac{3,2}{(1+s)^2}} = -\frac{\frac{20}{1+s}}{s(1+s)^2 + 1,28k(1+2,5s)} \\ = -\frac{20s(1+s)}{s^3 + 2s^2 + s(3,2k + 1) + 1,28k} \Rightarrow H_{Z,d}(s) = -\frac{20s(1+s)}{s^3 + 2s^2 + (3,2k + 1)s + 1,28k}$$

$$H_0(s) = \frac{k(1+2,5s)}{2,5s} \cdot \frac{3,2}{(1+s)^2} \Rightarrow H_0(s) = \frac{1,28k(1+2,5s)}{s(1+s)^2}$$

R₂: $H_R(s) = \frac{k(1+s\sqrt{1})}{1+s\sqrt{2}} = \frac{k(1+2,5s)}{1+9,1s}$

$$H_{Z,R}(s) = \frac{\frac{k(1+2,5s)}{1+0,1s} \cdot \frac{3200}{(1+s)^2}}{1 + \frac{k(1+2,5s)}{1+9,1s} \cdot \frac{3,2}{(1+s)^2}} = \frac{\frac{3200k(1+2,5s)}{(1+9,1s)(1+s)^2}}{\frac{(1+0,1s)(1+s)^2 + 3,2k(1+2,5s)}{(1+0,1s)(1+s)^2}} \\ = \frac{3200k(1+2,5s)}{(1+9,1s)(s^2 + 2s + 1) + 32k + 8k s} \Rightarrow H_{Z,R}(s) = \frac{3200k(1+2,5s)}{9,1s^3 + 1,2s^2 + s(8k + 2,1) + 32k}$$

$$H_{Z,d}(s) = -5 \cdot \frac{\frac{4}{1+s}}{1 + \frac{k(1+2,5s)}{1+9,1s} \cdot \frac{3,2}{(1+s)^2}} = -\frac{\frac{20}{1+s}}{\frac{0,1s^3 + 1,2s^2 + (8k + 2,1)s + 3,2k + 1}{(1+0,1s)(1+s)^2}}$$

$$\Rightarrow H_{Z,d}(s) = \frac{-20(1+9,1s)(1+s)}{9,1s^3 + 1,2s^2 + (8k + 2,1)s + 3,2k + 1}$$

$$H_0(s) = \frac{k(1+2,5s)}{1+9,1s} \cdot \frac{3,2}{(1+s)^2} \Rightarrow H_0(s) = \frac{3,2k(1+2,5s)}{(1+0,1s)(1+s)^2}$$

(4)

$$\textcircled{2} \quad R_1: \Delta(s) = s^3 + 2s^2 + (3,2k+1)s + 1,28k = a_3s^3 + a_2s^2 + a_1s + a_0$$

$$\Delta(s) = 1 + H(s) = 1 + \frac{1,28k(1+2,5s)}{s(1+s)^2} \Rightarrow \Delta(s) = s(1+s)^2 + 1,28k(1+2,5s) \Rightarrow$$

$$\Delta(s) = \Delta(s^2 + 2s + 1) + 1,28k + 3,2k s = s^3 + 2s^2 + s(1+3,2k) + 1,28k$$

Sunt impuse condiții de neceitate specificate în T₂:

$$a_3 = 1 > 0$$

$$a_2 = 2 > 0$$

$$\begin{aligned} a_1 = 3,2k + 1 > 0 \Rightarrow 3,2k > -1 \Rightarrow k > -0,3125 \Rightarrow k \in (-0,3125, +\infty) \\ a_0 = 1,28k > 0 \Rightarrow k \in (0, +\infty) \end{aligned} \quad \left. \right\} \Rightarrow$$

$$k \in (-0,3125, +\infty) \cap (0, +\infty) \Rightarrow k \in (0, +\infty) \quad (*)$$

$$m=3 \Rightarrow H = \begin{bmatrix} a_2 & a_0 & 0 \\ a_3 & a_1 & 0 \\ 0 & a_2 & a_0 \end{bmatrix} = \begin{bmatrix} 2 & 1,28k & 0 \\ 1 & 3,2k+1 & 0 \\ 0 & 2 & 1,28k \end{bmatrix}$$

Sunt impuse condiții de stabilitate (condiție suficientă):

$$\det(H_1) = 2 > 0$$

$$\det(H_2) = 2(3,2k+1) - 1,28k = 6,4k + 2 - 1,28k = 5,12k + 2 > 0 \Rightarrow$$

$$k > -0,390625 \Rightarrow k \in (-0,390625, +\infty)$$

$$\begin{aligned} \det(H) = a_0 \det(H_2) = 1,28k(5,12k+2) > 0 \Rightarrow k \in (0, +\infty) \cap (-0,390625, +\infty) \\ \Rightarrow k \in (0, +\infty) \end{aligned}$$

$$\Rightarrow k \in (0, +\infty) \cap (-0,390625, +\infty) \Rightarrow k \in (0, +\infty) \quad (**)$$

$$\text{Din } (*) \text{ și } (**) \Rightarrow k \in (0, +\infty)$$

$$R_2: \Delta(\alpha) = 9,1\alpha^3 + 1,2\alpha^2 + (8k+2,1)\alpha + 3,2k+1 = a_3\alpha^3 + a_2\alpha^2 + a_1\alpha + a_0$$

Sunt impuse condițiile necese:

$$a_3 = 9,1 > 0$$

$$a_2 = 1,2 > 0$$

$$a_1 = 8k+2,1 > 0 \Rightarrow k > -0,2625 \Rightarrow k \in (-0,2625; +\infty)$$

$$a_0 = 3,2k+1 > 0 \Rightarrow k > -0,3125 \Rightarrow k \in (-0,3125; +\infty)$$

$$k \in (0; +\infty) \cap (-0,2625; +\infty) \cap (0,3125; +\infty) \Rightarrow k \in (0; +\infty) (*)$$

$$m=3 \Rightarrow H = \begin{bmatrix} a_2 & a_0 & 0 \\ a_3 & a_1 & 0 \\ 0 & a_2 & a_0 \end{bmatrix} = \begin{bmatrix} 1,2 & 3,2k+1 & 0 \\ 0,1 & 8k+2,1 & 0 \\ 0 & 1,2 & 3,2k+1 \end{bmatrix} \Rightarrow$$

Sunt impuse condițiile suficiente:

$$\det(H_1) = 1,2 > 0$$

$$\begin{aligned} \det(H_2) &= 1,2(8k+2,1) - 0,1(3,2k+1) = 9,6k+2,52 - 0,32k - 0,1 = \\ &= 9,28k + 2,42 > 0 \Rightarrow k > -0,2608 \Rightarrow k \in (-0,2608; +\infty) \end{aligned}$$

$$\det(H) = a_0 \det(H_2) = (3,2k+1)(9,28k+2,42) \Rightarrow k \in (-0,2608; +\infty) \cap (-0,3125; +\infty)$$

$$\Rightarrow k \in (-0,2608; +\infty)$$

$$\Rightarrow k \in (0; +\infty) \cap (-0,2608; +\infty) \Rightarrow k \in (0; +\infty) (**)$$

$$\text{Olim } (*) \wedge (**) \Rightarrow k \in (0; +\infty)$$

$$\textcircled{3} \quad R_1: RG - PI \Rightarrow \begin{cases} e_{\infty} = 0 \\ e_{\infty} = r_{\infty} - y_{\infty} \end{cases} \Rightarrow y_{\infty} = r_{\infty} = 8 \Rightarrow y_{\infty} = 8$$

$$m_{\infty} = 8 \cdot u_{\infty} \Rightarrow m_{\infty} = 25$$

$$p_{1\infty} = p_{2\infty} - d_{1\infty} = 800u_{\infty} - 500$$

$$p_{2\infty} = 100m_{\infty} = 800u_{\infty}$$

$$z_{\infty} = \frac{1}{4}p_{1\infty} = 3200u_{\infty} - 2000 \Rightarrow z_{\infty} = 8000$$

$$d_{1\infty} = 5d_{\infty} = 500$$

$$y_{\infty} = 0,001z_{\infty} = 3,2u_{\infty} - 2 = 8 \Rightarrow u_{\infty} = 3,125$$

$$R_2 : RG - PDT_1 \Rightarrow e_{\infty} \neq 0 \\ e_{\infty} = k_{\infty} - y_{\infty} \quad \left. \right\} \Rightarrow y_{\infty} = \delta \cdot e_{\infty} \Rightarrow \boxed{y_{\infty} = 6,6487} \approx 6,649$$

$$\begin{aligned} u_{\infty} &= k \cdot e_{\infty} \\ k &= 2 \end{aligned} \quad \left. \right\} \Rightarrow u_{\infty} = 2e_{\infty} \Rightarrow \boxed{u_{\infty} = 2,7026} \approx 2,703$$

$$m_{\infty} = 8u_{\infty} = 16e_{\infty} \Rightarrow \boxed{m_{\infty} = 21,6208} \approx 21,62$$

$$p_{2\infty} = 100u_{\infty} = 1600e_{\infty}$$

$$d_{1\infty} = 5d_{\infty} = 500$$

$$p_{1\infty} = p_{2\infty} - d_{1\infty} = 1600e_{\infty} - 500$$

$$z_{\infty} = 4p_{1\infty} = 6400e_{\infty} - 2000 \Rightarrow \boxed{z_{\infty} = 6648} \approx 6649$$

$$y_{\infty} = 0,001z_{\infty} = 6,648e_{\infty} - 2 = 8 - e_{\infty} \Rightarrow 7,648e_{\infty} = 10 \Rightarrow \boxed{e_{\infty} = 1,3513}$$

$$(4) R_1 : z(\Delta) = H_{z,R}(0)r(\Delta) + H_{z,d}(0)d(\Delta) \xrightarrow{\text{RSC}} z_0 = H_{z,R}(0)r_{\infty} + H_{z,d}(0)d_{\infty}$$

$$\Rightarrow z_{\infty} = k_R r_{\infty} + k_d d_{\infty}$$

$$\begin{aligned} k_R &= H_{z,R}(0) = \frac{1280k}{1,28k} = 1000 \\ k_d &= H_{z,d}(0) = 0 \end{aligned} \quad \left. \right\} \quad \begin{aligned} z_{\infty} &= 1000r_{\infty} + 0 \cdot d_{\infty} \\ k_R &= 1000 \quad \text{si} \quad k_d = 0 \end{aligned}$$

$$R_2 : k_R = H_{z,R}(0) = \frac{3200k}{3,2k+1} \quad \left. \right\} \Rightarrow \boxed{z_{\infty} = \frac{3200k}{3,2k+1} r_{\infty} - \frac{20}{3,2k+1} d_{\infty}}$$

$$k_d = H_{z,d}(0) = \frac{-20}{3,2k+1} \quad \left. \right\} \quad \begin{aligned} k_R &= \frac{3200k}{3,2k+1} \\ k_d &= \frac{-20}{3,2k+1} \end{aligned} \quad \text{si} \quad \left. \right\}$$

$$(5) R_1 : H_{PC}(\Delta) = H_A(\Delta) \cdot H_{P2}(\Delta) \cdot H_{P1}(\Delta) \cdot H_M(\Delta) = \frac{8}{\Delta} \cdot 100 \cdot \frac{4}{1+\Delta} \cdot 0,001 - \frac{3,2}{\Delta(1+\Delta)} (ET - IT_1)$$

$$H_{z,R}(\Delta) = \frac{\frac{k(1+2,5\Delta)}{2,5\Delta} \cdot \frac{3200}{\Delta(1+\Delta)}}{1 + \frac{k(1+2,5\Delta)}{2,5\Delta} \cdot \frac{3200}{\Delta(1+\Delta)}} = \frac{1280k(1+2,5\Delta)}{\Delta^2(1+\Delta) + 1,28k(1+2,5\Delta)}$$

(7)

$$H_{2,r}(\Delta) = \frac{1280k(1+2,5\Delta)}{\Delta^3 + \Delta^2 + 3,2k\Delta + 1,28k}$$

$$H_{2,d}(\Delta) = -5 \cdot \frac{\frac{4}{1+\Delta}}{\Delta^3 + \Delta^2 + 3,2k\Delta + 1,28k} = -\frac{20\Delta^2}{\Delta^3 + \Delta^2 + 3,2k\Delta + 1,28k}$$

$$\Delta(\Delta) = \Delta^3 + \Delta^2 + 3,2k\Delta + 1,28k = a_3\Delta^3 + a_2\Delta^2 + a_1\Delta + a_0$$

Sunt impuse condiții de necesitate:

$$a_3 = 1 > 0$$

$$a_2 = 1 > 0$$

$$a_1 = 3,2k > 0 \Rightarrow k \in (0; +\infty)$$

$$a_0 = 1,28k > 0 \Rightarrow k \in (0; +\infty)$$

$\} \Rightarrow k \in (0; +\infty)(*)$

$$m=3 \Rightarrow H = \begin{bmatrix} a_2 & a_0 & 0 \\ a_3 & a_1 & 0 \\ 0 & a_2 & a_0 \end{bmatrix} = \begin{bmatrix} 1 & 1,28k & 0 \\ 1 & 3,2k & 0 \\ 0 & 1 & 1,28k \end{bmatrix}$$

Sunt impuse condiții de stabilitate:

$$\det(H_1) = 1 > 0$$

$$\det(H_2) = 3,2k - 1,28k = 1,92k > 0 \Rightarrow k \in (0; +\infty)$$

$$\det(H) = a_0 \det(H_2) = 1,28k \cdot 1,92k = 2,4576 > 0$$

Atât (*) și (***) $\Rightarrow k \in (0; +\infty)$

$$k_r = H_{2,r}(0) = \frac{1280k}{1,28k} = 1000 \Rightarrow k_r = 1000$$

$$kd = H_{2,d}(0) = 0 \Rightarrow kd = 0$$

$$\boxed{R_2}: H_{2,r}(\Delta) = \frac{\frac{k(1+2,5\Delta)}{1+0,1\Delta} \cdot \frac{3200}{\Delta(1+\Delta)}}{1 + \frac{k(1+2,5\Delta)}{1+0,1\Delta} \cdot \frac{3,2}{\Delta(1+\Delta)}} = \frac{\frac{3200k(1+2,5\Delta)}{\Delta(1+0,1\Delta)(1+\Delta)}}{\Delta(1+0,1\Delta)(1+\Delta) + 3,2k + 8k\Delta} =$$

$$= \frac{3200k(1+2,5\Delta)}{\Delta(0,1\Delta^2 + 1,1\Delta + 1) + 8k\Delta + 3,2k} \Rightarrow \boxed{H_{2,r}(\Delta) = \frac{3200k(1+2,5\Delta)}{0,1\Delta^3 + 1,1\Delta^2 + (8k + 1)\Delta + 3,2k}}$$

$$H_{2,d}(\Delta) = \frac{\frac{-20}{1+5}}{3\Delta^3 + 1,1\Delta^2 + (8k+1)\Delta + 3,2k} = \frac{-\frac{20}{1+5}(1+9\Delta)}{3\Delta^3 + 1,1\Delta^2 + (8k+1)\Delta + 3,2k}$$

$$\Delta(\Delta) = 3\Delta^3 + 1,1\Delta^2 + (8k+1)\Delta + 3,2k = a_3\Delta^3 + a_2\Delta^2 + a_1\Delta + a_0$$

Sunt impuse condiții de necesitate:

$$a_3 = 3 > 0$$

$$a_2 = 1,1 > 0$$

$$\left. \begin{array}{l} a_1 - 8k + 1 > 0 \Rightarrow k > -0,125 \Rightarrow k \in (-0,125; +\infty) \\ a_0 = 3,2k > 0 \Rightarrow k \in (0; +\infty) \end{array} \right\} \Rightarrow k \in (0; +\infty) (\ast),$$

$$m=3 \Rightarrow H = \begin{bmatrix} a_2 & a_0 & 0 \\ a_3 & a_1 & 0 \\ 0 & a_2 & a_0 \end{bmatrix} = \begin{bmatrix} 1,1 & 3,2k & 0 \\ 0,1 & 8k+1 & 0 \\ 0 & 1,1 & 3,2k \end{bmatrix}$$

Sunt impuse condiții de suficiență:

$$\det(H_1) = 1,1 > 0$$

$$\det(H_2) = 1,1(8k+1) - 9,32k = 8,8k + 1,1 - 9,32k = 8,48k + 1,1 > 0 \Rightarrow k > -0,1297 \Rightarrow k \in (-0,1297; +\infty)$$

$$\det(H) = a_0 \det(H_2) = 3,2k(8,48k + 1,1) > 0 \Rightarrow k \in (0; +\infty) \cap (-0,1297; +\infty) \Rightarrow k \in (0; +\infty)$$

$$\Rightarrow k \in (0; +\infty) \cap (-0,1297; +\infty) \Rightarrow k \in (0; +\infty) (\ast\ast)$$

$$\Rightarrow \text{Din } (\ast) \text{ și } (\ast\ast) \Rightarrow k \in (0; +\infty)$$

$$k_x = H_{2,d}(0) = \frac{3200k}{3,2k} = 1000 \Rightarrow k_x = 1000$$

$$k_d = H_{2,d}(0) = 0 \Rightarrow k_d = 0$$

$$\textcircled{6} \quad \Delta(z) = z^3 - 2z^2 + (1,3 - b)z - 0,1 = a_3 z^3 + a_2 z^2 + a_1 z + a_0$$

$a_3 = 1$
 $a_2 = -2$
 $a_1 = 1,3 - b$
 $a_0 = -0,1$

(*)

-cu $m=3$ și $a_3=1 > 0$

Sunt testate primele 3 conditii de stabilitate:

$$\Delta(1) = 1 - 2 + (1,3 - b) - 0,1 = -1 + 1,3 - b - 0,1 = 0,2 - b > 0 \Rightarrow b < 0,2 \Rightarrow$$

$b \in (-\infty; 0,2)$ (*)

$$\Delta(-1) = -1 - 2 - (1,3 - b) - 0,1 = -3,1 - 1,3 + b = b - 4,4 < 0 \Rightarrow b < 4,4 \Rightarrow$$

$b \in (-\infty; 4,4)$ (**)

$$a_0 = -0,1 \Rightarrow |a_0| = 0,1 < a_3 \text{ A.}$$

$$b_0 = \begin{vmatrix} a_0 & a_3 \\ a_3 & a_0 \end{vmatrix} = \begin{vmatrix} -0,1 & 1 \\ 1 & -0,1 \end{vmatrix} = (-0,1)^2 - 1 = 0,01 - 1 = -0,99$$

$$b_1 = \begin{vmatrix} a_0 & a_2 \\ a_3 & a_1 \end{vmatrix} = \begin{vmatrix} -0,1 & -2 \\ 1 & 1,3 - b \end{vmatrix} = -0,1(1,3 - b) + 2 = -0,13 + 0,1b + 2 \\ = 0,1b + 1,87.$$

$$b_2 = \begin{vmatrix} a_0 & a_1 \\ a_3 & a_2 \end{vmatrix} = \begin{vmatrix} -0,1 & 1,3 - b \\ 1 & -2 \end{vmatrix} = 0,99 - 1,3 + b = b - 1,1.$$

Liniile	\mathbb{Z}^0	\mathbb{Z}^1	\mathbb{Z}^2	\mathbb{Z}^3	
(1)	$\frac{-0,1}{(a_0)}$	$\frac{1,3 - b}{(a_1)}$	$\frac{-2}{(a_2)}$	$\frac{1}{(a_3)}$	$ b_0 > b_2 \Rightarrow$
(2)	$\frac{1}{(a_3)}$	-2	$\frac{1,3 - b}{(a_1)}$	$\frac{-0,1}{(a_0)}$	$0,99 > 1,1 - b \Rightarrow$
(3)	$-0,99$	$0,1b + 1,87$	$b - 1,1$	—	$b > 1,1 - 0,99$
(4)	$b - 1,1$	$0,1b + 1,87$	$-0,99$	—	$b > 0,11 \Rightarrow$
	(b_0)	(b_1)	(b_2)		$b \in (0,11; +\infty)$ (***)

$$|b_0| = 0,99$$

\cap lin (*), (**), (***) =

$$|b_2| = |b - 1,1| = |-(1,1 - b)| = 1,1 - b$$

$b \in (-\infty; 0,2) \cap (-\infty; 4,4) \cap (0,11)$

$\Rightarrow b \in (0,11; 0,2)$

(10)