DFT $N = 4$ điểm $\tilde{x}(n) = \{\vec{1}, 5, 0, 8\}$ chu kỳ 4

FFT phân theo thời gian

Đặt $f_1(n) = x(2n) = \{1, 0\}$

$f_2(n) = x(2n+1) = \{5, 8\}$

$\Rightarrow F_1(k) = \underset{N/2}{DFT}[f_1(n)]$ | $F_2(k) = \underset{N/2}{DFT}[f_2(n)]$

$\cancel{F_1(k) = \Sigma}$

$F_1(0) = f_1(0)W_2^0 + f_1(1)W_2^0 = f_1(0) + f_1(1) = 1+0 = 1$

$F_1(1) = f_1(0)W_2^0 + f_1(1)W_2^1 = f_1(0)W_2^0 - f_1(1)W_2^0$

$= [f_1(0) - f_1(1)]W_2^0 = 1 - 0 = 1$

$F_2(0) = f_2(0)W_2^0 + f_2(1)W_2^0 = f_2(0) + f_2(1) = 5+8 = 13$

$F_2(1) = f_2(0)W_2^0 + f_2(1)W_2^1 = f_1(0)W_2^0 - f_2(1)W_2^0$

$= \cancel{f_1(0)W^0}\ [f_2(0) - f_2(1)]W_2^0 = 5 - 8 = -3$

$X(k) = F_1(k) + F_2(k) \cdot W_N^k$

$\Rightarrow X(0) = F_1(0) + F_2(0)W_4^0 = 1 + 13 = 14$

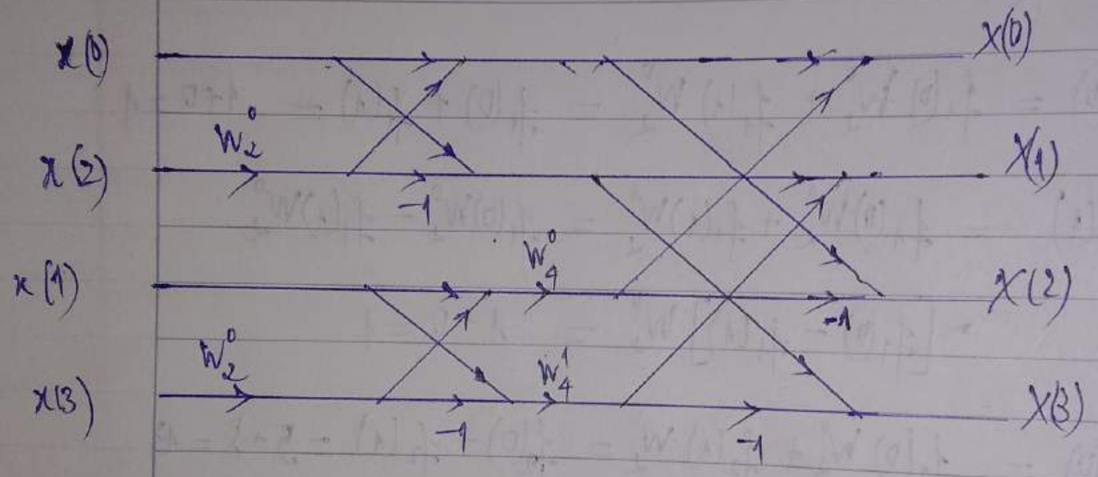
$X(1) = F_1(1) + F_2(1)W_4^1 = 1 + (-3)\cdot(-j) = 1+3j$

$X\left(k+\frac{N}{2}\right) = F_1(k) - F_2(k)\, W_N^k$

$\Rightarrow X(2) = F_1(0) - F_2(0)\, W_4^0 = 1 - 13 = -12$

$X(3) = F_1(1) - F_2(1)\, W_4^1 = 1 - (-3)(-j) = 1 - 3j$

$\Rightarrow X(k) = \{\overrightarrow{14}, 1+3j, -12, 1-3j\}$



DFT $N = 4$ điểm $\tilde{x}(n) = \{\vec{1}, 8, 0, 9\}$ chu kỳ 4

FFT phân theo tần số

Đặt $g_1(n) = x(n) + x(n+N/2)$

$g_2(n) = [x(n) - x(n+N/2)]\, W_N^n$ $\quad n = 0, 1, \dots, N/2$

$$\Rightarrow \begin{cases} g_1(0) = x(0) + x(2) = 1 + 0 = 1 \\ g_1(1) = \cancel{x(0) - x(2)}\ x(1) + x(3) = 8 + 9 = 17 \end{cases}$$

$$\Rightarrow \begin{cases} g_2(0) = [x(0) - x(2)]\, W_4^0 = (1-0).1 = 1 \\ g_2(1) = [x(1) - x(3)]\, W_4^1 = (8-9)(-j) = j \end{cases}$$

$X(2k) = \mathrm{DFT}_{N/2}[g_1(n)]$ | $X(2k+1) = \mathrm{DFT}_{N/2}[g_2(n)]$

$X(2k) = \sum_{n=0}^{N/2-1} g_1(n)\, W_{N/2}^{kn}$ | $X(2k+1) = \sum_{n=0}^{N/2-1} g_2(n)\, W_{N/2}^{kn}$

$X(0) = g_1(0) W_2^0 + g_1(1) W_2^0 = g_1(0) + g_1(1) = 1 + 17 = 18$

$X(2) = g_1(0) W_2^0 + g_1(1) W_2^1 = g_1(0) W_2^0 - g_1(1) W_2^0$

$= [g_1(0) - g_1(1)]\, W_2^0 = g_1(0) - g_1(1) = 1 - 17 = -16$

$X(1) = g_2(0) W_2^0 + g_2(1) W_2^0 = g_2(0) + g_1(0) = 1 + j$

$X(3) = g_2(0) W_2^0 + g_2(1) W_2^1 = g_2(0) W_2^0 - g_2(1) W_2^0$

$= [g_2(0) - g_2(1)]\, W_2^0 = g_2(0) - g_2(1) = 1 - j$

$\Rightarrow X(k) = \{\vec{18}, 1+j, -16, 1-j\}$

Thứ
Ngày
No.