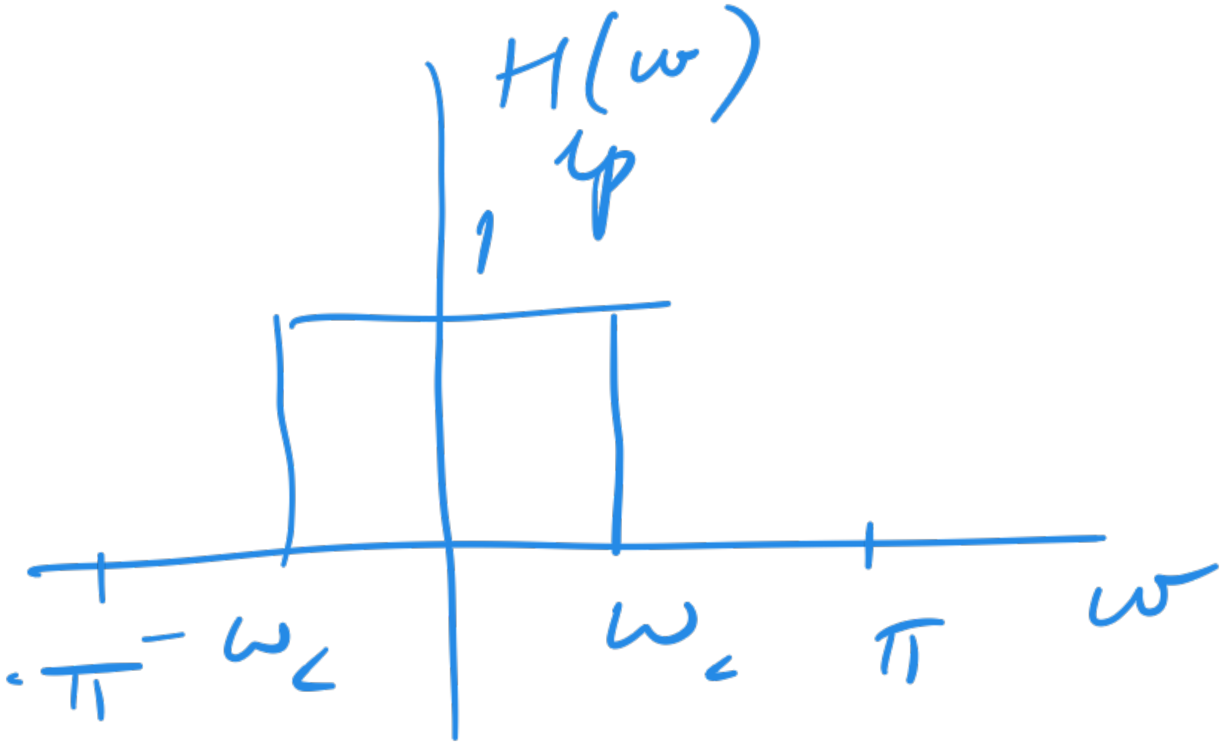
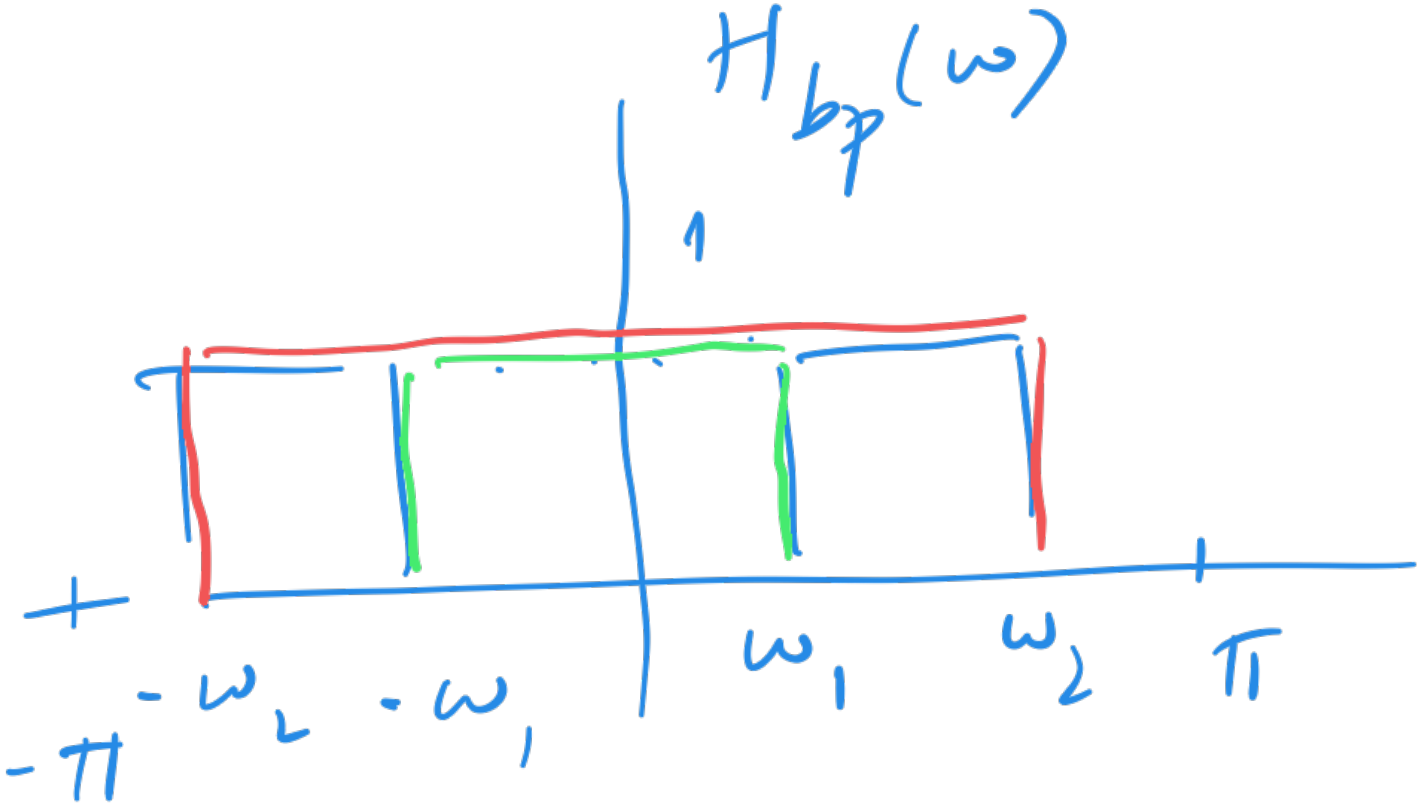


$$\rightarrow h_{lp}(n) = \frac{\sin(\omega_c n)}{\pi n}$$

$$h_{hp}(n) = \delta(n) - \frac{\sin(\omega_c n)}{\pi n}$$



$$h_{bp}(n) = \left(\frac{\sin(\omega_2 n)}{\pi n} - \frac{\sin(\omega_1 n)}{\pi n}\right)$$

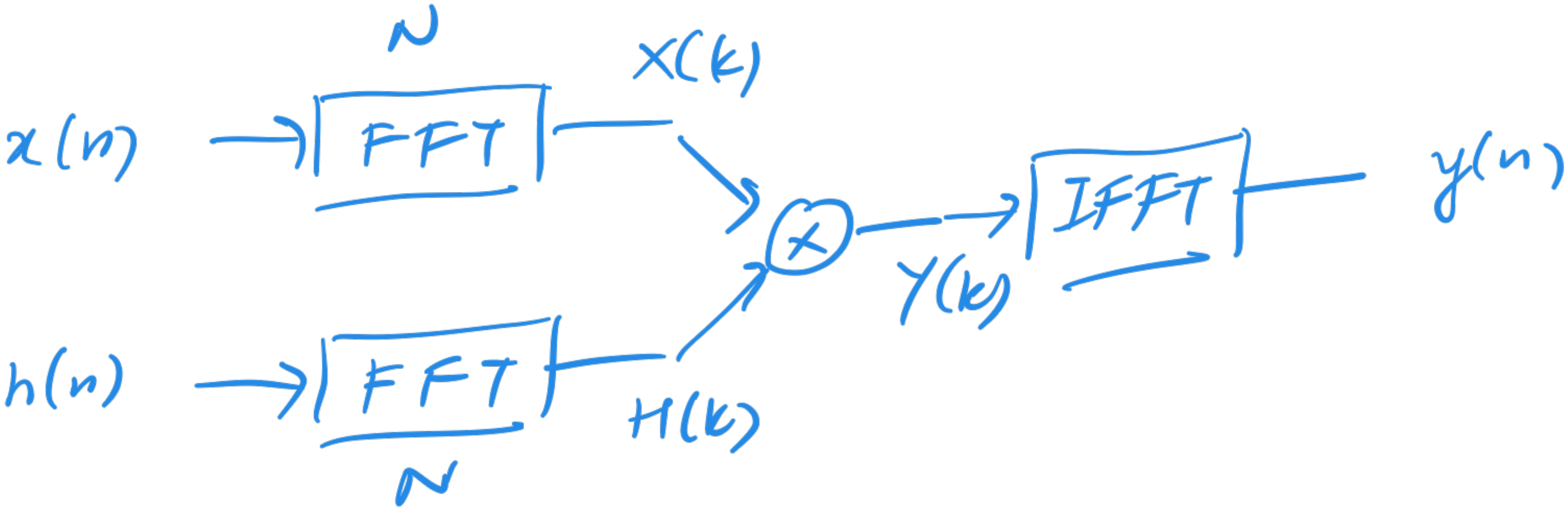
$$h_{bs}(n) = \delta(n) - (\quad)$$

$x(n)$ 200

$h(n)$ 150 $\rightarrow$ $y(n)$ FFT / IFFT

+ Trực tiếp: 200×150 phép nhân

+ $L\{y(n)\}$: 351 $\rightarrow$ FFT 512 đ' : $N = 512$ (2^9)



$$3 \times \frac{N}{2} \log_2 N + N =$$

$$x(n) = \{3, 2j, 5, -7j\}$$

$$X(k) = DFT\{x(n)\}$$

$$x_1(n) = IDFT\{Re\{X(k)\}\} \;?$$

$$Re\{X(k)\} = \frac{1}{2}\left(X(k) + X^*(k)\right)$$

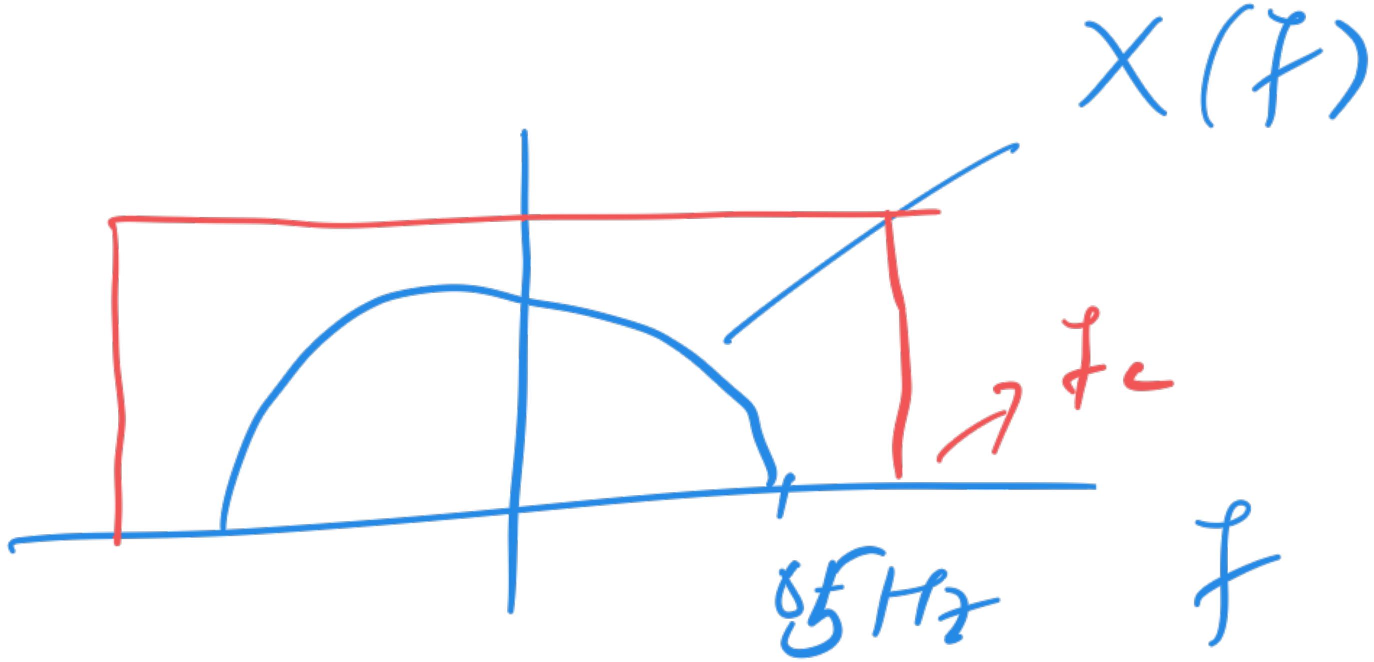
$$\Big\downarrow IDFT$$

$$\frac{1}{2}\left(x(n) + x^*(-n)\right)$$

$$x^*(-n) = \{3, 7j, 5, -2j\}$$

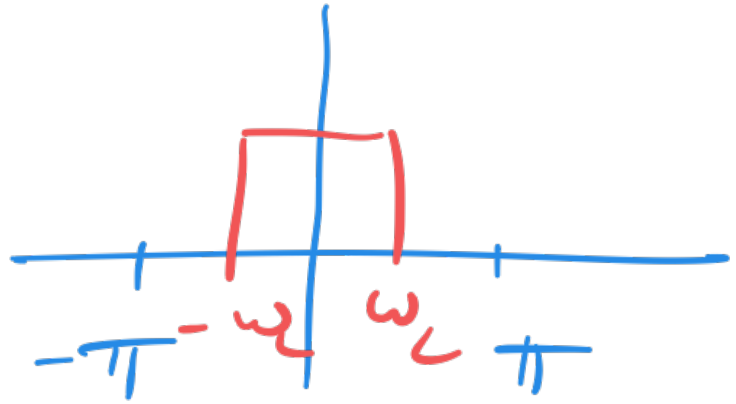
$x(t)$. $B = 85\,Hz$; $f_s = 250\,Hz$

$\omega_c = ?$



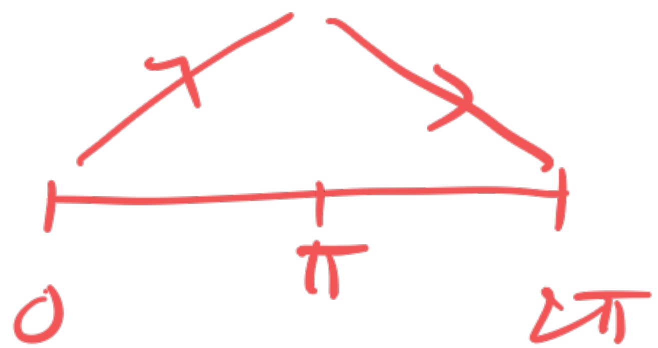
$f_c \geq 85\,Hz$ $\quad f_s/2$

$$\omega_c \geq \frac{85 \cdot \pi}{(f_s/2)} \qquad \pi$$



$\omega_{c\ min}$:

$$\cos(\omega_c n) = \cos((\omega_c + 2\pi) n)$$



$h(n)$. Hamming, $M = 5$, $\omega_c = \ldots$

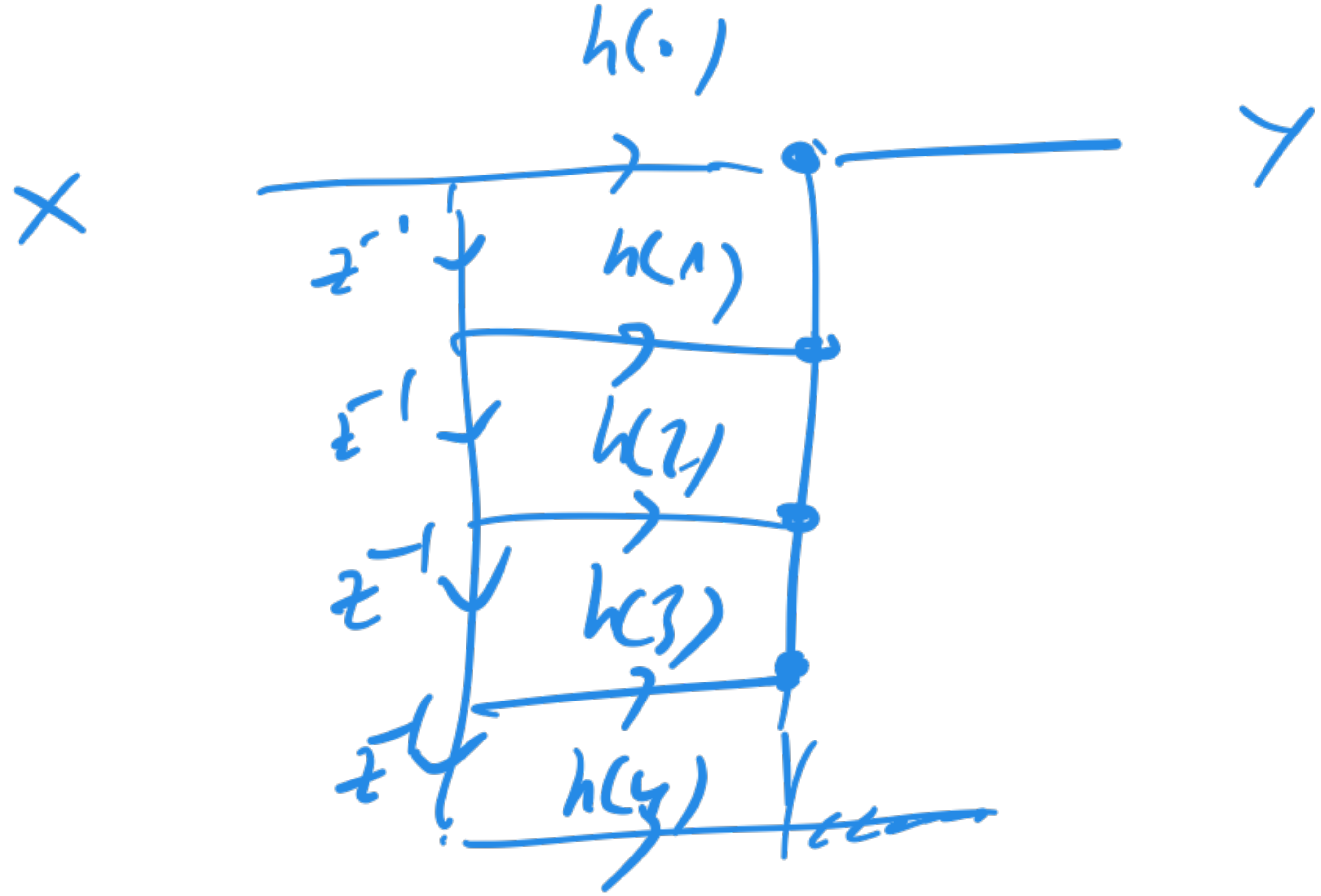
$\downarrow$

$$w(n) = 0.54 - 0.46 \cdot \cos\left(\frac{2\pi n}{M-1}\right)$$

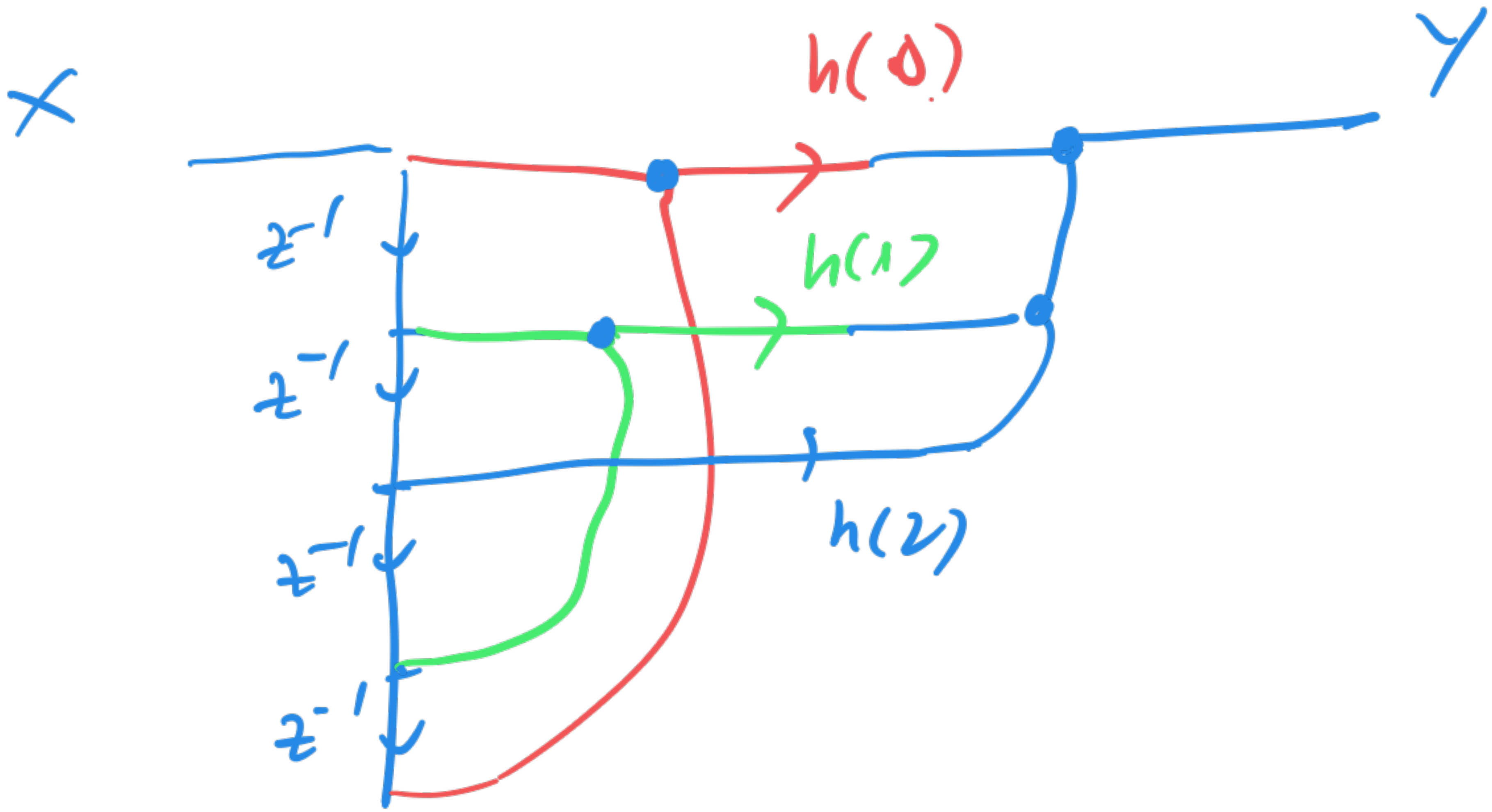
$$h_d(n) = \frac{\sin(\omega_c n)}{\pi n}$$

$$h(n) = h_d\left(n - \frac{M-1}{2}\right) \cdot w(n)$$

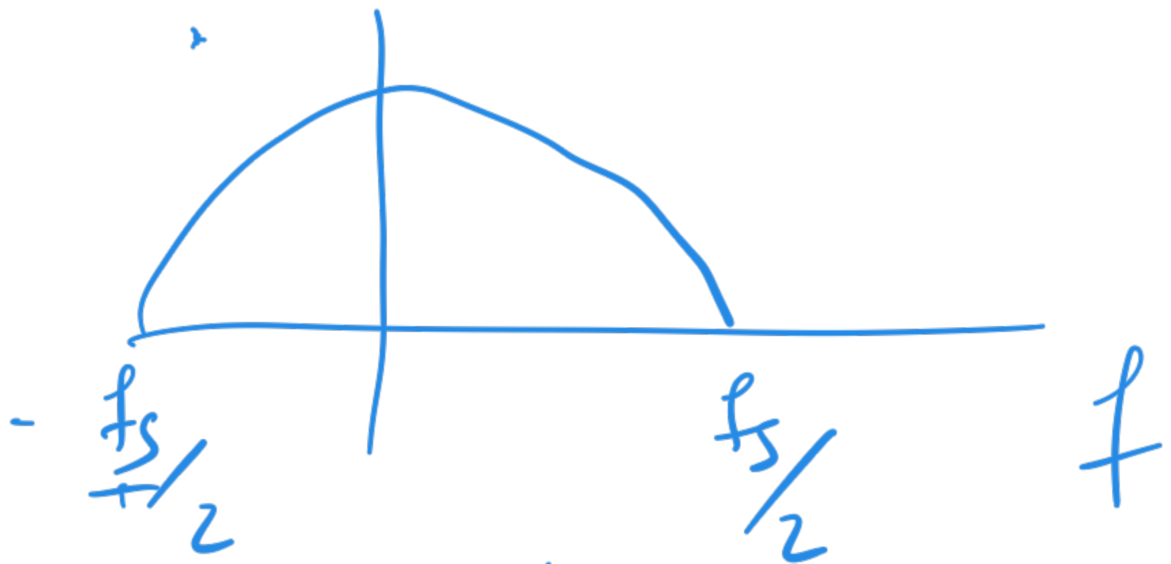
$$\{\underline{h(0)}, \underline{h(1)}, h(2), \underline{h(3)}, \underline{h(4)}\} \quad \text{FIR}$$



$$x \cdot a + y \cdot a = (x+y)a$$

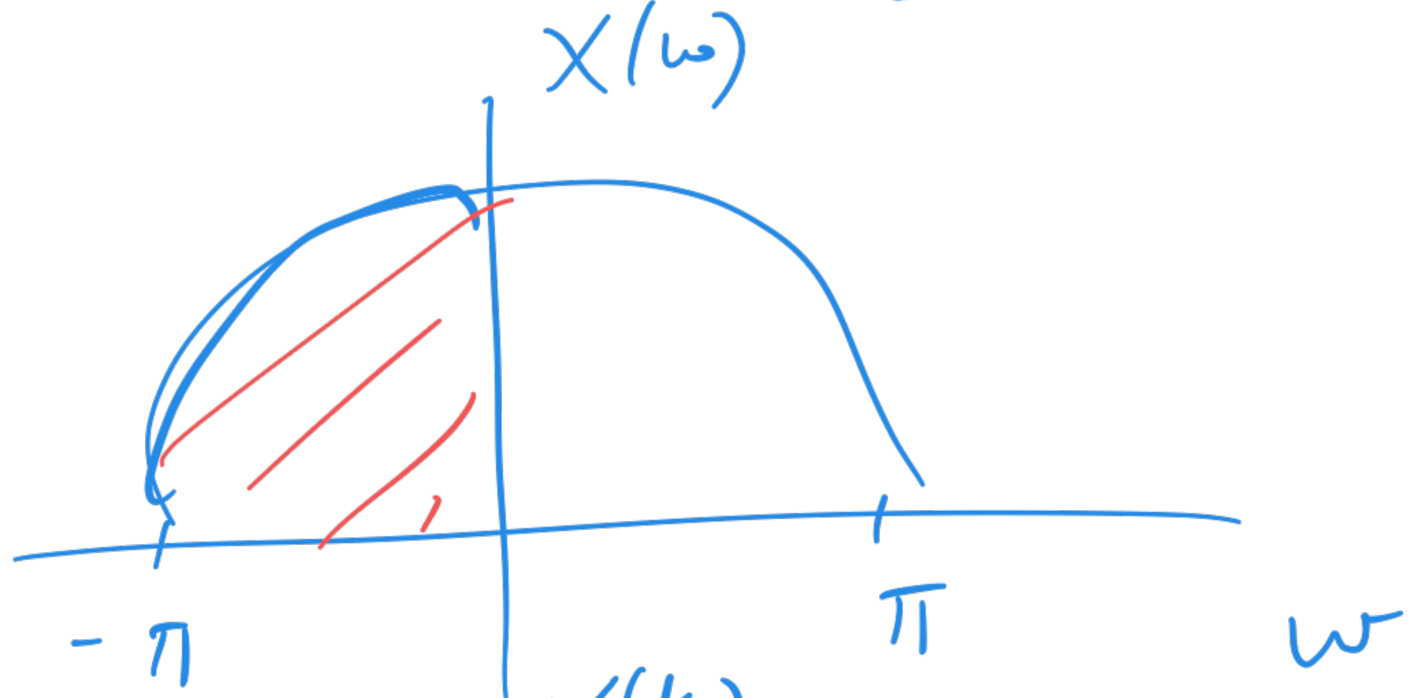


$f_{max} = 20\ Hz$, $f_s = 50\ Hz$, $N = 1000$



$X(k) = X(\omega)\Big|_{\omega = k\cdot\frac{2\pi}{N}}$

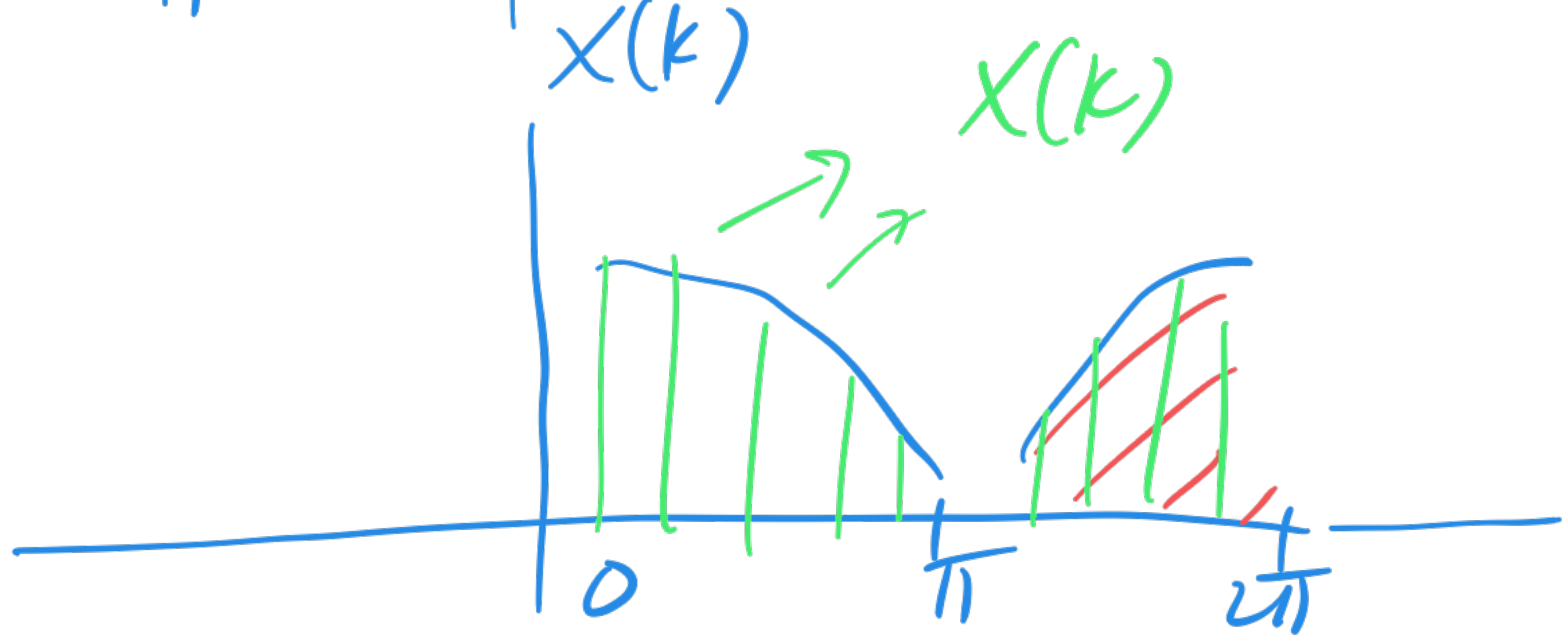
$(k = 0, N-1)$



$0 \to 2\pi$: N mẫu

$\boxed{\frac{2\pi}{N}}$ ω

$\frac{50}{1000}$ $\boxed{\frac{f_s}{N}}$ f



$$x_1(n) = \{2j, -j, 0, j\} \qquad x_2(n) = \{0, -j, 1, 2\}$$

$$x_1(n) \circledast_4 x_2(n) \; ?$$

$$\begin{bmatrix} \\ ? \\ \\ \end{bmatrix} = \begin{bmatrix} 2j & j & 0 & -j \\ -j & 2j & j & 0 \\ 0 & -j & 2j & j \\ j & 0 & -j & 2j \end{bmatrix} \begin{bmatrix} 0 \\ -j \\ 1 \\ 2 \end{bmatrix}$$

$$x_1((n-2023))_4 \circledast x_2(n)_4$$

$$x_1((n-3))_4 \circledast x_2(n)$$

$$x(n) = \left(\frac{1}{3}\right)^n u(n-1) - \left(\frac{1}{4}\right)^n u(n)$$

$$y(n) = \left(\frac{1}{2}\right)^n u(n)$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{\dfrac{1}{1-\frac{1}{2}z^{-1}}}{\frac{1}{3}\cdot z^{-1}\cdot\dfrac{1}{1-\frac{1}{3}z^{-1}} - \dfrac{1}{1-\frac{1}{4}z^{-1}}}$$

$$= \frac{\dots + \dots z^{-1} + \dots z^{-2}}{\dots + \dots z^{-1} + \dots z^{-2} + \dots z^{-3}}$$

vé sơ đồ

$$= \frac{A}{1-\frac{1}{2}z^{-1}} + \frac{B}{1-z_{p_1} z^{-1}} + \frac{C}{1-z_{p_2}\cdot z^{-1}}$$

$$\rightarrow h(n) = A\cdot\left(\frac{1}{2}\right)^n u(n) + B\cdot(z_{p_1})^n u(n) + C\cdot(z_{p_2})^n u(n)$$

$$x(n) \xrightarrow{FT} X(\omega) = \frac{1}{1+0.3\, e^{-j\omega}}$$

$$e^{j\frac{n}{2}}\, x(n-3) \xrightarrow{FT} \ ?$$

$$x(n-3) \xrightarrow{FT} e^{-j\omega\cdot 3}\, X(\omega)$$

$$e^{j\frac{1}{2}\cdot n}\, x(n-3) \xrightarrow{FT} e^{-j(\omega-\frac{1}{2})\cdot 3}\, X\left(\omega-\frac{1}{2}\right)$$

$$e^{-j(\omega-\frac{1}{2})\cdot 3} \cdot \frac{1}{1+0.3\cdot e^{-j(\omega-\frac{1}{2})}}$$

$$y(n) = x(n+3) - 2x(n+1) + x(n) - x(n-1) + 2x(n-2) - x(n-4)$$

$$h(n) = \{1, -2, \underset{\uparrow}{1}, -1, 2, -1\}$$