Text

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**Laboratory Report**

Fall 2021

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| Laboratory Number: | **1** |
| Laboratory Title: | **Fourier Decomposition** |
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| TUID: | **915614617** |

**Description:**

This lab will introduce MATLAB as a tool to generate desired periodic signals and determine their number of periods. From the sample program, I will generate a signal based upon my and generate three waveforms ending at periods equal to ,, and. This data will allow the signal to be reconstructed using the Fourier Series and examined using the spectrum analyzer in next week’s lab. Based upon the collected data, I will be able to compare the mean square error (MSE) versus the number of harmonics.

**Images:**

Chart, line chart

Description automatically generatedChart, line chart

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Figure 1. Plot ending at 1Tb Figure 2. Plot ending at 2Tb

Chart, line chart

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Figure 3. Plot ending at 4Tb

**Descriptive Answers to Tasks:**

For both tasks this week I needed to generate a waveform based on my TUID, therefore following the requirements dictated my amplitude, therefore Amplitude (). Frequency () was determined by , therefore . The desired waveform was determined by which is . This plot consists of a pulse in the positive cycle ending at and a triangle wave for the negative cycle until it crosses the positive axis at and it’s multiples. I then used the slider in MATLAB to generate plots for and .

**Code:**.

**Section 01**

Task1:

clc; clear; %TUID: 915614617

A = 8; % Signal amplitude in Volts

rb = 2e3; % (Fundamental) frequency of signal in kHz

Tb = 1 / rb; % Period of signal

fs = 1000 \* rb; % Sampling frequency

Ts = 1 / fs; % Sampling period

**Section 02**

Task2:

figure();

t = 0:Ts:4\*Tb;

plot(t, signal6(A, Tb, t));

ylim([-A-1, A+1]);

**Function Definitions**

Task 2 TUID(7):4,5,6:

function s = signal6(A, T, t)

t = mod(t, T);

s = 0 .\* t;

s(t <= T/2) = A; %Pulse on positive cycle

s((t > T/2)&(t<3\*T/4)) = -4 \* A / T \* (t((T/2 < t) & (t < 3\*T/4)) - T/2); %First half of Negative Triangle cycle

s(3\*T/4 <= t ) = 4 \* A / T \* (t(3\*T/4 <= t ) - T); %Second half of Negative Triangle cycle

end