ICE503 Homework-03

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Q. 3

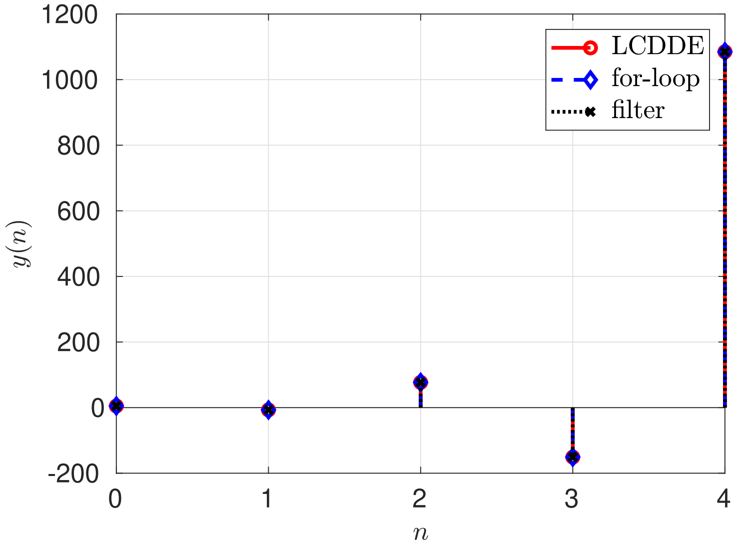

Fig. 1: 3 Plot of $y(n)$ by three different methods.

(a) The solution of the LCCDE is found to be:

$$y(n) = \frac{24}{7}(-4)^n + \frac{18}{7}(3)^n + \mu(n)$$

The first plot is obtained from the above equation.

(b) The given equation is:

$$y(n) + y(n-1) - 12y(n-2) = 10\mu(n)$$

This is rewritten as:

$$y(n) = 10\mu(n) - y(n-1) + 12y(n-2)$$

The value of $y(n \geq 0)$ is obtained from the above equation with the 'for' loop while considering the initial solutions $y(-2) = -0.5$, $y(-1) = -1$. Then the plot is obtained from the resulting data.

(c) To obtain the filter form. First, the equation is considered in its standard form,

$$y(n) + y(n-1) - 12y(n-2) = 10\mu(n)$$

Next, the coefficients of x and y are noted as $[1]$ and $[1, 1, -12]$, respectively. Then the initial solution is considered as $y_0 = [-1, -0.5]$. These values are passed to the *filtic* function which then constructs the LCCDE. Then these values along with the value of n and the LCCDE are passed to the *filter* function. Then the *filter* function output is the $y(n)$, which is overlaid on the above plot.

It should be noted that the resultant plot proves that, the values of $y(n)$ obtained by all these three methods are the same. Therefore, these methods are all equivalent to each other.

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Q. 4 (a)

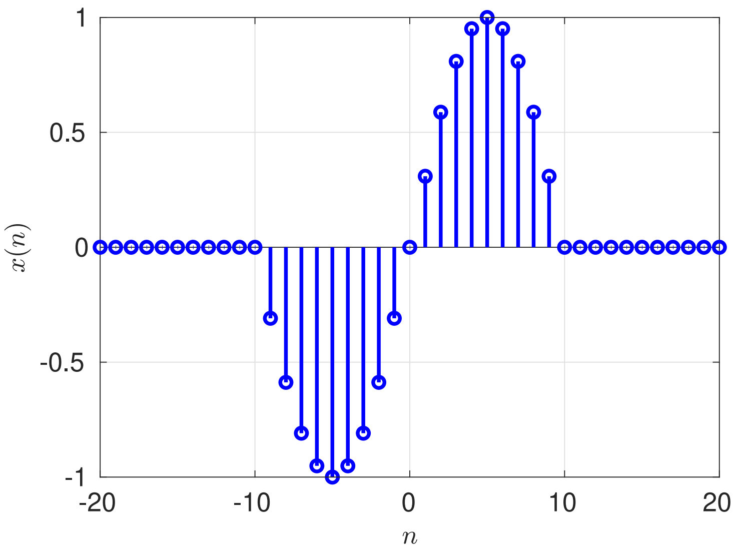

Fig. 2: 3 Plot of $x(n)$.

(b) & (c)

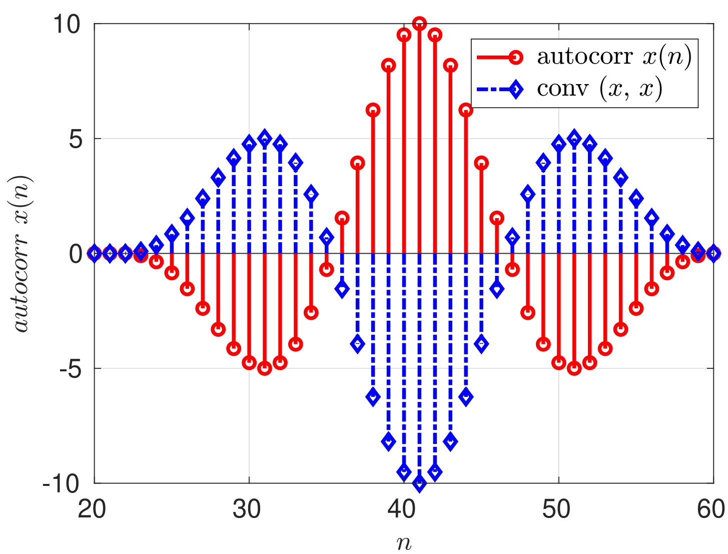

Fig. 3: 3 Plot of (b) auto-correlation of $x(n)$ and, (c) convolution of $x(n)$ with itself.

(d) The formula for auto-correlation of $x(n)$ is written as:

$$R_{xx}(n) = \sum_{n \in \mathcal{Z}} x(m)x(m-n)$$

But, the convolution function is defined as:

$$x(n) \circledast x(n) = \sum_{m \in \mathcal{Z}} x(m)x(n-m)$$

By comparing both expressions it can be seen that, in the right-hand side (RHS) of correlation, the right-most term $x(n-m)$ is a flipped form of $x(m-n)$ of the auto-correlation function. Hence, the resultant plot is flipped along the Y-axis. This can be corrected if the convolution expression is replaced from $x(n) \circledast x(n)$ to $x(n) \circledast\ left - flip\ x(n)$ or $x(n) \circledast x(-n)$.