ECE 111 - Homework #11

Week #11 - ECE 343 Signals- Due 8am Tuesday, November 8th

Problem 1-5) Let x(t) be a function which is periodic in 2π

$$x(t) = x(t + 2\pi)$$

Over the interval $(0, 2\pi)$ x(t) is

$$x(t) = \max(0, 5\sin(t) - 3)$$

or in Matlab:

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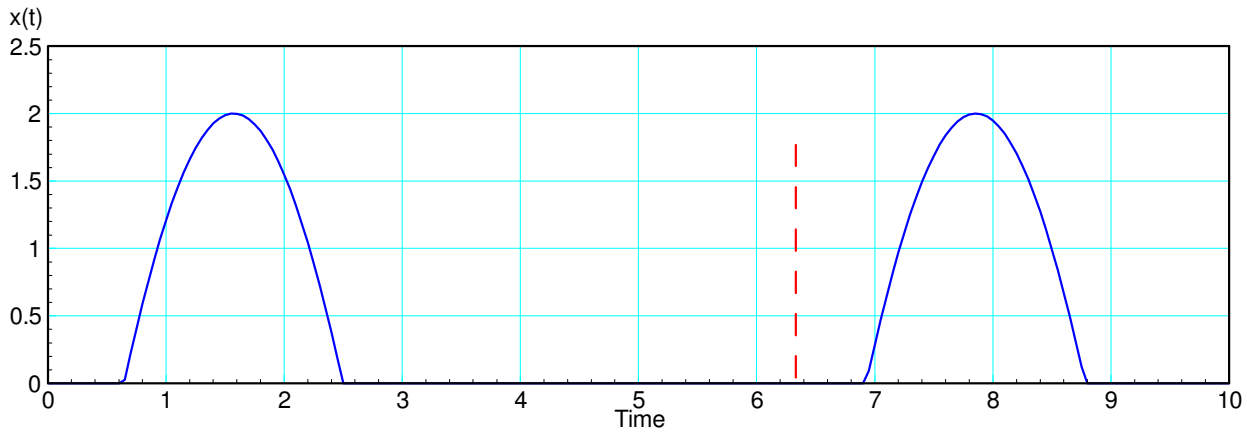
t = [0:0.001:2*pi]';
x = max(0, 5*sin(t) - 3);
plot(t,x)
```



x(t) Note that x(t) repeats repeats every 2π seconds

Curve Fitting with a power series:

1) Using least squares, approximate x(t) over the interval $(0, 2\pi)$ as

$$x(t) \approx a_0 + a_1 t + a_2 t^2 + a_3 t^3 + a_4 t^4 + a_5 t^5$$

Plot x(t) along with it's approximation.

Curve Fitting using a Fourier Series

2) Using least squares, approximate x(t) over the interval $(0, 2\pi)$ as

$$x(t) = a_0 + a_1\cos(t) + b_1\sin(t) + a_2\cos(2t) + b_2\sin(2t) + a_3\cos(3t) + b_3\sin(3t)$$

Plot x(t) along with it's approximation.

Superposition

3) Assume X and Y are related by

$$Y = \left(\frac{1/2}{s^2+s+1/2} \right) X$$

3a) Determine x(t) in terms of its Fourier Transform out to 3 rad/sec

3b) Plot x(t) and its Fourier approximation taken out to 3 rad/sec

4) Determine the gain of this filter at each frequency present in problem #2 (i.e. 0, 1, 2, 3 rad/sec)

- *note: You should get a complex number for the gain at each frequency*

5a) Determine the phasor representation for Y(jw) at each frequency.

- *note: You should get a complex number for Y - the phasor representation for y(t) at 0, 1, 2, and 3 rad/sec*

5b) From this, determine y(t)

6) Plot x(t) and y(t).