Digital filtering

Signal processing

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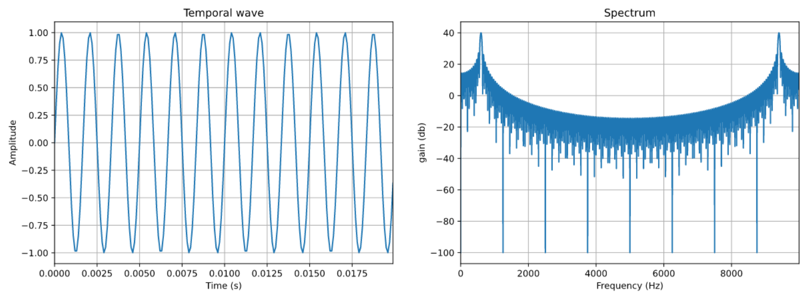
1 Approximation of second order filters

Band-pass filter:

1. Finding θ : we computed $\theta = \frac{f}{2\pi} Fe = 1.88$.
2. Finding ρ : we fixed K = 1 and we drawn this graph representing the height differency between {120Hz,121Hz} and {119Hz,120Hz}.



   we fixed $\rho = 0.87$

3. Finding K : we computed $K = \frac{1}{A_{120Hz}} = 0.2432$.

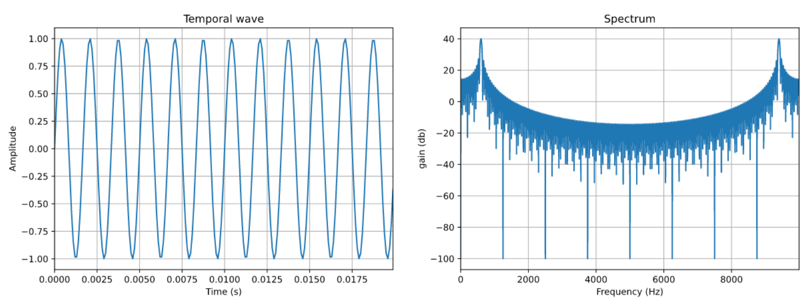
The transfer function of the pass-band filter is

$$H(Z) = K \frac{1 - \cos(\theta) Z^{-1}}{1 - 2\rho\cos(\theta) Z^{-1} + \rho^2 Z^{-2}}$$

where K = 0.2432, $\rho = 0.87$ and $\theta = 1.88$.

Stop-band filter:

1. Finding θ : we computed $\theta = \frac{50}{2\pi} Fe = 0.78$.
2. Finding ρ : we fixed K = 1 and we drawn this graph representing the attenuation at 49.9 Hz and 50.1 Hz. We want to attenuate these frequency at -47dB



   we fixed $\rho = 0.56$

3. Finding K : we computed $K = \frac{1}{A_{120Hz}} = 0.6713$.

The transfer function of the stop-band filter is

$$H(Z) = K \frac{1 - 2\cos(\theta) Z^{-1} + Z^{-2}}{1 - 2\rho\cos(\theta) Z^{-1} + \rho^2 Z^{-2}}$$

where K = 0.6714, $\rho = 0.56$ and $\theta = 0.78$.