

SNS COLLEGE OF ENGINEERING



(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

UNIT-I

Discrete Fourier Transform

Introduction to DFT





DISCRETE FOURIER TRANSFORM :



DFT {2(K)} = X(K) = = N , k=0, 1 ... Ny

DISCRETE FOURIER TRANSFORM INVERSE

enum 201 10 year - - - n=0, 1, N-1

compute 4-point per of the sequence $x(n) = \{1, 1, 0, 0\}$

LIFE FOR EAST TO xun= \$1,1,0,07

WK.T, DET (K) = 1 x(n) e N ; K=0,1,...N-1 K= 0, 1, ... (N-1)

(K=0,1,2,3)

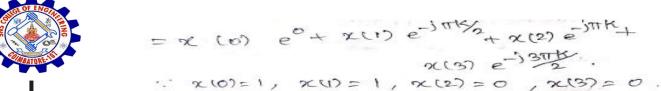
degree our tothe william the

 $\chi(k) = \frac{3}{5} \chi(n) e^{-\frac{32\pi i kn}{4}}$

= x(0) e + x(1) e + + $x(2) e^{-\frac{1}{2\pi i}k(2)} + x(3) e^{-\frac{1}{2\pi i}k(3)}$









T. e-10 = coso - isino] .

= 1. 1+ 1. e-jtk/2 + 0+0

X(K)= 1+ (08/11K) - 1 sin(11K).

K=0,1,2,3

x(0)= 1+ cos(2)-1 sin(2).

 $x(0) = 1 + \cos(0) - i\sin(0) = 1 + 1$

x(1) = 1+ co(=) -5 sin(=).

= 1+0-j 8% (1) = = (case radion

11 i-1 = CDX

x (2) = 1+ COS(2) - 1 SIN (2)

= 1+61)-1007.

X13) = 1+ cos (311) - 7 c/u (311)

1 = 1+ 0 - 1 (- 17. 17. 18. 18. 18. 18.

11. [+1 =(8)x

ANGER :

x (K) = {2, 1-1, 0, 1+13.







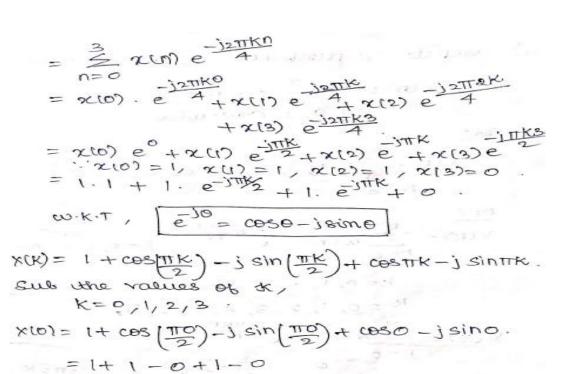
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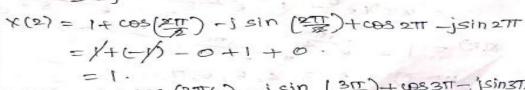












X(1) = 1+ cos (1) - 1 sin (1) + cos 11 - jsin TT

$$Y(3) = 1 + \cos(37\%) - j \sin(37) + \cos 377 - j \sin 377$$

$$= y + 0 - j(-1) - y + 0$$

$$= + j$$
ANSWER: $Y(K) = \{3, -j, 1, +j\}$

= X+0-jun-x-0



compute 8-point DFT of the tollowing



$$x(n) = \begin{cases} 1 & 0 \le n \le 2 \\ 0 & \text{otherwise} \end{cases}$$

: 900

$$\frac{\text{DFT}}{\text{Y(K)}} = \frac{\text{N-1}}{\text{E}} \propto \text{Cn} \qquad = \frac{\text{J2TK}}{N} ; k = 0, 1 \dots N - 1$$

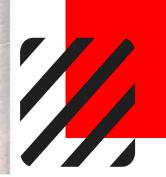
$$k = 0, 1, \dots, 8-1$$

$$K = 0, 1, 2, 3, 4, 5, 6, 7,$$
 $X(K) = \sum_{n=0}^{\infty} \chi(n) e^{n}$

$$x(1) = \frac{12\pi k}{8}$$
 $x(3) = \frac{12\pi 3k}{12\pi 3k}$
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 $x(4) = \frac{12\pi 3k}{12\pi 3k}$
 $x(5) = \frac{12\pi 5k}{12\pi 3k}$
 $x(6) = \frac{12\pi 5k}{12\pi 3k}$
 $x(1) = \frac{12\pi 5k}{12\pi 3k}$

$$K(K) = 1 + e^{\frac{1\pi k}{4}} + e^{\frac{1\pi k}{2}} + 0 + 0 + 0 + 0$$

$$k = 0, 1, 2, 3, 4, 5, 6, 7.$$





$$\chi(K) = 1 + \frac{\cos(\pi K)}{4} - j \sin(\frac{\pi K}{4}) + \cos(\frac{\pi K}{2}) - j$$

$$\sin(\frac{\pi K}{2}) + \sin(\frac{\pi K}{2}) + \cos(\frac{\pi K}{2}) - j$$

$$\sin(\frac{\pi K}{2}) + \sin(\frac{\pi K}{2}) + \cos(\frac{\pi K}{2}) - j$$

$$\sin(\frac{\pi K}{2}) + \cos(\frac{\pi K}{2}) + \cos(\frac{\pi K}{2}) - j$$

$$\sin(\frac{\pi K}{2}) + j$$



$$\begin{aligned}
x(0) &= 1 + \cos 0 - j \sin 0 + \cos 0 - j \sin 0 \\
&= 1 + 1 + 0 + 1 + 0
\end{aligned}$$

$$x(1) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) \\
&= 1 + 0 \cdot \tau \circ \tau - j \circ \tau \circ \tau + 0 - j
\end{aligned}$$

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&= 1 + 0 \cdot \tau \circ \tau - j \circ \tau \circ \tau + 0 - j
\end{aligned}$$

$$x(2) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) \\
&= 1 + 0 \cdot \tau \circ \tau - j \circ \tau \circ \tau + 0 + j$$

$$= 1 - 0 \cdot \tau \circ \tau - j \circ \tau \circ \tau + 0 + j$$

$$= 0 \cdot 293 + 0 \cdot 293j$$

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$$x(4) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(5) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(6) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(7) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(8) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(9) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(9) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

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$$x(1) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

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$$x(1) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right) + \cos \left(\frac{\pi}{4}\right)$$

$$x(2) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(3) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(4) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(5) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(6) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(7) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(8) &= 1 + \cos \left(\frac{\pi}{4}\right) - j \sin \left(\frac{\pi}{4}\right)$$

$$x(8) &= 1 + \cos \left(\frac{\pi}{4}\right)$$



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= 0.293 - 0.293





$$x(b) = 1 + \cos\left(\frac{b\pi}{4}\right) - i\sin\left(\frac{b\pi}{4}\right) + \cos\left(\frac{3\pi}{4}\right) - i\sin\left(\frac{b\pi}{4}\right) + i\sin\left(\frac{b\pi}{4}\right) - i\sin\left(\frac{b\pi}{4}\right) + i\sin\left(\frac{b\pi}{4}\right) - i\sin\left(\frac{b\pi}{4}\right) + i\sin\left(\frac{b\pi}{4}\right$$

$$x(7) = 1 + \cos \left(\frac{7\pi}{4}\right) - i \sin \left(\frac{7\pi}{4}\right) + \cos \left(\frac{7\pi}{2}\right) - i$$

$$= 1 + 0.707 + i 0.707 + 0 + i$$

ANSWER :





Find the IDFT of X(K)= {1,0,1,0}



 $\frac{\pm DFT}{\times (n)} = \frac{1}{N} \sum_{k=0}^{N-1} \times (k) \cdot e^{\frac{32\pi T^{2}kn}{N}}, \text{ where}$ Here, $\times (k) = 21,0,1,03$

$$x(n) = \frac{1}{4} \sum_{k=0}^{3} x(k) e^{\frac{12\pi kn}{4}}$$

$$x(n) = \frac{1}{4} \left[x(n) \cdot e^{0} + x(n) e^{\frac{12\pi kn}{4}} + x(n) e^{\frac{12\pi kn$$







$$\frac{1}{4} (1+1)$$

$$\chi(2) = \frac{1}{2}.$$

$$\chi(3) = \frac{1}{4} [t + ces 3TT - jsin 3T]$$

$$= \frac{1}{4} [1-1]$$

$$\chi(3) = 0.$$
Answer:
$$\chi(n) = \frac{1}{2} \frac{1}{2}, 0\frac{1}{2}, 0\frac{3}{2}.$$







Thank You!

