

EXAM 1 – Computer PORTION

Put all of your code in one m-file and name it: `lastname_firstname.m` (all lower case). Include your name, section number, and CM number in the header section of your code. There should be no output other than what is asked for.

Problem (60 pts)

Download the Excel spreadsheet named “rocket.xls” from the course web page at <http://www.rose-hulman.edu/ME123/courseware.shtml>

The data file you have is the thrust measurement from a rocket engine in a static test. It contains two columns of data. The first column lists the time, t , in seconds while the second column lists the thrust, $F(t)$, in Newtons. The time data is evenly spaced; the difference between all times is a constant. The duration of the test is 5.00 seconds.

Write a MATLAB code to

- (20 points) Read in the data stored in the Excel spreadsheet. Plot the rocket thrust, $F(t)$, in Kilonewtons, against the time, t , in seconds. Properly label both axes, and provide a meaningful title to the figure.
- (20 points) The rocket’s mass flow rate $\frac{dm}{dt}$ is modeled by the equation $\frac{dm}{dt} = 500 \exp(-1.25 t)$ kg/s. We can then calculate the exhaust gas velocity at each time point as follows.

$$V_e = \frac{F(t)}{\frac{dm}{dt}}$$

Use Matlab to calculate the maximum exhaust gas velocity. Have your program print this information to the command window using the exponential notation in the following format.

The maximum V_e is `x.xxxxexx m/s`.

Hint: Use the `max` function.

- (20 points) To calculate the effectiveness of the engine in the test, its impulse must also be calculated. The impulse is the area under the thrust curve from the start to the end of the test. Use the trapezoidal rule to calculate this integral:

$$I = \int_{t=0}^{t=5} F(t) dt \approx \sum_{i=1}^{N-1} \left[\frac{F(t_i) + F(t_{i+1})}{2} \right] \Delta t$$

where N is the number of rows in the data file. Print the result of your calculation to command window using the following format.

The impulse is `x.xxexxx N-s`.

(Please turn the page over for further instructions.)

When you are done, post your m-file answer to the correct folder:

1. Double-click on "Documents" on your desktop.
2. Double-click on "DFS Root" on the left column.
3. Double-click on AcademicAffairs.
4. Double-click on ME.
5. Double-click on ME123.
6. Double-click on Exams.
7. Double-click on the folder with your section number.
8. Copy and paste your m-file to this folder.

NOTE: All programming must stop at 8:30 pm. You will have a few minutes after that to post your file if you need that time.