Networks and Systems EEL 3123, Section 1

HOMEWORK 4 – Assigned Oct 26, 2011 Due in class on Nov 2, 2011

Covers Chapter 16. If there are doubts, you are welcome to see me and discuss your problems. Your notes and the textbook should be ample material to solve these problems.

1. Write the Fourier series of a full-wave rectified cosine function. The output of a full-wave rectifier is the absolute value of its input.
2. Determine the Fourier series of a periodic triangular waveform that goes through the origin, has a time period of $\pi/2$ and swings between an amplitude of -4 and +4. Use the best possible symmetry to compute efficiently.
3. Compute an expression for the exponential form of the Fourier series for a square wave with time period T=10 and amplitude swings between -6 and +6. Place the y-axis so that the function is even and place the x-axis such that the average value of the wave is zero. Use the expression in Matlab to plot the Fourier series expression for the square wave up to n=200. Discuss how the approximation relates to the actual signal.
4. A periodic current signal ramps up from 0 to 240 mA in the first half-cycle and is then held constant at that value for the next half-cycle. This current is applied to a 1 KΩ resistor. (a) Use the first 3 non-zero terms in the Fourier series of the signal to estimate average power dissipated in the 1 KΩ resistor. (b) Calculate the exact value of the average power dissipated in the 1 KΩ resistor. (c) What is the percentage of error in the estimated value of the average power?
5. (a) Using the first 3 non-zero terms in the Fourier series, estimate the rms value of the full-wave rectified sinusoidal voltage with amplitude 170V and time period (for unrectified signal) 40 ms. (b) Calculate percentage estimation error (c) Repeat (a) and (b) if the full-wave signal is replaced by a half-wave signal.