ECE 111 - Homework #11

Week #11 - ECE 343 Signals- Due Tuesday, April 4th
Please email to jacob.glower@ndsu.edu, or submit as a hard copy, or submit on BlackBoard

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

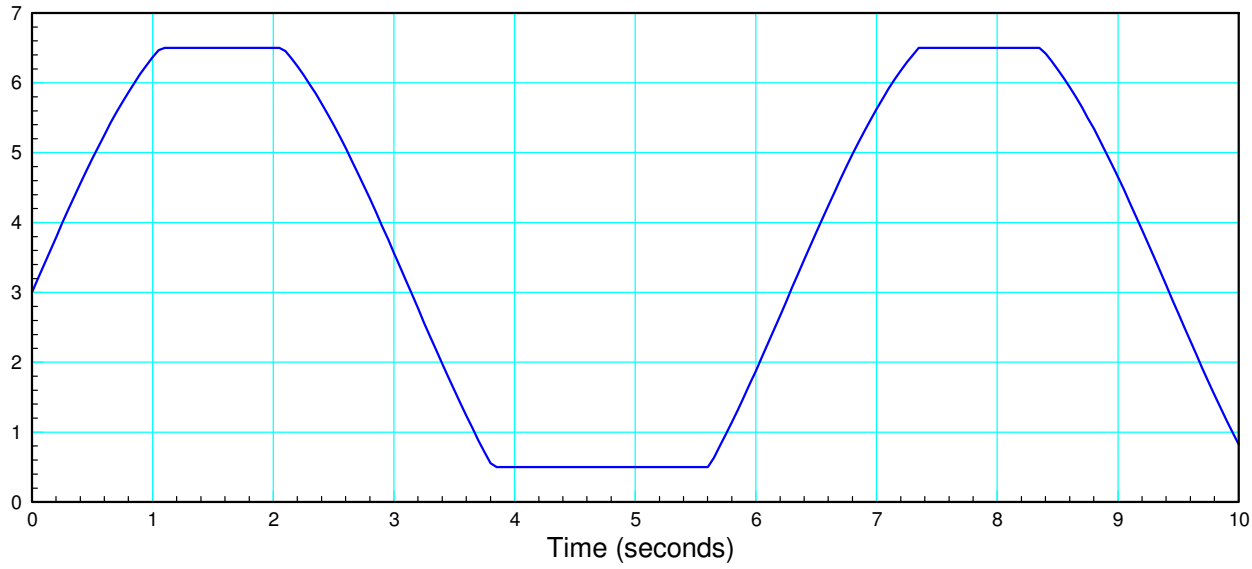
$$x(t) = x(t + 2\pi)$$

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

$$x(t) = 4\sin(t) + 3$$

clipped at +6.5V and +0.5V. In Matlab:

```
t = [0:0.001:2*pi]';
x = 4*sin(t) + 3;
x = min(x, 6.5);
x = max(x, 0.5);
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, 2π) 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, 2π) 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.

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

Superposition:

Assume X and Y are related by

$$Y = \left(\frac{2}{s^2+0.3s+1.5}\right)X$$

4) Using the results from problem 2 & 3, determine y(t) assuming

$$x(t) = a_0$$

5) Using the results from problem 2 & 3, determine y(t) assuming

$$x(t) = a_1\cos(t) + b_1\sin(t)$$

6) Using the results from problem 2 & 3, determine y(t) assuming

$$x(t) = a_2\cos(2t) + b_2\sin(2t)$$

7) Using the results from problem 2 & 3, determine y(t) assuming

$$x(t) = a_3\cos(3t) + b_3\sin(3t)$$

8) Plot y(t) when x(t) is the sum of x(t) for problems 4..7

- hint: use superposition and sum the results for problem 4..7