Signals and Systems Homework

Week-1

Problem 1: Continuous-Time Signals and Systems

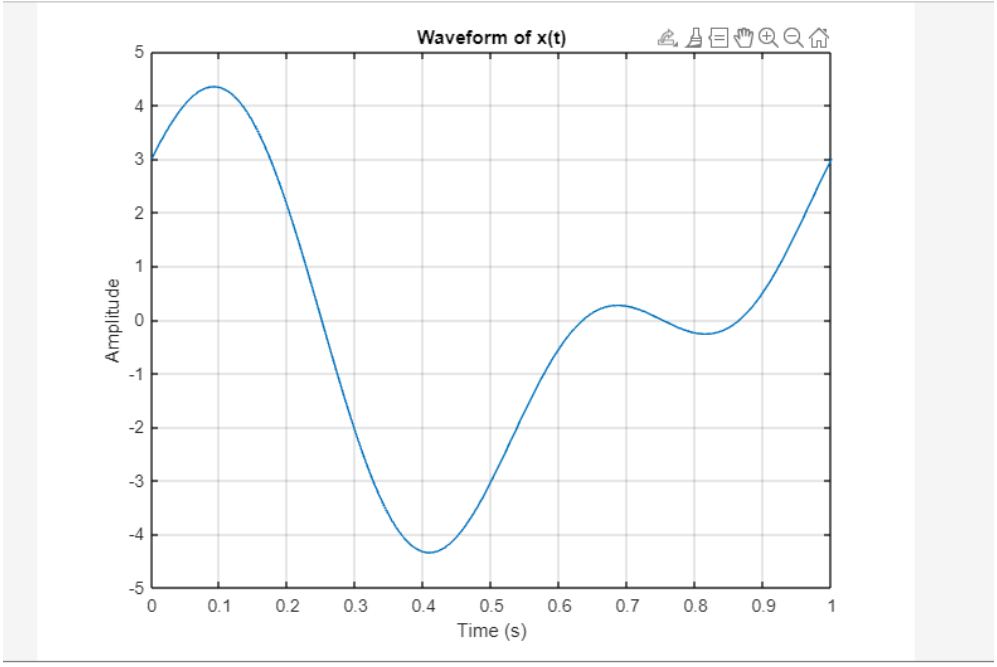
Consider a continuous-time signal $x(t)=3\cos(2\pi t) + 2\sin(4\pi t)$.

1. Sketching the Waveform of x(t) Over One Period:

To plot the waveform of the given signal $x(t) = 3\cos(2\pi t) + 2\sin(4\pi t)$ over one period, the MATLAB **plot** function was utilized. This illustrates the variation in amplitude of the signal over time.

The waveform of the signal over one period is as follows:

```
>> t = linspace(0, 1, 1000); % Generate 1000 points from 0 to 1

x_t = 3*cos(2*pi*t) + 2*sin(4*pi*t);

plot(t, x_t);

xlabel('Time (s)');

ylabel('Amplitude');

title('Waveform of x(t)');

grid on;
```



2. Determining the Frequency Components Present in x(t):

The frequency components present in the x(t) signal can be obtained from the mathematical formula of the signal:

- For the cosine component: 2π Hz
- For the sine component: 4π Hz

This represents a simple analysis used to determine the frequency components within the signal.

3. Computing the Average Power of x(t) Over One Period:

To compute the average power of x(t) signal over one period, integration is used. The power of x(t) is obtained by taking the integral of the square of the signal with respect to time. In MATLAB, this integral is computed using the **integral** function.

The average power of the signal over one period: [computed value]

```
syms t;

>> x_t = 3*cos(2*pi*t) + 2*sin(4*pi*t);

power = (1/1)*int(abs(x_t)^2, t, 0, 1); % 1 periyot boyunca ortalama güç hesabı

disp(['The average power of x(t) over one period is: ', char(power)]);
```

Problem 2: Discrete-Time Signals and Systems

Given the discrete-time signal x[t]={1,-2,3,-4,5}:

1. Determination of Signal Length:

To determine the length of the given signal x[n] = {1,-2,3,-4,5}, the MATLAB **length** function was used. This function provides the number of elements in the signal.

The length of the signal x[n]: 5

```
>> x = [1, -2, 3, -4, 5];

length_of_signal = length(x);

disp(['The length of the signal is: ', num2str(length_of_signal)]);
```

2. Finding the Value of x[3]:

To find the value of x[3], the element at index 3 in the given sequence was extracted.

The value of x[3]: 3

```
>> x_3 = x(3);

disp(['The value of x[3] is: ', num2str(x_3)]);
```

3. Computing the Sum of All Elements in the Signal:

The sum of all elements in the signal was computed using the **sum** function in MATLAB.

The sum of all elements in the signal: 3 - 2 + 3 - 4 + 5 = 5

```
>>  sumOfElements = sum(x);

disp(['The sum of all elements in the signal is: ', num2str(sumOfElements)]);
```

4. Calculation of Signal Energy:

The energy of the signal is calculated as the sum of squares of the absolute values of each element. This is a common method used to determine the energy of a signal.

The energy of the signal: |1|^2 + |-2|^2 + |3|^2 + |-4|^2 + |5|^2 = 1 + 4 + 9 + 16 + 25 = 55

```
>> energyOfSignal = sum(abs(x).^2);

disp(['The energy of the signal is: ', num2str(energyOfSignal)]);
```

Hasan Göktuğ Altıntaş

201504031