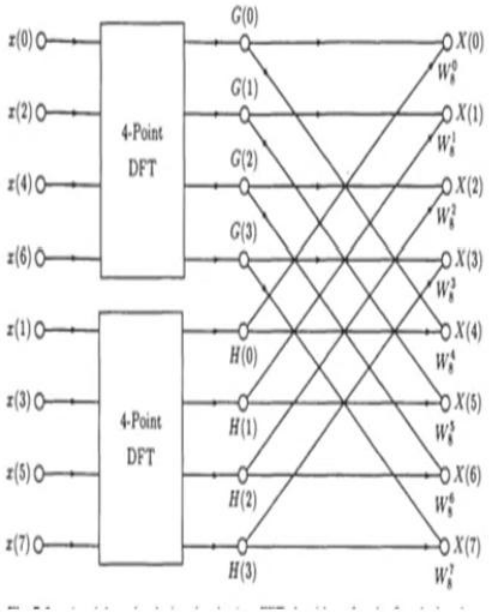

$$X[k] = \sum_{n=0}^{N-1} x[n]e^{-j(2\pi/N)kn} = \sum_{n\ \text{even}}^{N-1} x[n]e^{-j(2\pi/N)kn} + \sum_{n\ \text{odd}}^{N-1} x[n]e^{-j(2\pi/N)kn}$$

Substitute variables n=2r for n even and n=2r+1 for odd

$$X[k] = \sum_{r=0}^{N/2-1} x[2r]W_N^{2rk} + \sum_{r=0}^{N/2-1} x[2r+1]W_N^{(2r+1)k}$$

$$= \sum_{r=0}^{N/2-1} x[2r]W_{N/2}^{rk} + W_N^k \sum_{r=0}^{N/2-1} x[2r+1]W_{N/2}^{rk}$$

$$= G[k] + W_N^k H[k]$$

G[k] and H[k] are the N/2-point DFT's of each subsequence

Document2 - Microsoft Word

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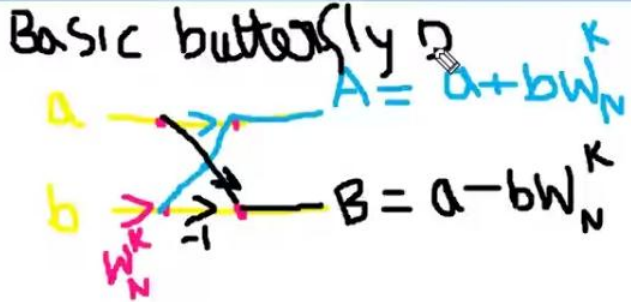
Basic butterfly



$A = a + bW_N^K$

$B = a - bW_N^K$

$X(k) = G_1(k) + W_N^K \cdot H(k)$, $k = 0, 1, \ldots, N/2 - 1$

$X(K) = G_1(K) - W_N^K H(K)$, $K = \frac{N}{2}, \ldots, N-1$

Page: 1 of 1 Words: 0 English (United States) 230%

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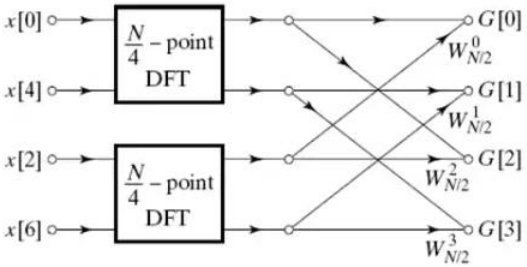

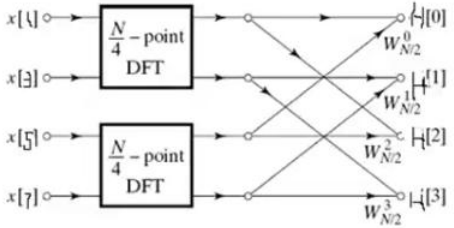

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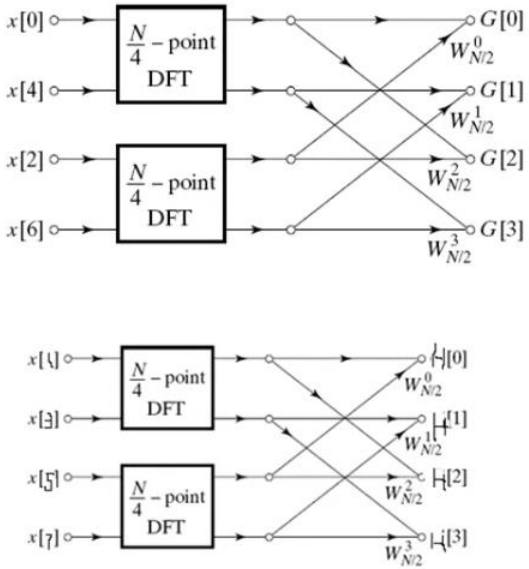

N=

$4\left(\frac{N}{4}\right)^2 = \frac{N^2}{16} + 4$

$= \frac{N^2}{4}$

N = 8

Direct

$N^2 = 64$

DIT

$\frac{N^2}{4} = \frac{64}{4} = 16$

N = 128

$(128)^2$

DIT