MEMO Number CMPE323-Lab00
DATE: August 13, 2016
TO: CMPE323
FROM: EFC LaBerge
SUBJECT: Getting Started With MATLAB

1 INTRODUCTION

This lab is a refresher on MATLAB. You should all be familiar with MATLAB from ENES101 and CMPE306, so this should go quickly.

2 EQUIPMENT

For this lab, you need a laptop with MATLAB installed.

For the purpose of CMPE323, please use the following naming conventions for all output files:

CMPE323F16_Lab<Lab#>_<Your Campus ID>

For the purpose of CMPE323, please use the following naming conventions for MATLAB scripts or functions that you are required to submit.

<function name>_<Your Campus ID>

Examples will be given in the lab description. Follow the instructions exactly, or you may not get graded!

3 LAB TASKS

You might find it useful to use the MATLAB function `diary` to capture your inputs and outputs.

3.1 Simple Computations

3.1.1 Exponential Growth

The population of a certain bacteria growing in an infinite medium is given as $N_0 e^{rt}$, where N_0 is the number of bacteria initially present (at $t = 0$), r is the effective growth constant per time interval, and t is time, measured in some appropriate unit. Let $N_0 = 1$ and $r = 0.6931$. Compute the number of bacteria present at end of each day from day 0 through day 10. Use a unique, descriptive name for these values and save for later use.

3.1.2 Exponentially Decaying Sinusoid

A simple RLC circuit is underdamped, with $a = 0.7$, and $w_0 = 1.0$. The natural response of this circuit is given by $v(t) = 2\cos(0.71t) - 1.5\sin(0.71t)$. Compute the output every 0.1 second from 0 to 10 seconds. Use a unique, descriptive name for these values and save for later use.

3.1.3 Complex Exponential

Compute the value of the complex exponentials $e^{j0.71t}$ and $e^{-j0.71t}$ every 0.1 second from 0 to 5 seconds. Use a unique, descriptive name for these values and save for later use.

3.2 Simple Plots

3.2.1 Simple Computations

Plot the result of 3.1.1 using time as your independent variable.

Then redo your plot, using a semilog scale, with the logarithmic scale on the y-axis

3.2.2 Exponentially decaying sinusoid

Plot the result of 3.1.2 using time as your independent variable, showing only the portion from 0 to 5 seconds. Use a line width of 2, label your axes, put a title on your plot, and turn the grid on.

3.2.3 Complex Exponential

Using the MATLAB function `subplot` create the following three plots on the same plotting screen:

1) the real parts of $e^{j0.71t}$ and $e^{-j0.71t}$
2) the imaginary parts of $e^{j0.71t}$ and $e^{-j0.71t}$
3) the error between $c(t) = \frac{e^{j0.71t} + e^{-j0.71t}}{2}$ and $\cos(0.71t)$

Use a line width of 2, label your axes, put a title on your plots, and turn the grids on.

3.3 Something new: anonymous functions

MATLAB gives us the ability to define *anonymous functions* at the beginning of a script, or computation session. One function that we will use quite a bit in CMPE323 is a *unit pulse of length T* that starts at time 0, extends to time *T*, and has amplitude 1. The anonymous function to define this pulse is

```
pulse = @(t,T) (t>=0)-(t-T>=0); t is an array of times, T is a constant
```

The function is defined by the "@" sign, the input parameters are (*t,T*), and we use MATLABs ability to evaluate logical functions by the two terms in parenthesis.

3.3.1 Use the anonymous function pulse

Use the anonymous function pulse to compute and plot a pulse of duration 3 seconds over the duration 0 to 10 seconds. Investigate the effect of using the function pulse with an argument of 2t, or of 0.5t. What happens to the pulse waveform? Investigate the effect of using the function pulse with an argument of t+3, of t-3? What happens?

3.3.2 Creating anonymous functions

Create anonymous functions for the computation of 3.1.1 and 3.1.2, above. Verify that your functions give the same outputs as your original computations.

4 LAB SUBMISSIONS

Submit the following via the Blackboard assignment Lab 1.

In a single PDF file named in accordance with the output naming conventions given above, include

a. The outputs generated in 3.1.1
b. The outputs generated in 3.1.2
c. The outputs generated in 3.1.3
d. The plots generated in 3.2.1 through 3.2.3
e. The five plots generated in 3.3.1 (no outputs)
f. Your three anonymous functions