EE1101 Signals and Systems JAN—MAY 2019
Tutorial 6, Extra Questions
March 11, 2019

1. A signal $x(t)$ is defined for one period as given below.

   $$x(t) = e^t.rect(t - 0.5)$$

   Find it's Exponential Fourier Series coefficients.

2. **(Parseval's Theorem)**. Consider a square pulse which oscillates between +1V and 0V with 50% duty cycle. Let P_i be the power of the signal considering only till the i^{th} harmonics. Find the ratio of P_2 and the total power. Comment on the ratio obtained.

3. For the following spectrum shown in the figure:

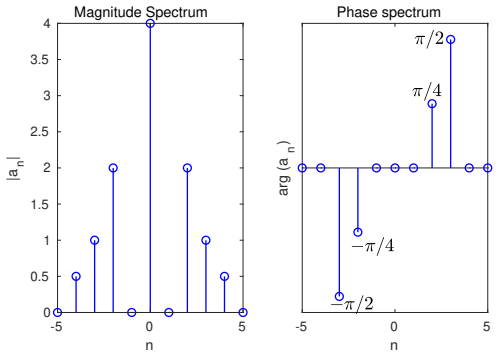

Figure 1

   (a) Find the power in the periodic signal?

   (b) By looking at the plots, can you say whether the signal is real or complex? Can you also say whether the signal is even symmetric or odd symmetric or none?

   (c) Assume that the fundamental frequency of the signal is 10Hz, what is the signal $x(t)$?

   (d) If the signal is passed through an ideal LPF with cutoff-frequency 25Hz, what will be the output?

4. Consider the input and outputs of the two systems:

   S1: $x(t) = \sin(10t)$ and $y(t) = 5\cos(10t + \frac{\pi}{6})$

   S2: $x(t) = \frac{1}{4}\sin(10t)$ and $y(t) = \cos(5t)$

   Are the systems LTI? (Use the concept of 'Fourier Series and LTI systems' to answer this question without any math)

5. A periodic signal $x(t)$ is defined for one period as given below.

   $$x(t) = t^2 \qquad -1 \leq t \leq 1$$

   Find it's Exponential Fourier Series coefficients. And verify the Parseval's theorem for this series,s given that

   $$\sum_{n=1}^{\infty} \frac{1}{n^4} = \frac{\pi^4}{90}$$

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