ICE503 Homework-09

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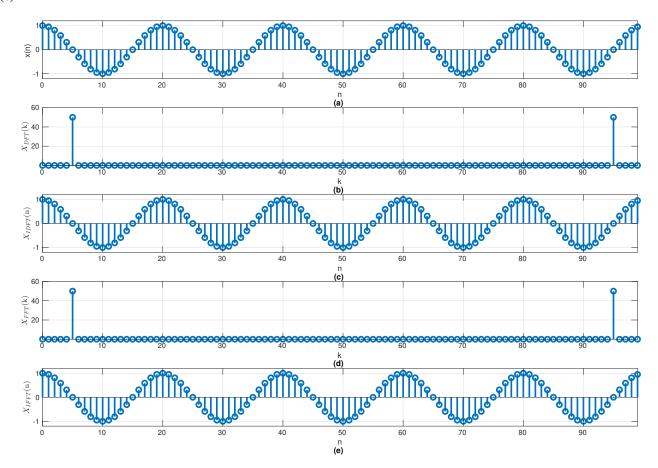
Q. 3

(a) Given sequence is $x(t) = \cos{(2\pi 5t)}$. To find the DFT, the **twiddle matrix W** is calculated. The (m,n)-th cell of twiddle matrix **W** have the value $e^{-j\frac{2\pi}{N}mn}$, where N=100 represents the number of samples of x(n) sampled in 1 seconds. Thereafter, the DFT is computed by the formula X(k) = W(k)x(n).

The sequence x(n) is shown in Fig. (a) and the corresponding amplitude of the DFT X(k) is shown in Fig. (b).

- (b) Compute the inverse DFT matrix as $\hat{\mathbf{W}} = \frac{1}{N}\mathbf{W}^*$, where * represents the conjugate operation. Hence, the IDFT is written as $\hat{x}(n) = \hat{\mathbf{W}}X(k)$. The sequence \hat{x} is shown in Fig. (c) as $x_{DFT}(n)$.
- (c) With the fft(x) function the FFT of x(n) is computed with the Fast Fourier Transform (FFT) method. The corresponding amplitude is plotted in Fig. (d).
- (d) With the ifft(x) function the IFFT of X(k) is computed with the Fast Fourier Transform (IFFT) method. The corresponding amplitude is plotted in Fig. (e).

(e)



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