KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-341 – Data and Computer Communication

Quiz 04 (Take-Home)- April 7th, 2009

Student Name:
Student Number:

Problem (50 points) Consider the periodic signal shown in the figure below.

1. Write a mathematical representation for $s(t)$?
2. Identify the period for the function $s(t)$ and calculate the corresponding fundamental frequency?
3. Compute the Fourier Series Expansion for signal $s(t)$. Plot the original $s(t)$ and $s\_e(k)$ for $k = 0, 1, 2,$ and 3 on the same figure similar to the example in class notes.
4. Compute the DC component of $s(t)$?
5. Does $s(t)$ contain frequencies lower than the fundamental frequency? What is (are) these frequencies and specify the terms containing these frequencies?
6. Does $s(t)$ contain frequencies higher than the fundamental frequency? What is (are) these frequencies and specify the terms containing these frequencies?
7. Compute the total power for $s(t)$?
8. Plot the power spectral density function for $s(t)$. Show that the total power in $s(t)$ computed in part (g) is equal to the total power for the Fourier Series Expansion. To do the second part of this question, show that the limit of the total power of $s\_e(k)$ as k tends to infinity is equal to the total power for the original $s(t)$.
9. In a table similar to that used in the class notes examples, find n^* such that $s\_e(k=n^*)$ contains at least 95% of the total power in the original $s(t)$.
10. If the signal $s(t)$ is passed through a low-pass filter that passes frequencies up to and including the frequency at three times the fundamental frequency. Write an expression for the output signal of the filter? Plot the output signal of the filter.
11. Determine the total power in the output signal of the filter.

The student must show ALL the derivation or mathematical steps leading to the answer. For the parts where plots are required, the code or original excel sheet is not required. Only the plots are needed. The plots must be clear and be correctly labeled. For the plots assume that the quantities A and T for signal $s(t)$ are both equal to 1. However, for all other parts, the answers must be in terms of the quantities A and T; i.e. you cannot assume a value for either A nor T.

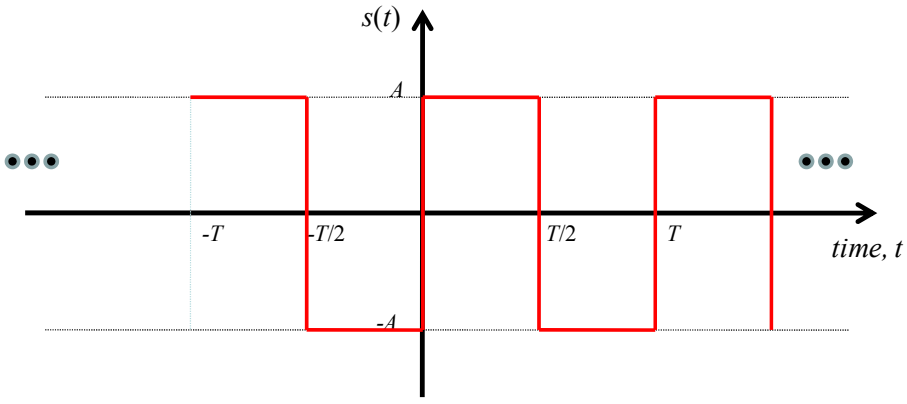

Figure: Saw-tooth signal s(t).