I. LABORATORIJSKA VJEŽBA

3.1-1 a) FIR KAUZALAN, STABILAN, MIN. FAZ, MAX. FAZ?

$$y[n] = u[n+1] - 2u[n] + u[n-1] \qquad x[n] = \{1, -2, 1\}$$

NIJE KAUZALAN JER OVISI O PROŠLOSTI ($u[n-1]$).

$$X(z) = \sum_{n=-\infty}^{\infty} x(n) \cdot z^{-n}$$

$$H(z) = \frac{Y(z)}{U(z)} = z - 2 + z^{-1} = \frac{z^2 - 2z + 1}{z}$$

POLOVI $z = 0$ => SUSTAV JE STABILAN (GRANIČNO)

NULE $1 - 2z + z^2 = 0$

$$z_{1,2} = \frac{2 \pm \sqrt{4-4}}{2} = 1$$ => SUSTAV NIJE MI

MINIMALNO NI MAKSIMALNO FAZNI

3.2-1 a) PRIJENOSNA FUNKCIJA KOJA DODAJE ODJEK

$$H(z) = 1 + a z^{-D}, \quad |z| \neq 0$$ a - REALNA KONSTANTA

D - CIJELI BROJ

MINIMALNO FAZNI -> POLOVI I NULE UNUTAR JED. KRUŽNICE

$$1 + a z^{-D} \neq 0 \qquad 1 = -a z^{-D} \quad / \cdot z^{D}$$

$$-a = z^{D}$$

$$H(z) = b_0 + b_1 z^{n-1} + \dots b_M z^{n-M}$$

$$\sqrt[D]{-a} = z, \quad |z| < 1$$

$$-1 < -a^{\frac{1}{D}} < 1$$

$$-a^{\frac{1}{D}} < 1 \qquad -a^{\frac{1}{D}} > -1$$

$$|\sqrt[D]{-a}| < 1$$

$$-a^{\frac{1}{D}} < (-a)^{0} \qquad (-a)^{\frac{1}{D}} > (-1) \cdot (-a)^{0}$$

$$|(-a)^{1/D}| < 1$$

$$\frac{1}{D} < 0 \qquad a < -1$$

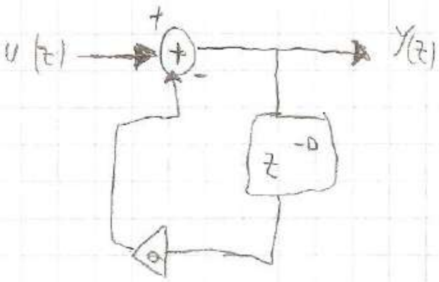
$$\underbrace{|a| < 1, D > 0} \qquad \underbrace{D > 0}$$

$$H^{-1}(z) = G(z) = \frac{1}{1+a z^{-D}} \cdot \frac{1 \cdot z^{D}}{1 \cdot z^{D}} = \frac{z^{D}}{z^{D}+a}$$

$H^{-1}(z)$ KONVERGIRA AKO $z \neq \sqrt[D]{-a}$

$$H^{-1}(z) = \frac{1}{1+a z^{-D}}$$

DIJAGRAM



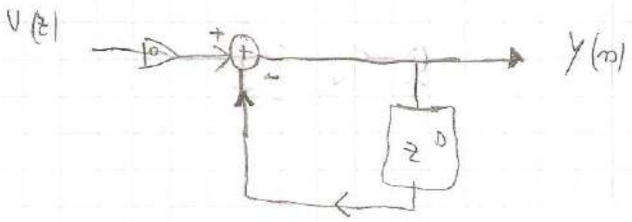
3.2-1

b) SUSTAV NIJE MINIMALNO FAZNI AKO SU NULE IZVAN JED KRUŽNICE.

$$z = \left|\sqrt[D]{-a}\right| > 1 \quad ZA \ |a|>1 \quad ; \quad DEN$$

$$H(z) = 1 + a z^{-D} \Rightarrow H_{MIN}(z) = a + z^{-D}$$

$$H^{-1}_{MIN}(z) = \frac{1}{a+z^{-D}}$$



3,2-2 a)

$$H(z) = \frac{1}{1 - a z^{-D}} \quad , |z| > \sqrt[D]{a}$$

MIN. FAZNI AKO SU POLOVI I NULE UNUTAR JED. KRUŽNICE

$$1 - a z^{-D} = \emptyset$$

$$\frac{a}{z^{-D}} = 1 \quad , z > 1$$

$$\left| \sqrt[D]{a} \right| < 1$$

$D > 0 \quad -1 < \sqrt[D]{a} < 1$

$a^{\frac{1}{D}} < 1 \qquad a^{\frac{1}{D}} > -1$

$\cancel{a > 1} \qquad \cancel{a < -1}$

$a < 1$ ✓ $\qquad a > -1$ ✓

$$\underbrace{|a| < 1, \; D > 0}$$

$$H^{-1}(z) = 1 - a z^{-D}$$

POD. KONVERGENCIJE $|z| > |r_M|$ TJ. $|z| > \left| \sqrt[D]{a} \right|$

POL S NAJVEĆIM MODULOM

3,2-3. a)

$$H(z) = \frac{-a + z^{-D}}{1 - a z^{-D}} \quad , |z| > \sqrt[D]{a}$$

$D > 0$ (VRIJEME DA SE JEKA VRATI)

STABILNOST OVISI O POLOVIMA, DOK MINIMALNO FAZNI SUSTAV OVISI O NULAMA I POLOVIMA. (UNUTAR JED. KRUŽNICE)

$\frac{a}{z^D} < 1 \quad \sqrt[D]{a} = z \quad , |z| < 1 \quad$ ISTO KAO 3,2-2 $\quad D > 0 \quad |a| < 1$

MIN FAZNI

$$-a + z^{-D} = \emptyset$$

$$a = \frac{1}{z^{D}}$$

$$\left(\frac{1}{a}\right)^{\frac{1}{D}} = z \quad , \quad |z| < 1$$

$$\left|a^{-\frac{1}{D}}\right| < 1$$

/

$$a^{-\frac{1}{D}} < 1 \qquad a^{-\frac{1}{D}} > -1$$

$$a^{-\frac{1}{D}} < a^{0} \qquad a^{-\frac{1}{D}} > (-1) \cdot a^{0}$$

$$\underbrace{a > 1} \qquad \underbrace{a < -1}$$

$|a| > 1$ NIJE MOGUĆE DA SUSTAV BUDE MINIMALNO FAZNI I STABILAN U ISTO VRIJEME.

b)

$$H^{-1}(z) = \frac{1 - a z^{-D}}{-a + z^{-D}} \qquad |a| > 1$$

$$-a + z^{-D} = 0$$

$$z^{-D} = a$$

$$\frac{1}{z} = \sqrt[D]{a} > 1 \qquad |a| > 1$$

c)

$$H_{MIN}(z) = \frac{-1 + a z^{-D}}{1 - a z^{-D}}$$

$$1 - a z^{-D} = 0$$

$$a z^{-D} = 1 \qquad / \cdot z^{D}$$

$$a = z^{D}$$

$$z = \sqrt[D]{a} \Rightarrow |a| > 1$$