ELEC 1908

MatLab Introductory Lab

Performed: Monday January 20th 2014

Submitted: Monday January 27th 2014

Performed By

Name, Student #

Name, Student #

Teaching Assistant

Svetlana Demptchenko

Introduction

<u>Purpose</u>

       The purpose of this lab is to familiarize the students with MatLab software. Using the software, the student will create and plot multiple moving wave functions. They will do this by creating a script then simulating it in MatLab.

<u>Preparation</u>

       To prepare for the lab, the students were asked to complete multiple built-in tutorials. Our group managed to complete most of the built in tutorials. These tutorials taught us many different skills such as; variable creation, matrix multiplication, graphing in 2&3D, and how to call on scripts we've written. These skills proved to be integral to the success of the lab.

Results

       After playing around with the different pieces of the function, we noticed many cool changes occurred. When the amplitude of the wave was changed, there was a change in size of the wave. By "size" it is meant that y-values of the function increase and decreased. When the amplitude was increased, the y-values grew in magnitude and when the amplitude was decreased, the y-values lessened in magnitude. When the wave frequency was adjusted it was noted that the speed of the wave was proportional to its increase or decrease. An increase in wave frequency led to a faster traveling wave and a decrease led to a slower traveling wave. Lastly, when the wavelength was changed, there was an obvious change in the spacing in the crests of the function. When the wavelength was increased, the spacing between the crests was increase and when it was decreased, the crests came closer together. All of these traits can be observed by the change in figures 1 and 2 in appendix A.

       When creating and plotting a second wave traveling in the opposite direction of the first, it was noted that of course, the wave instead of moving from left to right, moved from right to left. To do this, the sign in front of the "omega" in the script was changed (to see the script please see appendix B).

       When the first and second function were added to each other, it was noted that they interfered in a both constructive and destructive pattern. This can be observed by the amplitude of the sum of the function being 3, where the amplitude of its components are 2 and 1. Whereas in contrast, the interference for the frequency was destructive. When the waves were added together the sum waves moved from right to left, but slower than wave "y2" that was the one providing that motion. One can conclude that this is due to the opposite frequency on "y1". Lastly, when observing the wave, it was noticed that the wavelength of the sum wave remained unchanged

       When playing around with the different values for the two graphs, it was noted that it was possible to control the interference. When the signs in front of the frequency and amplitude were the same, it produced constructive interference, and when the signs were opposite, it produced negative interference. When changing the wavelengths, there was no noticeable pattern.
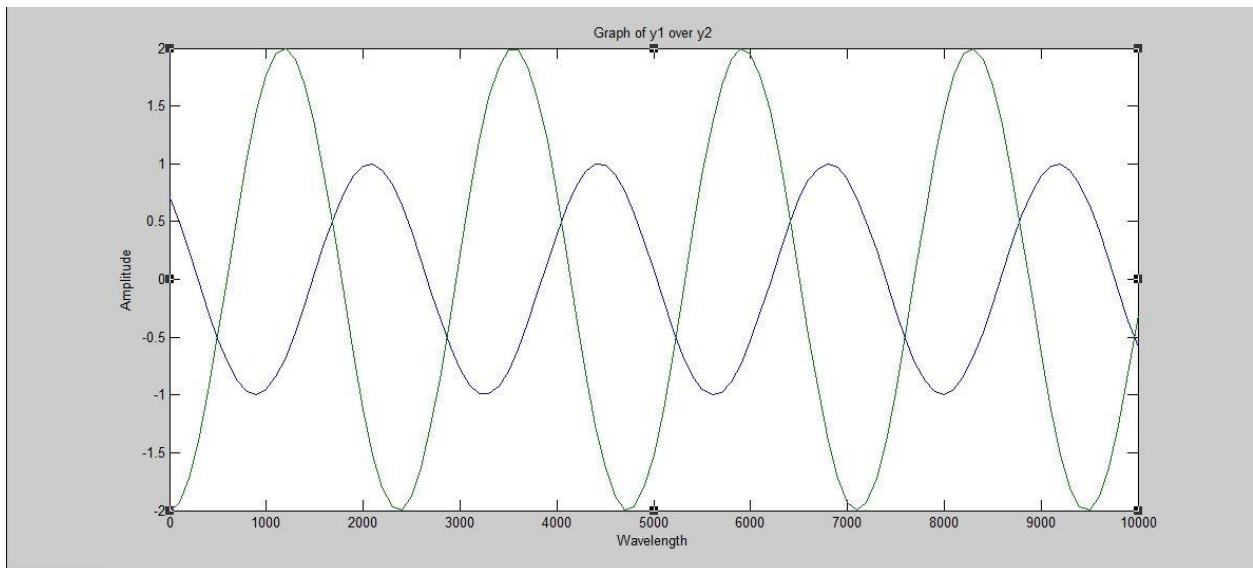
Conclusion

In conclusion, this introductory lab provided the students with the chance to play around with the different features in Matlab. The most useful application of MatLab our group found was to linear algebra. MatLab allows for easy creation and manipulation of matrices. This can be used to solve many problems that would involve many long tedious calculations. In the future, we will use this program to increase our efficiency when dealing with large matrices.

Some of the vices we found for MatLab was the scripting syntax. We had a lot of problems figuring out the syntax and the tutorials were of little or no help. Most of the help we got was not from the built in software, but instead the internet. I'm sure with more time and practice, the full potential can be brought forward. However, for people that are not familiar with the syntax, this is not a very easy to use program.

<div align="center">

Appendix A

~Graph of y1, y2~

</div>

Figure 1: This figure demonstrates a graph with two functions y1 and y2. y1 (blue) can be thought of as the original wave. When changes were made to the frequency, amplitude, and wavelength, the second graph y2(Green) was produced. The graph y2 is a result of doubling the amplitude, tripling the frequency and leaving the wavelength the same. The script for this graph can be found in appendix B.
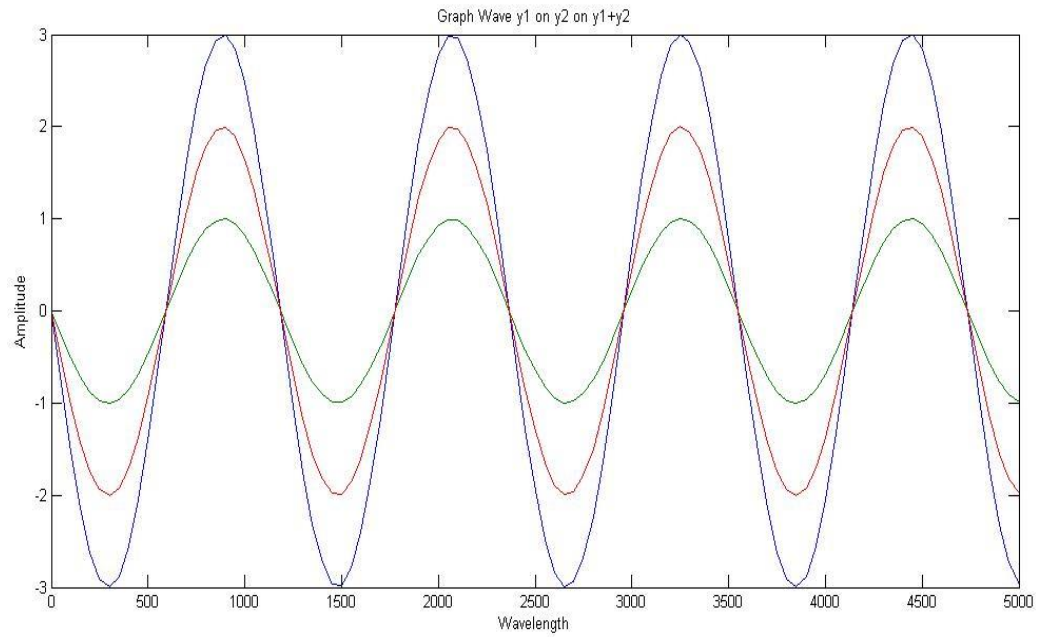
Appendix B

~Script for y1, y2~

```
x = 0:100:1000;

xlabel ('Wavelength')

ylabel ('Amplitude')

title ('Elec 1908 A1 Wave:y1+y2)')

for i = 0:1000

t = 0.1*i;

L = 1;

F = 0.5;

f = 1.5;

Beta = 1/L;

Omega = 2*pi*F;

omega = 2*pi*f;

Alpha = 1;

alpha = 2;

y2 = Alpha*sin(Beta*x-Omega*t) ;

y3 = alpha*sin(Beta*x+omega*t);

plot (x,y,x,y2,x,y3); pause(0.1);

end
```

Appendix C

~Graphing Interference~

Figure 2: This figure demonstrates the result of adding the two functions y1 and y2 to each other. In this figure, the sum of the two functions is in blue, and the other functions are in blue red respectively. As it can be seen, the two waves interfere constructively and create a bigger amplitude. The script used to generate this plot can be found in appendix D.

Appendix D
~Script for Plotting Interference~

```
x = 0:50:5000;
xlabel ('Wavelength')
ylabel ('Amplitude')
title ('Elec 1908 A1 Wave:y1+y2)')
for i = 0
t = 0.1*i;
L = 1;
F = 0.5;
f = 1.5;
Beta = 1/L;
Omega = 2*pi*F;
omega = 2*pi*f;
Alpha = 1;
alpha = 2;
y = (Alpha*sin(Beta*x-Omega*t))+(alpha*sin(Beta*x+omega*t)) ;
y2 = Alpha*sin(Beta*x-Omega*t) ;
y3 = alpha*sin(Beta*x+omega*t);
plot (x,y,x,y2,x,y3); pause(0.1);
end
```

Figure 3: After experimenting with the hold function this graph was generated