**Question**

1. The force on a cutting tool of a shaping machine varies over the length of cut as follows:

   Distance (mm)     0     20     40     60     80     100

         Force (kN)     60     72     65     53     44     50

Determine the work done as the tool moves through a distance of 100 mm.

2. Create two array data sets**x = [22 3 55.6 9 12 10]** and **y = [5 31 95 56.3 77 61]** from the command window. Create a Simulink model to implement equation **z=3x2-5y+1**8  Store result values using **To File** block.

3. Go to Matlab Help. Type the keyword ‘Mass-Spring-Damper in Simulink and Simscape’. Open the model and solve the following problems:

1. Derive the governing equation for the model
2. Change the value of mass, damper, and spring for the Simscape model and plot the result. Change the value of Mass, displacement as x0=2 in the Simulink model, and plot the results.
3. Make the response from Simscape and Simulink as two separate displays.

**NOTE:** If you are using Matlab R2021a above versions, kindly convert you to lower or equal to R2021a version and attach it in the submission.

Conversion: Save > Pervoius Version > Choose R2021A or lower version.

**Grading Policy :**

1. Upload the supporting results as images or by any other means
2. Write a detailed report
3. Report attached as an image will lead to zero marks
4. plagiarism is not tolerated
5. upload Simulink files if needed through the google drive, any external links will not be accepted

**Your Answers**

Challenge 1-

According to Joules law Work=Force\*displacement, in order to find total work done while the cutting tool travels 100 mm and to model different forces experienced by tool at different distances a signal builder block was used, distance in mm and force in KN was converted to m and N respectively and a product block was used to find work. Output is displayed with help of scope and display.

Challenge 2-

To model the equation in simulink listed blocks where used,

1. Product Block

2. Add Block

3. Constant Block

4. To File Block

Modelled equation can be easily undertood by just having a glimpse of model, an important concept that was implemented in this model was importing data from MATLAB command window, variables x and y representing an array were specified in the command window, same was imported in the model. This was done with help of a constant block, one error that I faced while running this model was that "External input specified in the Configuration Parameters dialog box on the Data Import/Export page (or as an option to SIM command) to a model containing no root level input ports" which I eliminated by following path: Modelling>Model Settings>Input(Unclicked).

Challenge 3-With help of Help button this model ‘Mass-Spring-Damper in Simulink and Simscape’. was brought to Simulink window and operations where performed as per instructions scope results after modifying either the stiffness, damping constant and mass or the displacement, results obtained in scope are attached.

Governing equation:

Md2/dt(x0)+bd/dt(x0)+kx0=0