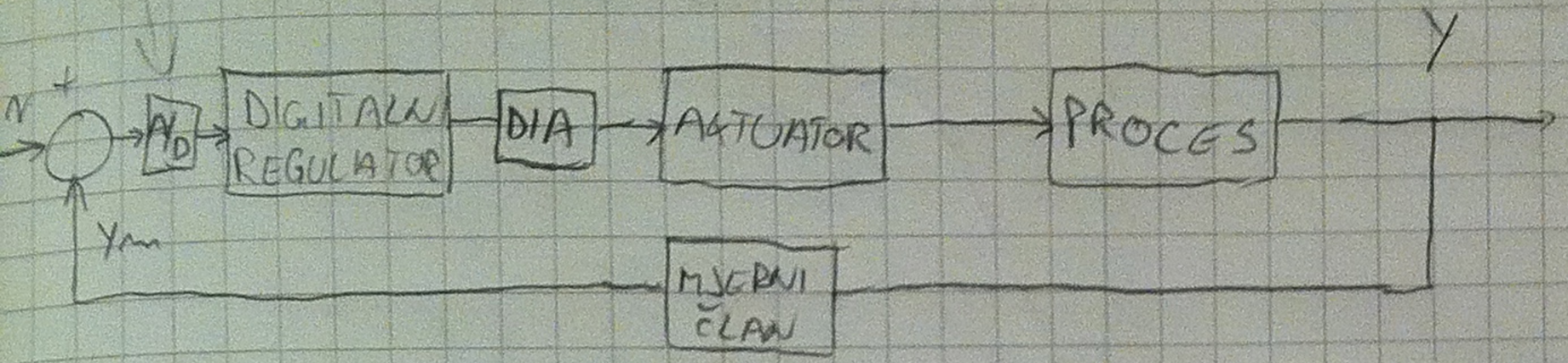
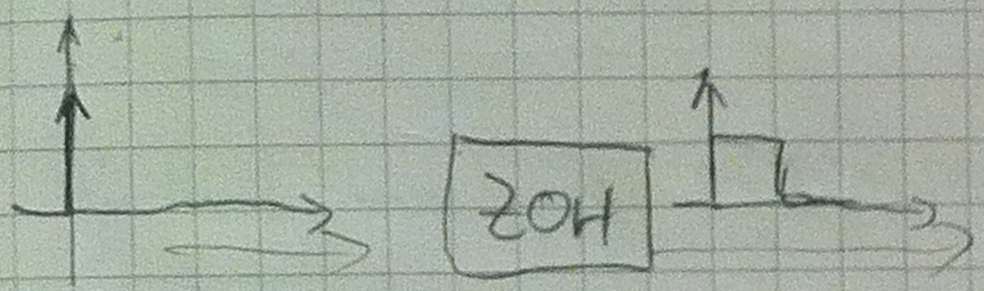
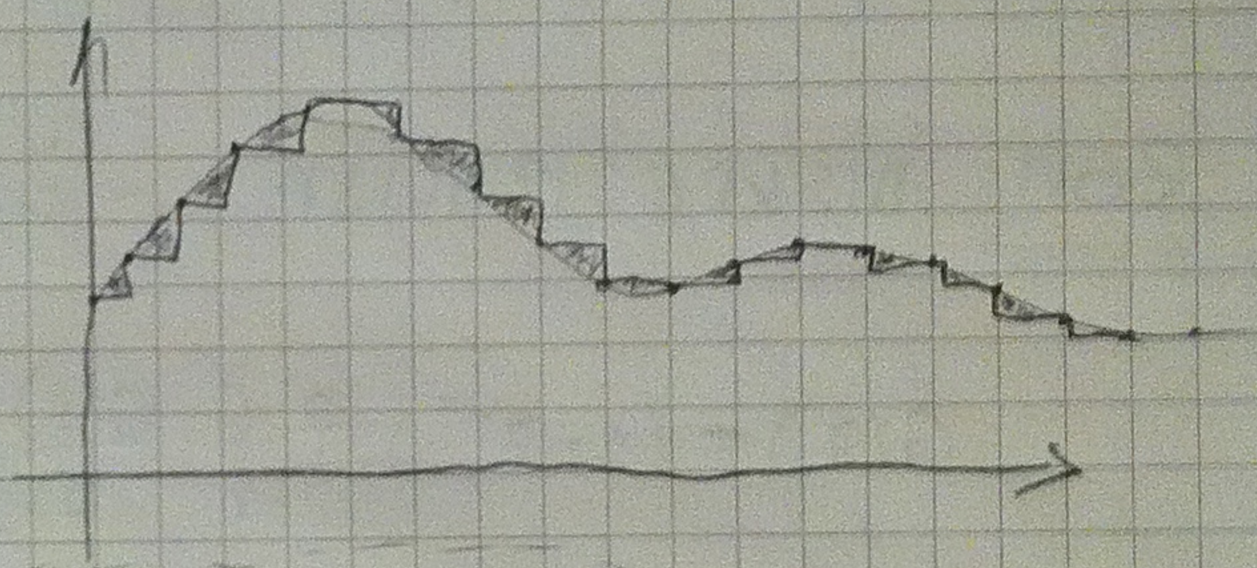
MASS 3

06.01.2011.

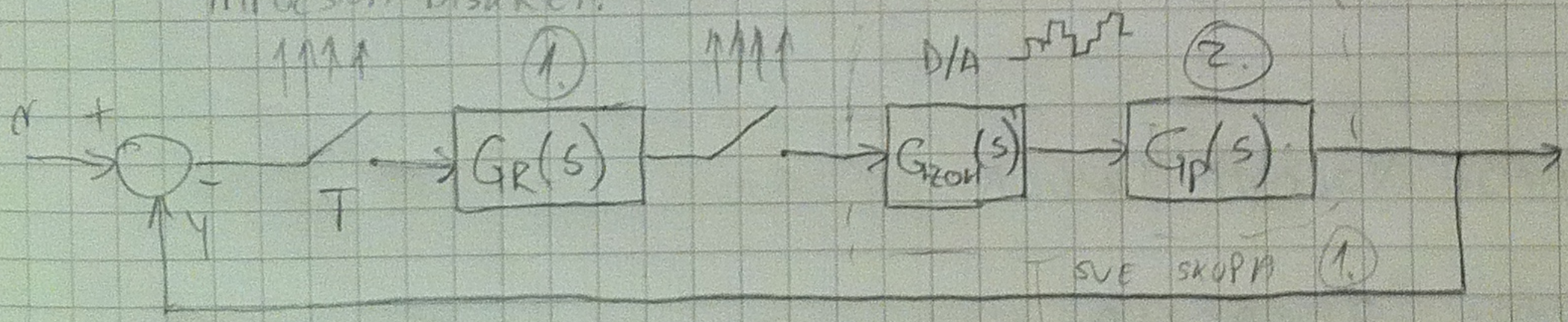
$\Omega_s \geq 2\Omega_{MAX}$

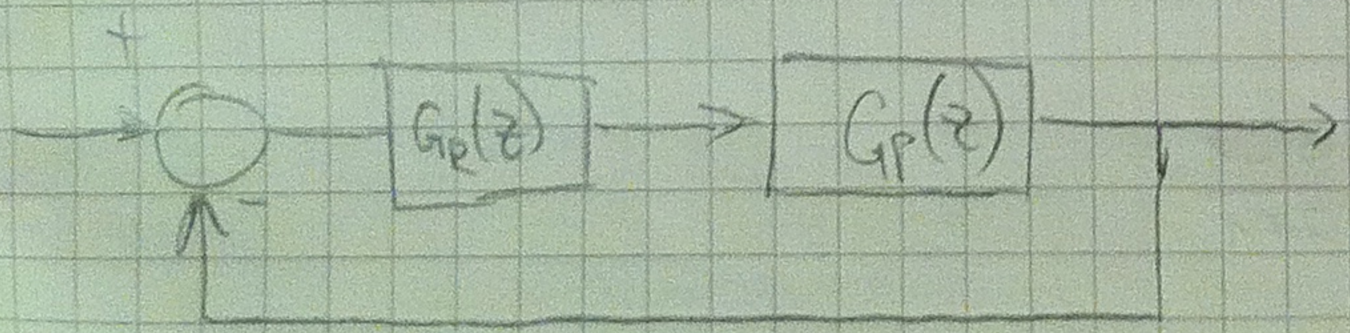






IMPULSNA DISKRET.





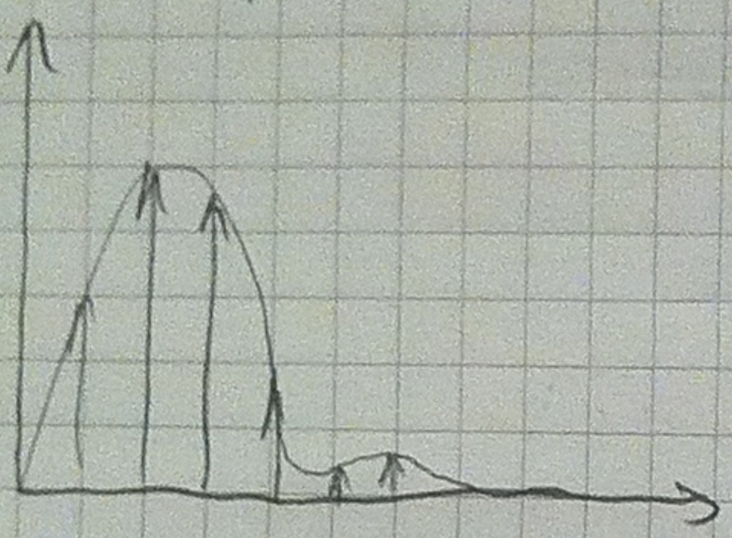
dig. sustav u diskretnoj domeni

$$G(s) = (1 - e^{-sT}) \frac{G_p(s)}{s}$$

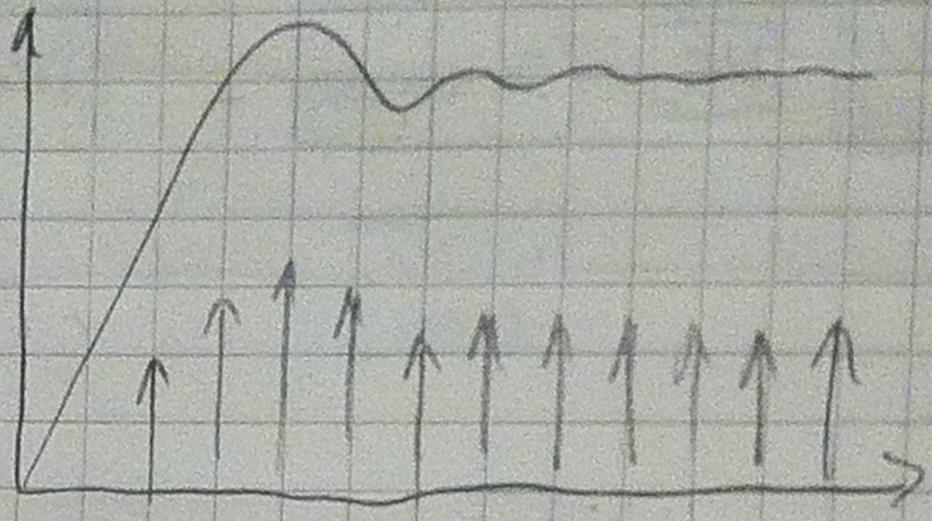
1. IMPULSNA DISKRETIZACIJA

$$G(z) = \mathcal{Z}\{G(s)\}$$ – čuva svojstva težinske funkcije

$g(t)$ – impulsni odziv



$h(t)$ – prijelazna funkcija (odziv na skp)



2. ZOH DISKRETIZACIJA – čuva svojstva prijelazne funkcije

$$G(z) = (1 - z^{-1})\,\mathcal{Z}\left\{\frac{G(s)}{s}\right\}$$

3. OČUVANJE POLOVA I NULA

4. TUSTINOVA RELACIJA

$$G(z) = G(s)\Big|_{s=\frac{2}{T}\frac{z-1}{z+1}}$$

5. EULER UNAPRIJEDNI

$$G(z) = G(s)\Big|_{s=\frac{z-1}{T}}$$

SJMO KAD SE TRAŽI

6. EULER UNAZADNI

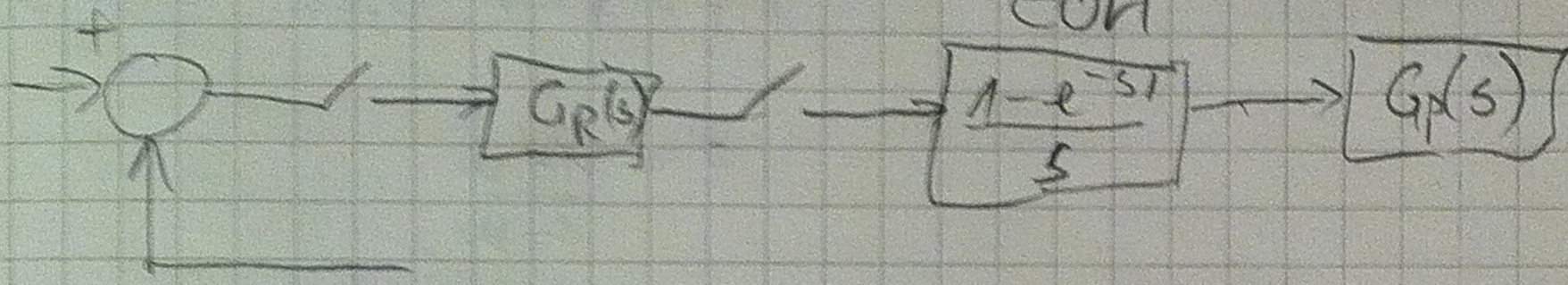
$$G_R(z) = G(s)\Big|_{s=\frac{z-1}{zT}}$$

2008/09

(4)

$$G_R(s) = 0.7 \quad \frac{1+s}{s}$$ IMPULSNA

$$G_P(s) = \frac{5}{(1+0.3s)(s+1)}$$ ZOH



$$G_R(s) = 0.7\left(1 + \frac{1}{s}\right)$$

$$\frac{1}{s} \rightarrow \frac{z}{z-1}$$

$$1 \rightarrow 1$$

$$G_R(z) = 0.7\left(1 + \frac{z}{z-1}\right) = 0.7\,\frac{2z-1}{z-1}$$

$$= 0.7\,\frac{2 - z^{-1}}{1 - z^{-1}} = \frac{U(z)}{E(z)}$$

REKURZIVNA JEDNADŽBA

$$0.7\left(2E(z) - z^{-1}E(z)\right) = U(z) - z^{-1}U(z)$$

$$0.7\left(2e(k) - e(k-1)\right) + U(k-1) = U(k)$$

$$G_P(s) = \frac{\frac{30}{3}}{3\left(s+\frac{10}{3}\right)(s+1)}$$

$$= \frac{3}{s} + \frac{s+1}{} + \frac{s+\frac{10}{3}}{}$$

(2) 2008./2009.

$$G_R(z) = 10\,\frac{z-0.4}{z-0.6}$$

$$G_P(z) = 0.04\,\frac{z+0.25}{(z-0.4)(z-0.6)}$$

$$G_0(z) = 0.4\,\frac{z+0.25}{(z-0.6)}$$

$$f(z) = z^2 - 1.2z + 0.36 + 0.4z - 0.1$$

$$f(z) = z^2 - 0.8z + 0.26 = 0$$

$$z = \frac{1+w}{1-w}$$

$$f(w) = \left(\frac{1+w}{1-w}\right)^2 - 0.8\,(1+w)(1-w) + 0.26(1-w)^2 = 0$$

$$f(w) = (1+2w+w^2) - 0.8(1-w^2) + 0.26(1-2w+w^2) = 0$$

$$f(w) = 2.06w^2 + 1.46w + 0.46 = 0$$

fazno osiguranje

$$\Delta\varphi = -\omega_c \frac{T}{2}$$

$$\varphi_d = \varphi_c + \Delta\varphi$$

$$\omega_c = 40\ s^{-1}$$

$$G_0(w) =$$

$$z = \frac{1 + w\frac{T}{2}}{1 - w\frac{T}{2}}$$

ZA DEKADNE BODEA

JURYEV KRITERIJ

$$f(z) = 1 - z + 2z^2 - 3z^3 + 2z^4 = 0$$

(1.) $f(1) > 0 \qquad f(1) = 1 > 0$

$(-1)^m f(-1) > 0 \qquad (-1)^4 f(-1) = 9 > 0$

(2.) TABLICA

$2m - 2$ REDAKA

GORNJI MANJI	R	z^0	z^1	z^2	z^3	z^4
	1	1	-1	2	-3	2
	2	2	-3	2	-1	1
	3	3	6	-2	-1	x
GORNJI VEĆI	4	-1	-2	5	-3	x
	5	8	-14	11	x	x
	6	11	-19	8	x	x

STABILNOST — 3 člana — STOP

I - TOČNO
N - NETOČNO

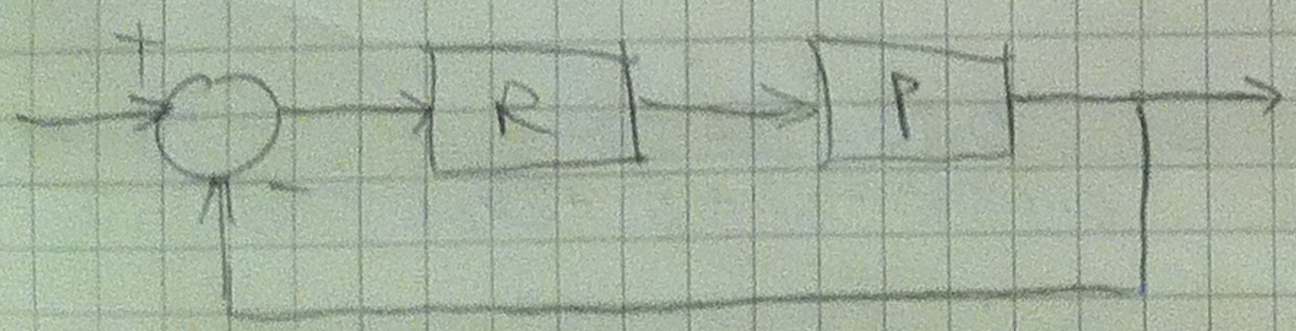
I
I
I
N

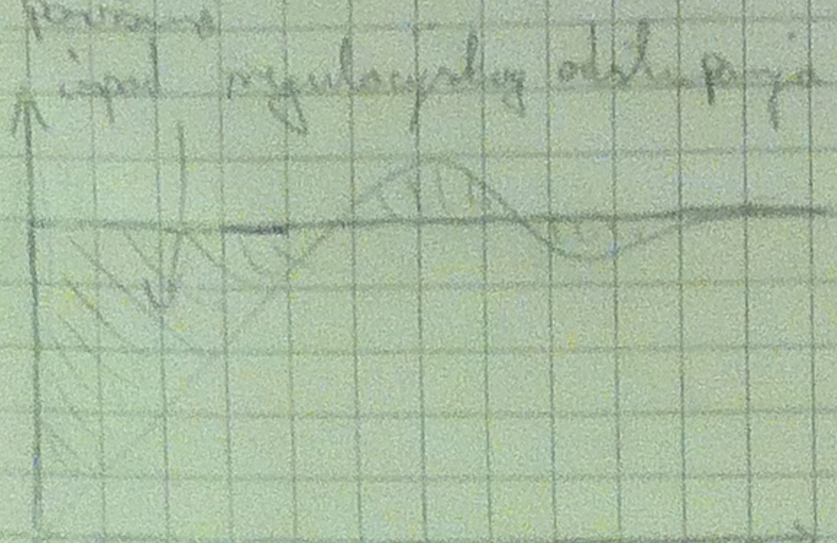
$$b_0 = \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} = -3$$

$$b_1 = \begin{vmatrix} 1 & -3 \\ 2 & -1 \end{vmatrix} = 5$$

SUSTAV JE NESTABILAN

INTEGRALNI KRITERIJ





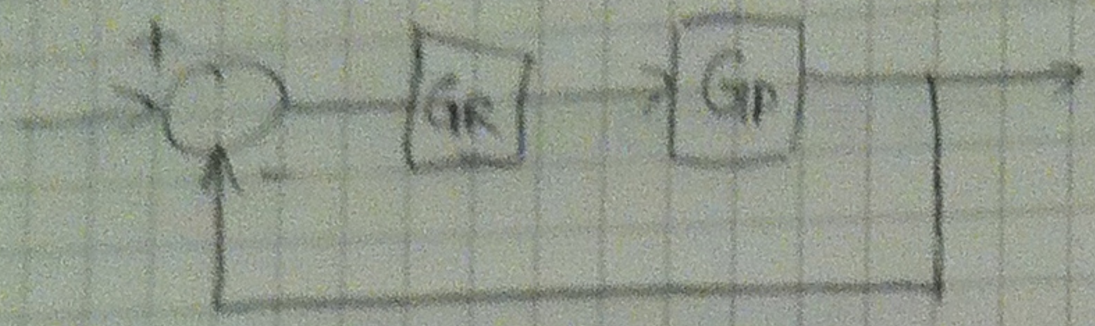
$\min(e) \Rightarrow \min(\text{površ od } e)$

$$J = \int_0^\infty e \, d\tau \qquad J = \int_0^\infty e^2 \, d\tau$$

ISE

$$I_k = \int_0^\infty f_k [e(t), u(t)] \, d\tau$$

PROMJER 8.



$$R(s) = \frac{1}{s}$$

$$G_R(s) = K_R$$

$$G_P(s) = \frac{K_P}{s(1+T_P s)^2} \qquad K_P = 2 \quad T_P = 0.5\,s$$

① PRONAĐI $E(s)$ U OBLIKU

$$E(s) = \frac{c_{n-1}s^{n-1} + \dots + c_1 s^1 + c_0}{s^n + d_{n-1}s^{n-1} + \dots + d_1 s^1 + d_0}$$

ODREDI KOEF. c_i i d_i

$$E(s) = \frac{R(s)}{1 + G_R(s)} = \frac{R(s)}{1 + G_R(s)G_P(s)}$$

$$E(s) = \frac{1}{s\left(1 + \frac{2K_R}{0.25s(s+2)^2}\right)} = \frac{0.25s^3 + s^2 + s}{0.25s^4 + s^3 + s^2 + 2K_R s} = \frac{0.25s^2 + s + 1}{0.25s^3 + s^2 + s + 2K_R}$$

$n = 3$

$c_2 = 0.25 \quad d_3 = 1$
$c_1 = 1 \quad d_2 = 2K_R$
$c_0 = 1 \quad d_1 = 1$
$\quad\quad\quad d_0 = 0.25$

(2) ODREDITI FUNKCIJU $I_{3,M}$

$$I_{3,3} = \frac{3k_R+2}{4k_R(2-k_R)}$$

(3) PARCIJALNE DERIVACIJE

$$\frac{\partial I_{3,3}}{\partial k_R} = \frac{1,5k_R^2+2k_R-2}{k_R^2(k_R-2)} = 0 \qquad \boxed{k_R = \frac{2}{3}}$$

~~$k_R = -2$~~ NEGATIVNO