ECE 3041 Spring 2012
Homework Problem Set No. 9 for
Experiment No. 11

Due Week of April 9

1. Determine (derive) the complex Fourier expansion coefficients, $\bar{c}_n$, as a function of n for the periodic function $x(t)$ shown graphically below using classical integration (no electronic computer). Calculate the normalized coefficients $|\bar{c}_n/\bar{c}_1|$ as n varies from 1 to 9. Calculate the THD using the first nine components.

2. Use SPICE to calculate the first nine Fourier series components. Calculate the total harmonic distortion using the first nine terms of the Fourier series. For the numerical analysis assume that $A = 1$ V, and $T = 1$ sec.

3. Calculate the first nine Fourier series components by using Mathcad to directly evaluate the expansion coefficients by numerically integation. Use the same values of A and T as Problem 2. Use Mathcad to plot (on the same graph) $x(t)$ and $y(t)$ versus t for two cycles of the periodic waveforms where

$$y(t) = \frac{a_o}{2} + \sum_{n=1}^{9}(a_n \cos n\omega_p t + b_n \sin n\omega_p t)$$

and a_n and b_n are the real trignometric expansion coefficients, $\omega_p = 2\pi f_p$, and $f_p = 1/T$.

4. Use Mathcad to obtain the FFT of $x(t)$ and to plot the spectra.