University of Rhode Island Department of Electrical and Computer Engineering
ELE 435: Communication Systems

Lab 1 Report and Grading Format
(Periodic Signals and the Fourier series)

1 Report Format

1. Briefly explain what you did in the lab

2. Show the Results/plots, you can use excel or a snap shot or draw it by hand. (3.4, 4.3, 5.3).

3. Matlab Code (print the code with the report and also send me the .m file, please save it as lab1 yourname.m) , (First and last name).
    (a) Matlab hints: You can use the following functions to generate a Square/Triangle/Saw-tooth wave (you can do it any other way as well).
        • To generate a square wave: square(**)
        • To generate a triangle wave: sawtooth(**,0.5)
        • To generate a sawtooth wave: sawtooth(**)

4. Compare the results/plots from Matlab with the results from lab. The plots should look similar, if not explain why not. Please not that the amplitude values might be different from the results seen in the lab, if the ratios of the values are the same it is acceptable.

5. Answer the following questions
    (a) What does spectrum of a time domain signal x(t) mean?

    (b) Why is the magnitude of the spectrum, $|X(f)|$ even symmetric for a real signal x(t)? Hint: you can use the basic definition of Fourier Transform.

    (c) Sec 3-5 (page-3 lab handout) Use equation (4) to derive a general solution for the coefficients, C_n, of a square wave with amplitude A.

    (d) Sec 3-6 (page-3 lab handout), why does the magnitude of the coefficients, C_n, decrease as $1/n$ for a square wave? (Hint: you can use the expression derived for the previous question)

    (e) Sec 4-5 (page-4 lab handout), determine the rate at which the magnitude of the coefficients, C_n, decrease for a triangular wave and why?

(Hint: you can use the properties of Fourier Transforms, if you use calculus it might be a long derivation)

(f) Sec 5-5 (page-5 lab handout), determine the rate at which the magnitude of the coefficients, C_n, decrease for a saw-tooth wave and why?
(same hint as above)

(g) For Sec 3-6, 4-5, 5-5 (above 3 questions), explain why there are odd harmonics for square wave and triangular wave, where as the sawtooth wave has both odd and even harmonics. In other words explain the graphs. (Sec 4-3 page 3, Sec 5-3 page 4) (same hint as above)

2 Grading format

The lab will be graded for a total of 10 points. There is an option for extra credit, you will not loose any points.

1. 5 points for Steps 1.1 - 1.4

2. 5 points for Step 1.5 (for answering the questions)

3. Extra credit: what insight did you get from this lab (points will vary on the effort and the justification)

You can work in groups but everybody should submit an individual report. The lab report is due in a week.

If you dont want to type any equations involving a lot of integrals, you can write them. As long as I can understand you will get credit.

It is crucial to understand the Fourier series concepts, as you will see them repeatedly through out the semester. Please feel free to ask if anything listed above is not clear.

If you have any other questions, you can send me an email at yazan_engineer@my.uri.edu or stop by the lab Kelly 201. Feel free to write any comments (what did you like about the lab and what you didn't so forth)