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MATLAB final project paper.

Earlier in the semester, my mechanics of materials professor assigned a small MATLAB based project. For this project, we had to use MATLAB to plot two graphs that represented the shear force and bending moment of a beam throughout its length. The code he gave us came in 4 separate files (I included these files in my repository to avoid any plagiarism issues). One of them was to input “q”, the distributed load across the beam, which is typically given in a problem. The next one was to plot “V”, the shear force that is found from integrating the q function and adding a point force “P” at a distance “x” if specified in the problem. The third function was then to integrate the V function, to produce the moment equation. The total graph should look something like this:

Diagram, engineering drawing

Description automatically generated

There are of course much more complicated types of problems like this but as I am only a beginner I picked one of the simpler iterations to work with. I got approval from Quinn after one of the lectures because I was unsure if this would even work in MATLAB.

The first and overall biggest problem I had to overcome was the fact that the base code I was working with was brute force code, which obviously does not work well for a Gui function like this one. Each of the functions had specific ranges in them that had to be entered manually depending on the problem and the input was only one variable. The code originally used this input x value and turned it into an array the length of the bar. It then ran a whole bunch of for loops based on the manually entered intervals.

To solve the problem the way I wanted to, I first needed to add a beam to the figure. This was just a simple function basePlot. It has a simple straight line that is made significantly thicker to represent a beam. I then focused on setting up the rest of the figure. Then I started to make the figure look how I wanted it to. I decided that the easiest way to set it up how the problems looked on paper was to do three horizontal subplots. Next I put in the 4 input boxes that are required along with a calculate button that actually runs all of the functions. For these functions I needed to have 4 inputs into the function for the 4 callbacks I wanted to run. When I talked to Quinn, she said the most efficient way to do this was put each of the 4 functions inside of each other because of the way they already called each other.

The next step was the always fun process of going through and ridding the code of the old x inputs adding input variables everywhere that was necessary. Then I could focus on actually changing the function to do what it is supposed to do through the correct calling of different inputs. I originally started with a q function, but I ended up sticking this inside the V function because all it ended up doing for my purpose was making it negative. Then I went to the V function. This is the bread and butter of the code because M just ends up integrating the values this spits out. Originally with V, there was an integral function in this code, but after almost an entire day struggling with this command not working correctly, I decided my code was only suited for linear q values anyway so I just made a for loop array and multiplied it by the q value to give the proper slope. Once I had my correct q value turned into the correct V value array, I moved on to the M function. For this function I only had to make a few changes to utilize the trapezoidal method of integration that my professor had used. He used this method because integrating an array of y values is very difficult in the matlab function.

After I had linked the functions together properly The code worked almost exactly how I wanted it to! The values are not super precise and again this type of problem is a very simple one. In the future knowing how to code something like this so it can be done over and over again very easily could be tremendously useful. The problem I have solved currently is from a third level Mech class and that is only the beginning of what could be done with more complex code. More forces could be added on more beams up to the point where you have a whole structure you can test for different forces. This is easily the most time I spent on any assignment this semester the knowledge I got from it could definitely payoff in the long run.