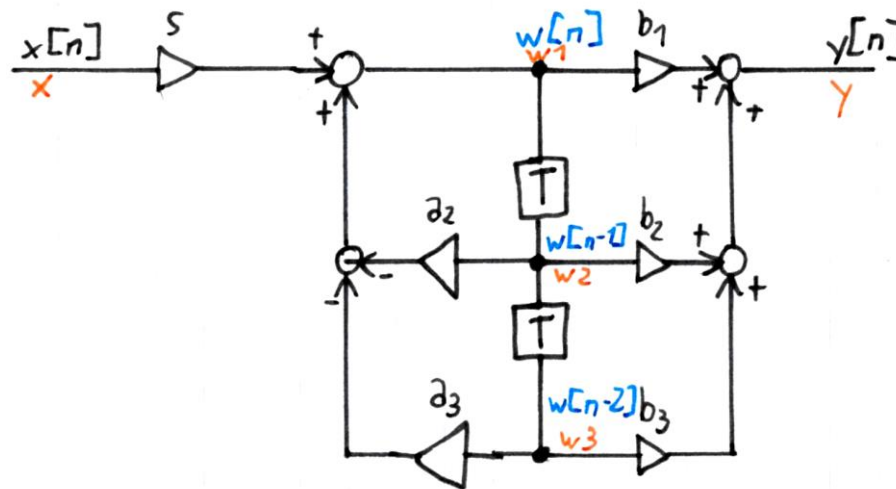




$$f_s = 48 \text{ kHz}$$

$$s = 0,003916$$

$$a_2 = -1,81534$$

$$a_3 = 0,831006$$

$$b_1 = 1$$

$$b_2 = 2$$

$$b_3 = 1$$

gesucht:

- Differenzengleichung
- $H(z)$
- Pol- / Nullstellen
- Pol- / Nullstellen ST-Diagramm
- Pol- / Nullstellen Frequenzen
- C-Code
- Bodediagramm

$$w[n] = s * x[n] - a_2 * w[n-1] - a_3 * w[n-2]$$

$$y[n] = b_1 * w[n] + b_2 * w[n-1] + b_3 * w[n-2]$$



$$W(z) = s * X(z) - a_2 * z^{-1} * W(z) - a_3 * z^{-2} * W(z)$$

$$Y(z) = b_1 * W(z) + b_2 * z^{-1} * W(z) + b_3 * z^{-2} * W(z)$$

$$W(z) * [1 + a_2 * z^{-1} + a_3 * z^{-2}] = s * X(z) \quad \rightarrow \quad W(z) = \frac{s * X(z)}{1 + a_2 * z^{-1} + a_3 * z^{-2}}$$

$$Y(z) = W(z) * [b_1 + b_2 * z^{-1} + b_3 * z^{-2}]$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{s * (b_1 + b_2 * z^{-1} + b_3 * z^{-2})}{1 + a_2 * z^{-1} + a_3 * z^{-2}}$$

$$H(z) = \frac{0,003916 * (1 + 2 * z^{-1} + z^{-2})}{1 - 1,81534 * z^{-1} + 0,831006 * z^{-2}}$$

$$H(z) = \frac{0,003916 * (z^2 + 2z + 1)}{z^2 - 1,81534 * z + 0,831006}$$

Polstellen: (Nenner = 0)

$$z^2 - 1,81534 * z + 0,831006 = 0$$

$$p_{12} = 0,90767 \pm j * 0,0845 = 0,9116 \angle \pm 0,093$$

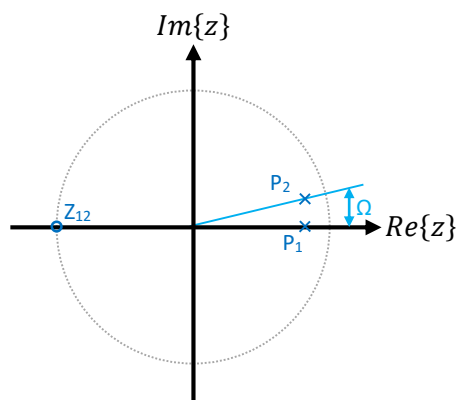
$$= 0,9116 \angle \pm 5,3^\circ$$

Nullstellen: (Zähler = 0)

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

$$z_{12} = -1 = 1 \angle \pi$$

$$= 1 \angle 180^\circ$$



$$\Omega_p = 2\pi * \frac{f_p}{f_s} \quad f_p \dots \dots \text{Polstellenfrequenz}$$

$$\Omega_{NST} = 2\pi * \frac{f_{NST}}{f_s} \quad f_{NST} \dots \text{Nullstellenfrequenz}$$

$$\Omega_p = 0,093 = 2\pi * \frac{f_p}{48 \text{ kHz}} \quad \rightarrow f_p = \frac{0,093}{2\pi} * 48 \text{ kHz} = 710 \text{ Hz}$$

$$\Omega_{NST} = \pi = 2\pi * \frac{f_{NST}}{48 \text{ kHz}} \quad \rightarrow f_p = \frac{\pi}{2\pi} * 48 \text{ kHz} = 24 \text{ kHz}$$

C-Code:

```
float x=0, y=0, w1=0, w2=0, w3=0;
float s=0, 003916, a2=-1,81534, a3=0,831006;
float b1=1, b2=2, b3=1;
TP_2.Ord:
  x = Eingang;
  w1 = s*x - a2*w2 - a3*w3;
  y = b1*w1 + b2*w2 + b3*w3;
  w3 = w2;
  w2 = w1;
  Ausgang = y;
Ende:
```