5. $H_0(z) = \dfrac{0.2 \cdot z + 0.5}{z^2 - 1.2z + 0.2}$

$\Delta(z) = 1 + H_0(z) = 1 + \dfrac{0.2z + 0.5}{z^2 - 1.2z + 0.2} = \dfrac{z^2 - z + 0.7}{z^2 - 1.2z + 0.2}$

$\Rightarrow \Delta(z) = 0 \Rightarrow \Delta(z) = z^2 - z + 0.7$

$n = 2$

$a_2 = 1 \quad a_1 = -1 \quad a_0 = 0.7$

- cond 1: $\Delta(1) = 1 - 1 + 0.7 = 0.7 > 0$ T
- cond 2: $\Delta(-1) = 1 + 1 - 0.7 = 1.3 > 0$ T
  ($n = 2$ even)
- cond 3: $|a_0| < a_n \Leftrightarrow |0.7| < 1 \Leftrightarrow 0.7 < 1$ T

Array for Jury's stability test

| | $z^0$ | $z^1$ | $z^2$ |
|---|---|---|---|
| 1 | $a_0 = 0.7$ | $a_1 = -1$ | $a_2 = 1$ |
| 2 | $a_n = 1$ | $a_{n-1} = -1$ | $a_{n-2} = 0.7$ |
| | | | |

$\Rightarrow$ THE SYSTEM IS STABLE

7. $\Delta(z) = z^3 - 2z^2 + 1.4z - 0.1$

$n = 3$

$a_3 = 1 \quad a_2 = -2 \quad a_1 = 1.4 \quad a_0 = -0.1$

- cond 1: $\Delta(1) = 1 - 2 + 1.4 - 0.1 = 0.3 > 0$ ✓ T
- cond 2: $\Delta(-1) = -1 - 2 - 1.4 - 0.1 = -4.5 < 0$ T
  (n = 3 odd)
- cond 3: $|a_0| < a_n \Leftrightarrow |a_0| < a_3 \Leftrightarrow +0.1 < 1$ T

Routh Array

$$b_0 = \begin{vmatrix} a_0 & a_{n-0} \\ a_n & a_0 \end{vmatrix} = \begin{vmatrix} -0.1 & 1 \\ 1 & -0.1 \end{vmatrix} = 0.01 - 1 = -0.99$$

$$b_1 = \begin{vmatrix} a_0 & a_{n-1} \\ a_n & a_1 \end{vmatrix} = \begin{vmatrix} -0.1 & -2 \\ 1 & 1.4 \end{vmatrix} = -0.14 + 2 = 1.86$$

$$b_2 = \begin{vmatrix} a_0 & a_{n-2} \\ a_n & a_2 \end{vmatrix} = \begin{vmatrix} -0.1 & 1.4 \\ 1 & -2 \end{vmatrix} = 0.2 - 1.4 = -1.2$$

Array for Jury's stability test

| | $z^0$ | $z^1$ | $z^2$ | $z^3$ |
|---|---|---|---|---|
| 1 | $a_0 = -0.1$ | $a_1 = 1.4$ | $a_2 = -2$ | $a_3 = 1$ |
| 2 | $a_3 = 1$ | $a_2 = -2$ | $a_1 = 1.4$ | $a_0 = -0.1$ |
| 3 | $b_0 = -0.99$ | $b_1 = 1.86$ | $b_2 = -1.2$ | |
| 4 | $b_2 = -1.2$ | $b_1 = 1.86$ | $b_0 = -0.99$ | |

- cond 4: $|b_0| > |b_{n-1}| \Leftrightarrow 0.99 > 1.2$ F

$\Rightarrow$ THE SYSTEM IS UNSTABLE