ICE503 Homework-01

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Q. 3

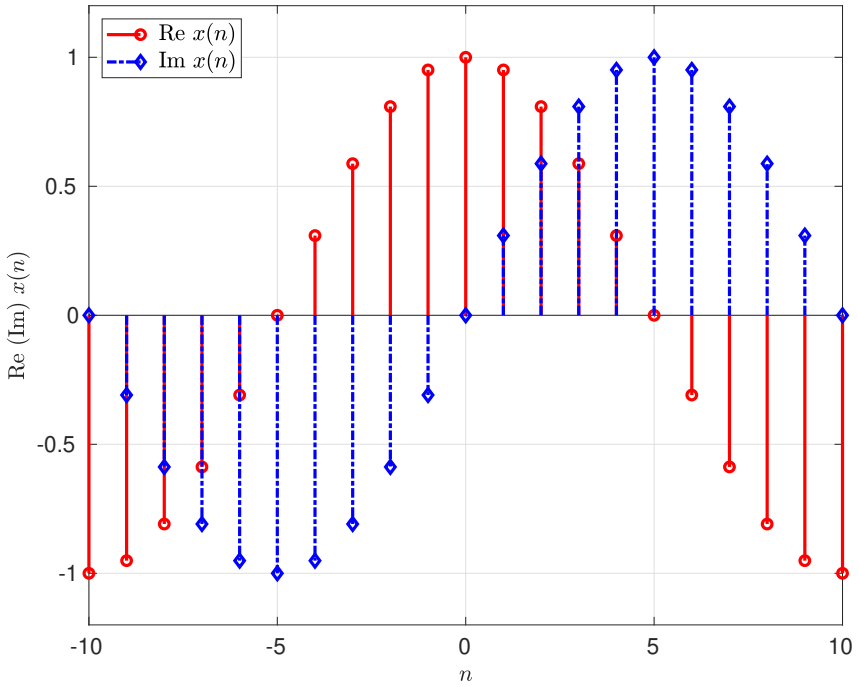

Fig. 1: 3(b) Plot of real and imaginary part of $x(n)$.

(b) The plot of the real and imaginary part is shown in Fig. 1.
(c) The given series is:

$$x(n) = e^{j\frac{1}{10}\pi n} \quad n \in \{-10, -9, \cdots, -1, 0, 1, \cdots, 10\} \tag{1}$$

Then calculate the value of $x^*(-n)$, which is written from equation (1) as:

$$\begin{aligned} x^*(-n) &= (e^{j\frac{1}{10}\pi(-n)})^* \\ &= (e^{-j\frac{1}{10}\pi n})^* \\ &= e^{j\frac{1}{10}\pi n} \\ &= x(n) \end{aligned} \tag{2}$$

From the definition of conjugate symmetric and antisymmertric series,

$$\text{Conjugate Symmetry :} \quad x^*(-n) = x(n)$$
$$\text{Conjugate Anti-symmetry :} x^*(-n) = -x(n)$$

The series $x(n)$ is ***conjugate symmetric*** which can be inferred from the equation (2) and above identities.

Since $|x(n)| = 1$, which infers that the signal $x(n)$ is an unit-modulus signal and therefore, it exhibits phase conjugate symmetry. Thus, such data transmission requires half of the data for the signal reconstruction, reducing storage and phase encoding steps by almost 50 %. This further reduces the computational load by similar amount during processing of such signals.