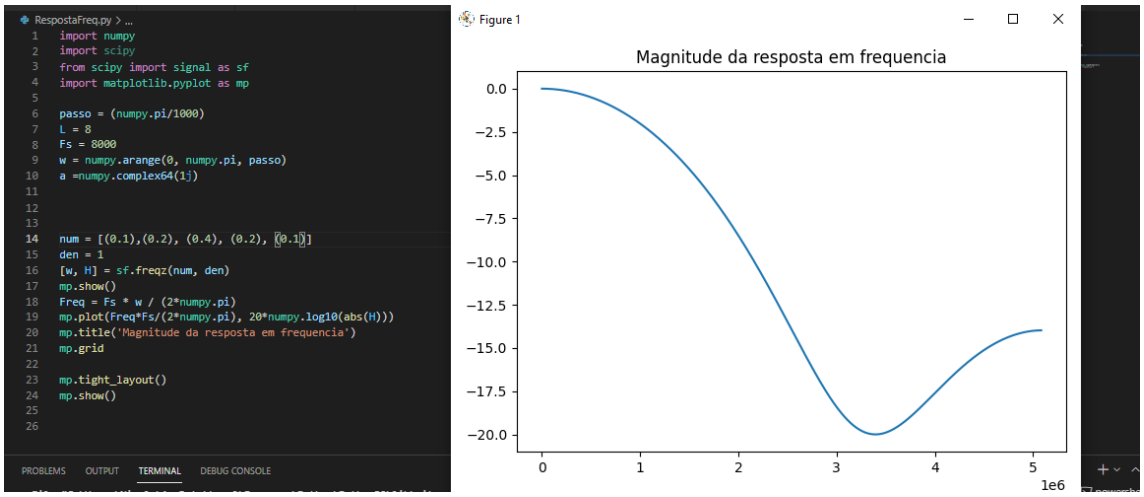
Transformada Z

- TAREFA: Obtenha a resposta em frequencia da sequencia finita dada por:

- X[k] = {0,1; 0,2; 0,4; 0,2; 0,1}



- TAREFAS: Obter a função de transferencia H[z] do filtro passa-baixas
- Plotar os pólos e zeros
- Implementar um programa para executar a equação diferença do filtro.
- Validar essa implementação com um sinal de entrada de sweep.

$$H(z) = \frac{wc}{s + wc} \rightarrow wc = \frac{1}{RC}$$

$$fc = \frac{1}{2\pi RC}$$

$$F = \frac{2}{T}$$

$$H(z) = \frac{Wc}{F\left(\frac{1 - z^{-1}}{1 + z^{-1}}\right) + Wc}$$

$$H(z) = \frac{Wc}{F\left(\frac{1 - z^{-1}}{1 + z^{-1}}\right) + Wc\left(\frac{1 - z^{-1}}{1 + z^{-1}}\right)}$$

$$H(z) = \frac{wc(1 + z^{-1})}{F(1 - z^{-1}) + wc\,(1 + z^{-1})}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{wc + wc * z^{-1}}{(F + wc) + (wc - F) * z^{-1}}$$

$$Y(z) = (F + wc) + Y(z)\,(wc - F) * z^{-1} = wcX(z) + wc\,X(z) * z^{-1}$$

$$Y[n] = \frac{wc}{(F + wc)}\,X[n] + \frac{wc}{(F + wc)}\,X[n - 1] - \frac{(wc - F)}{(F + wc)}\,Y[n - 1]$$

$$Y[n] = aX[n] + aX[n - 1] - bY[n - 1]$$

$$fc = 1000$$

$$wc = 6280$$

$$Fs = 8000$$

$$F = 16000$$

$$a = 0.282\ e\ b = -0.4361$$

$$Y[n] = 0.282X[n] + 0.282X[n - 1] - (-0.4361)Y[n - 1]$$

Polos:

```
Data   =[0.282,0.282,0.4361]
den = [1,0,0]
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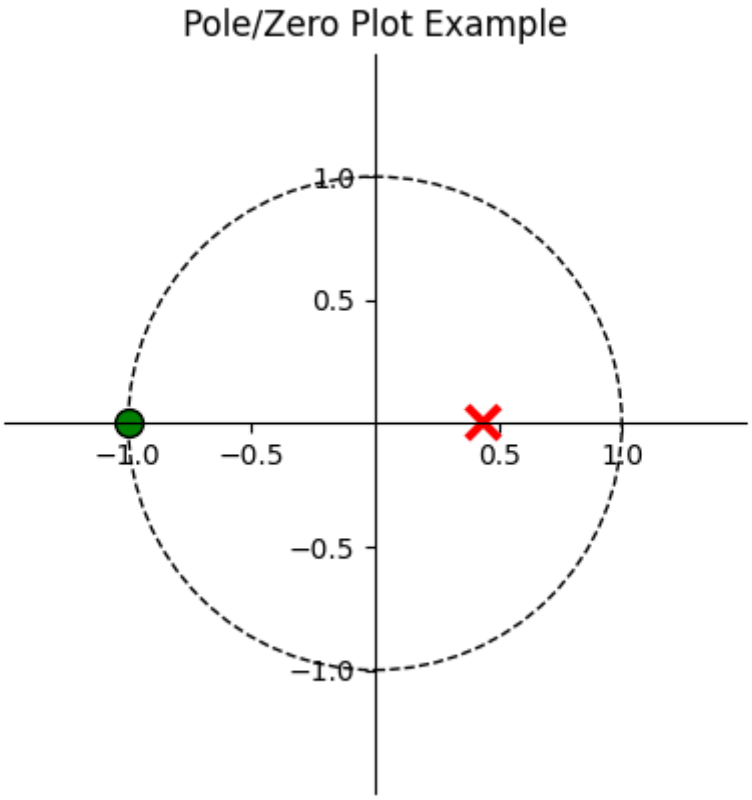
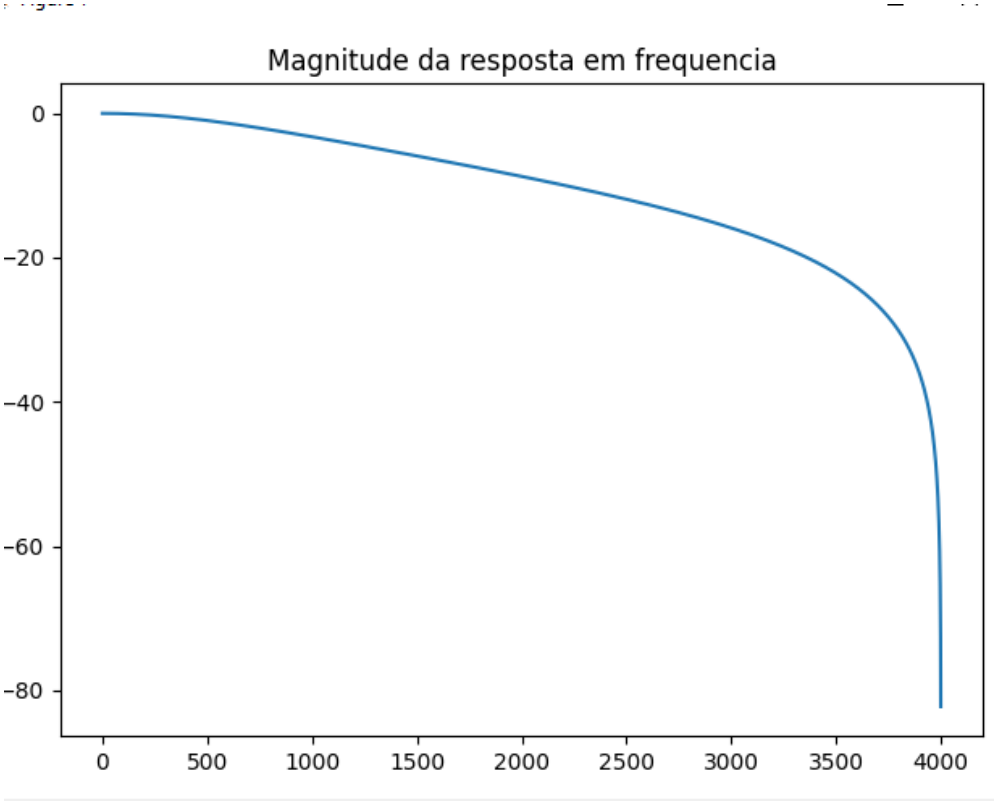


Resposta de frequência:

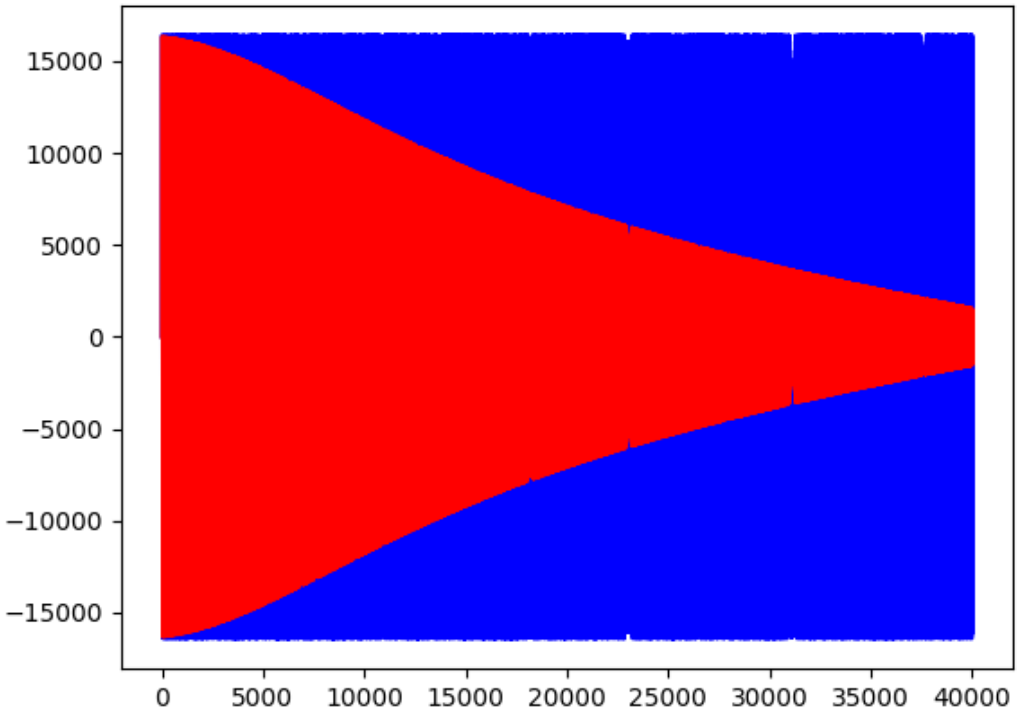
$$H(z) = \frac{Y(z)}{X(z)} = \frac{wc + wc * z^{-1}}{(F + wc) + (wc - F) * z^{-1}}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{6280 + 6280 * z^{-1}}{(16000 + 6280) + (6280 - 16000) * z^{-1}}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{6280 + 6280 * z^{-1}}{22280 - 9720 * z^{-1}}$$



Equação diferença:



Projeto e implementação do filtro IIR

- TAREFAS:

  Plotar os pólos e zeros
- Implementar um programa para executar a equação diferença do filtro.
- Validar essa implementação com um sinal de entrada de sweep.

Função de transferência:

$$H(s) = \frac{s}{s + wc}$$

$$F = \frac{2}{T}$$

$$H(z) = \frac{\frac{2}{T} * (\frac{1 - z^{-1}}{1 + z^{-1}})}{\frac{2}{T} * \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right) + wc} \rightarrow \; H(z) = \frac{F * (\frac{1 - z^{-1}}{1 + z^{-1}})}{F * \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right) + wc}$$

$$H(z) = \frac{F * (\frac{1 - z^{-1}}{1 + z^{-1}})}{F * \left(\frac{1 - z^{-1}}{1 + z^{-1}}\right) + \frac{wc * (1 - z^{-1})}{(1 + z^{-1})}}$$

$$H(z) = \frac{F * (1 - z^{-1})}{F * (1 - z^{-1}) + wc\,(1 + z^{-1})}$$

$$H(z) = \frac{F - F * z^{-1}}{(F + wc) + (wc - F) * \; z^{-1}}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{F - F * z^{-1}}{(F + wc) + (wc - F) * \; z^{-1}}$$

$$Y(z) = (F + wc) + Y(z)\,(wc - F) * \; z^{-1} = FX(z) - \; F\,X(z) * \; z^{-1}$$

$$Y[n] = \frac{F}{(F + wc)}\,X[n] - \frac{F}{(F + wc)}\,X[n - 1] - \frac{(wc - F)}{(F + wc)}\,Y[n - 1]$$

$$Y[n] = aX[n] - aX[n - 1] - bY[n - 1]$$

$$fc = 1000$$

$$wc = 6280$$

$$Fs = 8000$$

$$F = 16000$$

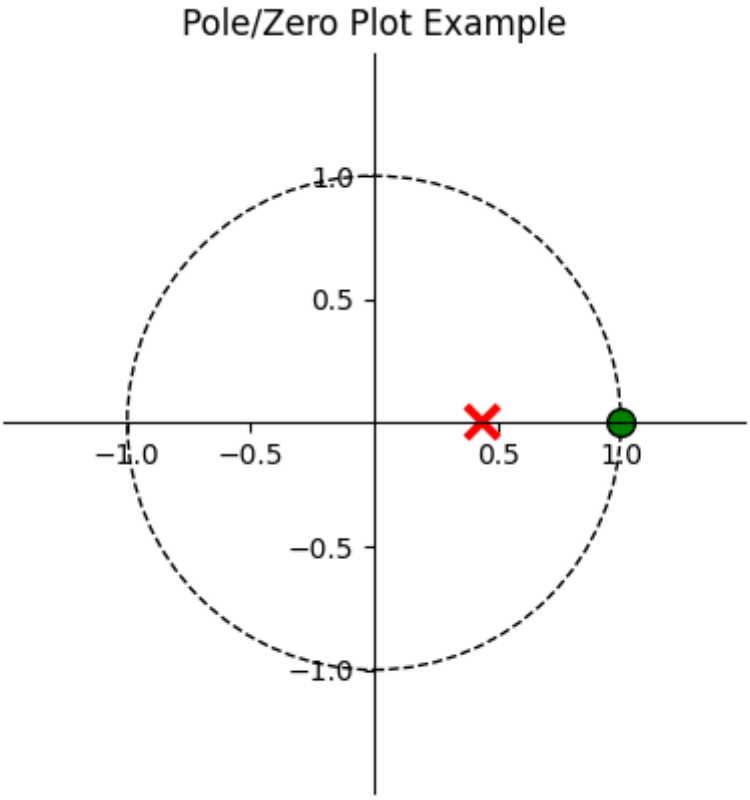
$$aX[n] = \frac{16000}{(16000 + 6280)} = 0{,}72$$

$$bX[n] = \frac{(6280 - 16000)}{(16000 + 6280)} = -0{,}436$$

Polos:

$$H(z) = \frac{F - F * z^{-1}}{(F + wc) + (wc - F) * z^{-1}}$$

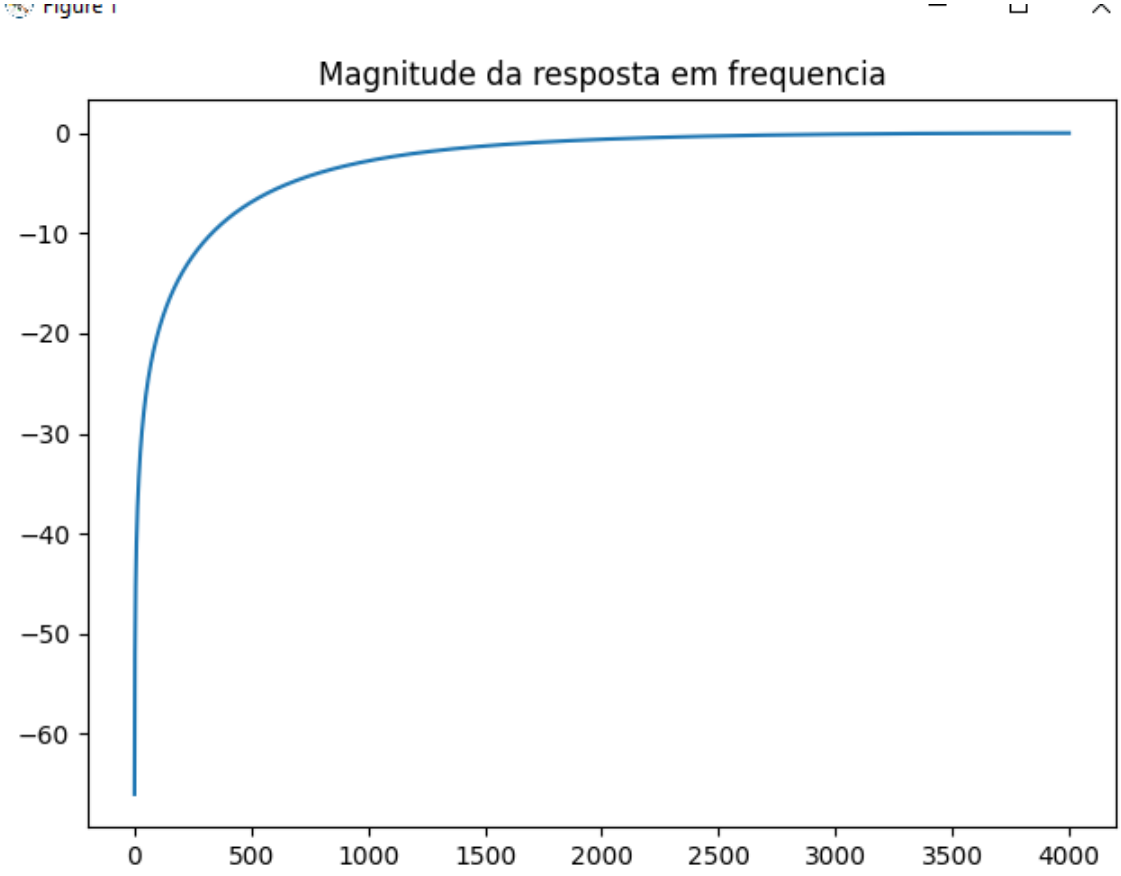
$$H(z) = \frac{16000 - 16000 * z^{-1}}{22280 - 9720 * z^{-1}}$$



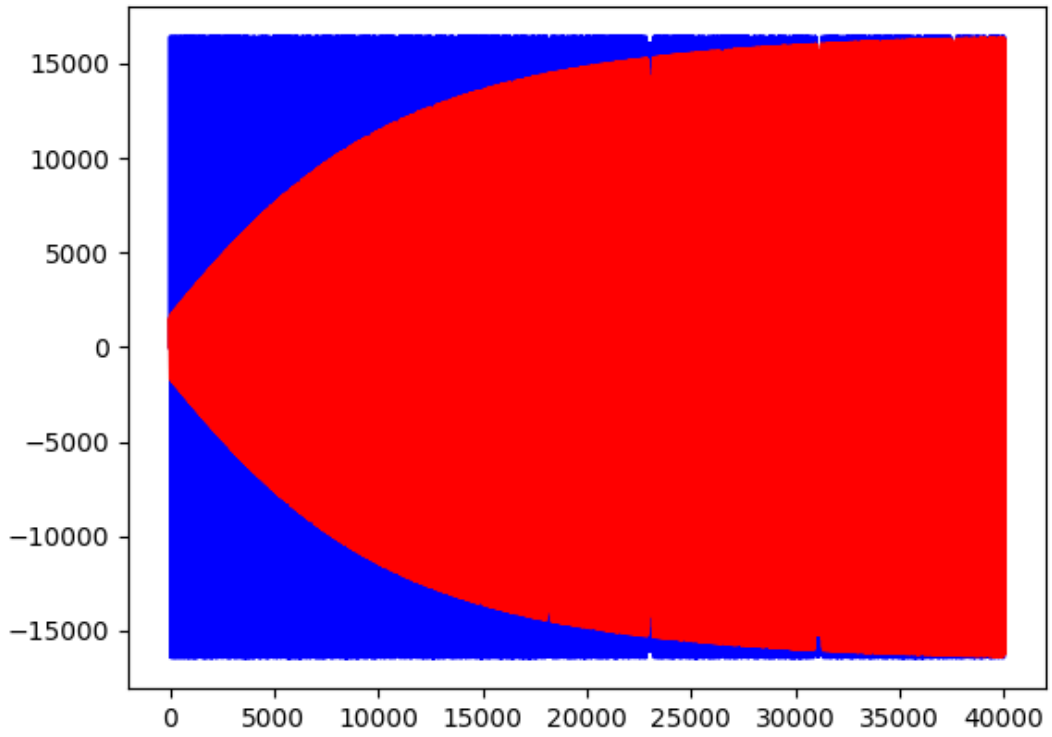
Resposta de frequência:

$$H(z) = \frac{F - F * z^{-1}}{(F + wc) + (wc - F) * z^{-1}}$$

$$H(z) = \frac{16000 - 16000 * z^{-1}}{22280 - 9720 * z^{-1}}$$



Equação diferencial:


15000
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