

RMIT University

School of Engineering

EEET2248 – Electrical Engineering Analysis

Lab Experiment #1

Introduction to MATLAB

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Group: Tuesday 10:30-12:30

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**Introduction**

This lab consisted of 7 tasks split into 2 discrete sections. The first section involved running a simulation of a coin dropping from the empire state building under various conditions and then plotting the output data. It was also a requirement to determine if the coin would break human skin based on the output data compared to a required pressure value. In the second section data was imported from a set of files. Several plots and figures were required to demonstrate successful importation and manipulation of this data. The contents of relevant variables then needed to be compared to highlight the way MATLAB stores the imported data. Overall the purpose of this lab was to demonstrate an array of MATLAB skills particularly those relevant to importing/exporting data and processing data to achieve a specific desired output.

**Input Data**

Part 1:

* Building height
* Mass of coin
* Diameter of coin
* Stopping time
* Pressure required to break skin
* Terminal velocity of coin

Part 2:

* Buildings data from spreadsheet (height, floors)
* CSV data from spreadsheet (voltage, time)
* .wav files
* Image files (Barbara.png, lena.tiff)

**Output Data**

Part 1:

* Time taken for coin to hit the ground
* Impact velocity
* Pressure on impact
* A plot of velocity and time as vectors
* A plot of displacement and time as vectors
* Time taken for coin to hit the ground assuming terminal velocity
* Height above the ground upon reaching terminal velocity
* Pressure on impact assuming terminal velocity

Part 2:

* Scatter plot of number of floors vs building height
* Plot of impact velocity vs building height
* Plot of voltage vs time
* Audio playback of .wav file at specific sample rate
* A figure of a greyscale image
* A figure of a colour image

**Design**

A picture containing text, whiteboard

Description generated with very high confidence

Figure 1: Flowchart

A close up of text on a white background

Description generated with high confidence

Figure 2: Hand Working 1

A close up of text on a white background

Description generated with high confidence

Figure 3: Hand Working 2

**Note:** For part 2 calculating the output under the ‘terminal velocity scenario’, the calculations were based on a hypothetical scenario where the coin would reach terminal velocity in a linear increase of velocity up until that limit. In reality, the coin would have a decreased acceleration as it approaches the limit of that terminal velocity and would take a much longer time to reach it.

**Output**

**A screenshot of a cell phone

Description generated with very high confidence**

Figure 4: Command Terminal Output

**Neither scenario appears to have enough pressure to break skin based on the input data**

A close up of a map

Description generated with high confidenceA close up of a map

Description generated with very high confidenceA close up of a map

Description generated with very high confidenceA screenshot of a cell phone

Description generated with high confidenceA screenshot of a cell phone

Description generated with very high confidenceA person posing for a photo

Description generated with very high confidenceA person wearing a hat

Description generated with very high confidence

**Discussion**

The numerical output appeared to be consistent with the hand working accounting for a small error margin that is likely to exist due to rounding during my hand working. Regardless, the output is consistent and within a good range of ‘expected’ output (e.g. correct order of magnitude). The graphs all seem to have reasonable outputs displayed and the first two graphs correlate correctly (Time vs Velocity is the gradient of time vs distance). The images also display correctly, as does the sound file.

**Conclusion**

A solution was designed that addressed all the requirements of the task and delivered output that, based on limited testing and comparison, appears to be accurate. The project design was successfully implemented and hand-worked calculations appeared to agree with all Matlab output despite some minor rounding errors. Our output also agreed with popular theory, such as the conclusion of the tv show “mythbusters” when they performed a similar experiment. From the output of this lab the conclusion for part 1 would be that the coin would not break skin. In conclusion, all 7 tasks were successfully completed and the required skills were demonstrated.

**Appendix (Matlab Script)**

%%

%clear

clear;

clc;

%%

%variables

h = 381; %height in metres

c = 3.11; %coin mass in grams

g = 9.8; %accelartaion due to gravity in m/s/s

cd = 19.05; %coin diameter in mm

bp = 689476; %pressure to break skin

st = 10/1000; %time in s for the coin to stop

termv = 50; %terminal velocity in kph

termvc = termv/3.6; %terminal velocity in m/s

%%

%script

t = timeT(h,g);

fprintf('---Default Scenario---\n')

fprintf('Time Taken is: %f seconds\n', t)

vf = vFin(t,g);

fprintf('Final velocity is: %f metres per second\n', vf)

%%

cm = c/1000; %coin mass in kg

cdf = cd/1000; % coin diameter in metres

cr = cdf/2; %coin radius

ca = pi\*cr\*cr; %coin area

%formulas for pressure

a = vf/st; %decelaration

F = cm\*a; %stopping force

P = F/ca; %pressure

fprintf('Pressure exerted is: %f Pa\n', P)

fprintf('Pressure required to break skin is: %f Pa\n\n', bp)

tv = [0:.1:t]; %time as a vector

vv = g\*tv;

sv = (g/2)\* (tv.^2);

figure(1)

plot(tv,vv);

title('time vs velocity');

xlabel('time (s)');

ylabel('velocity (m/s)');

figure(2)

plot(tv,sv);

title('time vs distance');

xlabel('time (s)');

ylabel('distance (m)');

%%

%terminal velocity scenario

fprintf('---Terminal Velocity Scenario---\n')

termt = termvc/g; %time taken to reach terminal v

termd = 0.5\*g\*(termt.^2); %displacement in above time

termh = h - termd; %height above the ground at terminal v

fprintf('Time taken to reach terminal velocity: %f\n', termt)

fprintf('Distance from ground at terminal velocity: %f\n', termh)

%formulas for pressure

a = termvc/st; %decelaration

F = cm\*a; %stopping force

P = F/ca; %pressure

fprintf('Pressure exerted is: %f Pa\n', P)

fprintf('Pressure required to break skin is: %f Pa\n', bp)

%%

%Importing excel spreadsheet

[BHeights]=xlsread('Data Files\Excel\Buildings.xls', 1 ,'D1:D136');

[BFloors]=xlsread('Data Files\Excel\Buildings.xls', 1 ,'E1:E136');

[BtimeT] = timeT(BHeights, g);

[BVelFin] = vFin (BtimeT, g);

figure(3)

plot(BHeights,BVelFin)

title('building heights vs final velocity');

xlabel('height (m)');

ylabel('final velocity (m/s)');

figure(4)

scatter(BHeights, BFloors);

title('building heights vs floors');

xlabel('height (m)');

ylabel('floors');

%%

%import csv

M = csvread('Data Files\CSV\scope1.csv');

csvT = M(1:2000, 1);

csvV = M(1:2000, 2);

figure(5)

plot(csvT,csvV)

title('voltage vs time');

xlabel('time(s)');

ylabel('voltage(V)');

%%

%importing audio

[aud1] = audioread('Data Files\Audio\gameover.wav');

soundsc(aud1, 30000);

soundsc(aud1, 60000);

[aud2] = audioread('Data Files\Audio\guitar.wav');

[aud3] = audioread('Data Files\Audio\laugh.wav');

%soundsc(aud2);

%soundsc(aud3);

%%

%importing images

img1 = imread('Data Files\Images\barbara.png');

img2 = imread('Data Files\Images\lena.tiff');

figure(6)

imshow(img1)

figure(7)

imshow(img2)

%%

%functions

function c = timeT(h,g)

c = sqrt((2\*h)/g);

end

function c = vFin(t,g)

c = g\*t;

end