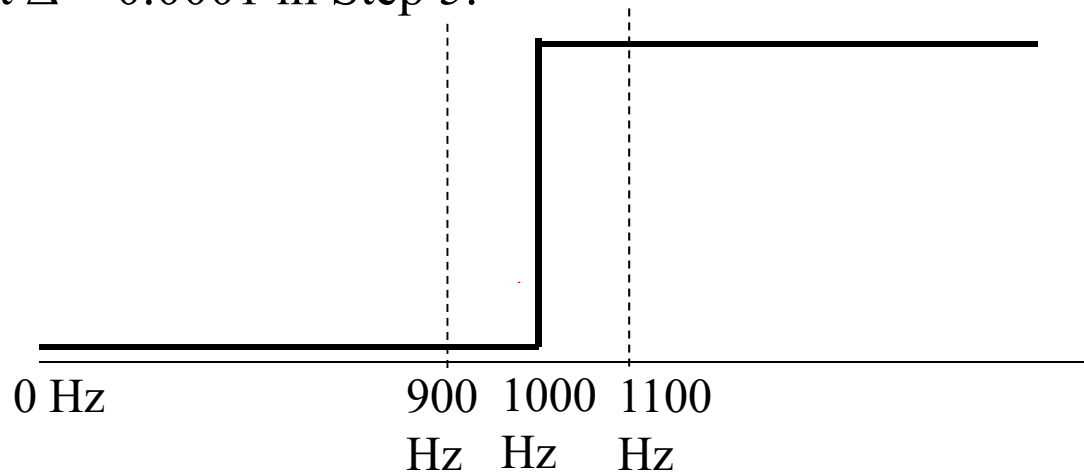


Homework 1 (Due: April 7th)

(1) Design a Mini-max **highpass** FIR filter such that (40 scores)

- ① Filter length = 21, ② Sampling frequency $f_s = 5000\text{Hz}$,
- ③ Pass Band 1100~2500Hz ④ Transition band: 900~1100 Hz,
- ⑤ Weighting function: $W(F) = 1$ for passband, $W(F) = 0.5$ for stop band .
- ⑥ Set $\Delta = 0.0001$ in Step 5.



※ Matlab program should be E-mailed to displab531@gmail.com
E-mail 主旨上註明學號

紙本上要有

- (a) the Matlab program, (b) the frequency response,
- (c) the impulse response $h[n]$, and (d) the maximal error for each iteration.

- (2) (a) What are the two most important applications of the Fourier transform? (b) From the view point of implementation, what are the disadvantages of the discrete Fourier transform? (15 scores)
- (3) Suppose that $x[n] = y(0.0002n)$ and the length of $x[n]$ is 25000 and $X[m]$ is the FFT of $x[n]$. Find m_1 and m_2 such that $X[m_1]$ and $X[m_2]$ correspond to the 300Hz and -100Hz components of $y(t)$, respectively. (10 scores)
- (4) Why ① the transition band and ② the weighting function are important in Minimax FIR digital filter design? (10 scores)
- (5) Estimate the length of the digital filter if both the passband ripple and the stopband ripple are smaller than 0.02, the sampling interval $\Delta_t = 0.0001$, and the transition band is from 2000Hz to 2200Hz. (10 scores)
- (6) Make a comparison among the methods of MSE, Minimax, and frequency sampling for FIR filter design and show their advantages and disadvantages. (15 scores)