

ADSP HW | 三溫循環 RL0945006

2,

a,

filter: convolution \rightarrow multiply

logarithm: multiply \rightarrow addition

b,

因為 discrete，會有一定的取樣率需求，若取樣率過低，會有一定的誤差。

且在計算上的 complexity 較高，會出現無理數。

5,

a,

$$m = 300 \leq 1000 \quad (n/2)$$

$$f_t = (300/2000)500 = 75 \text{ Hz}$$

b,

$$m = 1800 > 1000 \quad (n/2)$$

$$f_t + 500 = (1800/2000)500 = 450$$

$$\rightarrow f_t = 450 - 500 = -50 \text{ Hz}$$

3,

$$\rightarrow y[n] = X[n] * 0.8^n u[n] - X[n] * 0.6^n u[n]$$

by z-transform:

$$Y(z) = X(z) \frac{1}{1-0.8z^{-1}} - X(z) \frac{1}{1-0.6z^{-1}}$$

$$\begin{aligned} \rightarrow Y(z) &= X(z) \left(\frac{1}{1-0.8z^{-1}} - \frac{1}{1-0.6z^{-1}} \right) \\ &= X(z) \left(\frac{0.2z^{-1}}{1-1.4z^{-1}+0.48z^{-2}} \right) \end{aligned}$$

$$\rightarrow Y(z) - 1.4z^{-1}Y(z) + 0.48z^{-2}Y(z) = 0.2z^{-1}X(z)$$

$$\rightarrow Y(z) = 0.2z^{-1}X(z) + 1.4z^{-1}Y(z) - 0.48z^{-2}Y(z)$$

$$\Rightarrow y[n] = 0.2x[n-1] + 1.4y[n-1] - 0.48y[n-2]$$

6,

$$d_1 d_2 = |0^{-\frac{3}{2}N\Delta f}-1|, \text{ 相同條件下, } -f \propto \frac{1}{d_1 d_2}$$

由 (a)(d) < d₁d₂ > (b)(c), 再由 weight 判斷

Weight in pass band: weight in stop band

\rightarrow (b) 1:1 j (c) 2:1

由 (c) 在 pass band 中有 the least error.

7,

$$K = (5-1)/2 = 2$$

$$h[2] = s[0] = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} H_d(f) df \rightarrow H[1] \Big|_{-0.5}^{0.5} = 0.6$$

$$\begin{aligned} h[1] = h[3] &= s[1] = 2 \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} H_d(f) \cos(2\pi f) df \\ &\rightarrow 2 \frac{1}{2\pi} (\sin(2\pi f) - \sin(2\pi f)) \Big|_{-0.5}^{0.5} \\ &= \frac{1}{\pi} (2\sin(\pi) - 2\sin(-\pi)) \hat{=} \frac{1.902}{\pi} \end{aligned}$$

$$\begin{aligned} h[0] = h[4] &= s[2] = 2 \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} H_d(f) \cos(4\pi f) df \\ &\rightarrow 2 \frac{1}{2\pi} (\sin(4\pi f) - \sin(4\pi f)) \Big|_{-0.5}^{0.5} \\ &= \frac{1}{\pi} (2\sin(2\pi) - 2\sin(-2\pi)) \hat{=} \frac{-1.96}{\pi} \end{aligned}$$

Extra,

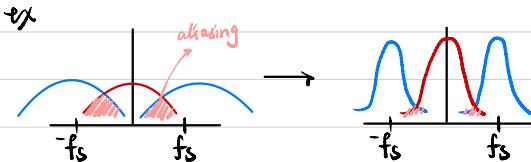
聲訊底層: 0, 6

Normalized frequency = f / f_s , $f_s = 6000 \text{ Hz}$

$$f_{1200} = 1200 / 6000 = 0.2$$

$$f_{1350} = 1350 / 6000 = 0.225$$

$$f_{1500} = 1500 / 6000 = 0.25$$



b)

將向±∞延伸之訊號壓縮至一定頻率中

ex,

