# Beam Analysis in Matlab

(For simply supported & Cantilever; For Point Load & UDL)

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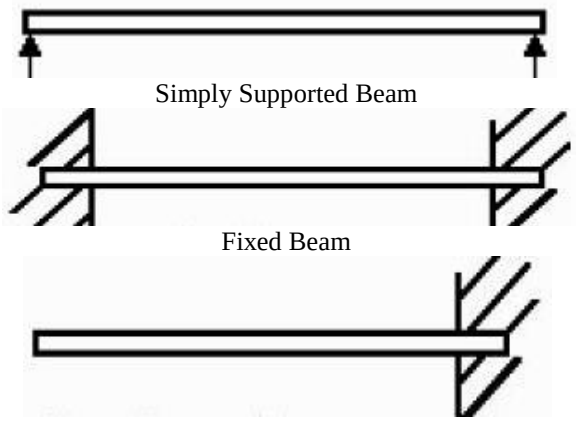
*Abstract- Beam being an important member of any structure and bears heavy loads and hence before using beams one have to be very sure about its strength and deflection. Industrial support beams all have different support and structural properties and are used in various types of design. Beam stresses and deflections should be within the material allowable limits and therefore analysis of beam design is essential.*

*In present work a software called "MATLAB" is used to analyse beam design. MATLAB is extensively used for scientific & research purposes. It is accurate & also has a number of built in functions which makes it versatile. This requirement of analysis meets with the Matlab software. This gives the package for high-performance numerical computation and visualization.*

## I. INTRODUCTION

1. Introduction of beam

A beam is a structure loaded by forces acting transversely (sideways) to it's length and this make the beam bend. Beams may be supported across a span in various ways as show.



Simply Supported Beam

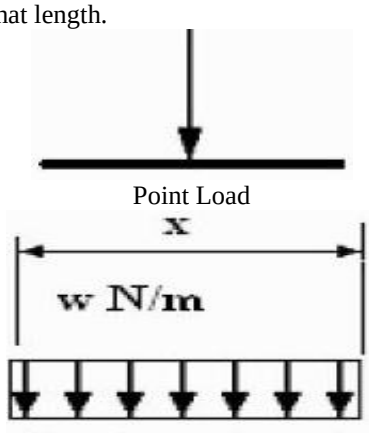
Fixed Beam

Cantilever Beam

Fig -1 Types of Beam

Bending is the most severe form of loading that can be applied. Think how easy it is to break a something like a ruler by bending is as opposed to stretching it or shearing it. The loads (forces) may be applied at a point (point loads) or spread along a length. For example the weight of a beam is spread along the length and this is an example of a uniformly distributed load (UDL).

A point load is shown as a single arrow and acts at a point. Uniform loads are shown as a series of arrows and has a value of Wn/m. For any given length x meters, the total load is wx Newton and this is assumed to act at the centre of that length.




Point Load

Uniformly Distributed Load

Fig-2 Types of Load

When a beam bends, one side is stretched and goes into tension and the other side is compressed. It follows that there is a layer (called the neutral layer) somewhere in the middle that is neither stretched nor compressed. It is always the tension that causes the material to fail and if the beam is made of something brittle like concrete, it will break very easily.

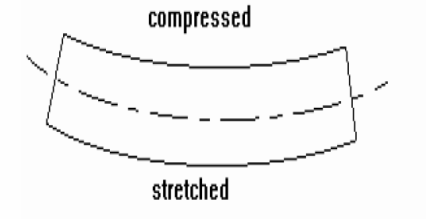



Fig -3 Bending

We need to study the relationship between the stress and the things that affect it. The three part formula shown next (the bending formula) expresses this and we need to study this closely.

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

## II.CLASSIFICATION OF BEAM

The beam can be attached in any structure through various ways and hence their name has given from that e.g. simply supported beam, cantilever beam,

overhanging beam & fixed beams. These beams to be make for their ability to sustain the different kind of load at different parts or the requirement of the design. These beams are to selected first with the proper arrangement and thus the different section can be chooses namely as Rectangular Section, I-section, C-section, L-section, T-section. These sections have different geometries and hence different Centroidal axis which further gives its different area moment of inertia. The dimensions of the beam may depend upon requirement or the possible case of beam design.[5]

The above elements help to figure out the shear forces and bending moment with the help of loads. The loads could be of various kinds as UDL, VDL, Pt. Load &Mixed load. These loads are applying on the beam because of various mechanical processes or simply the use of beams in loadings and offer a direct connection.[2]

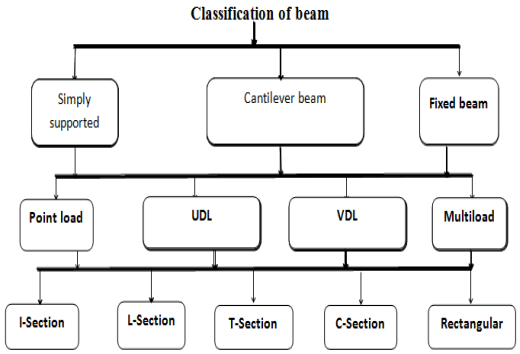



Fig 4.Classification of Beam

## III. ABOUT MATLAB

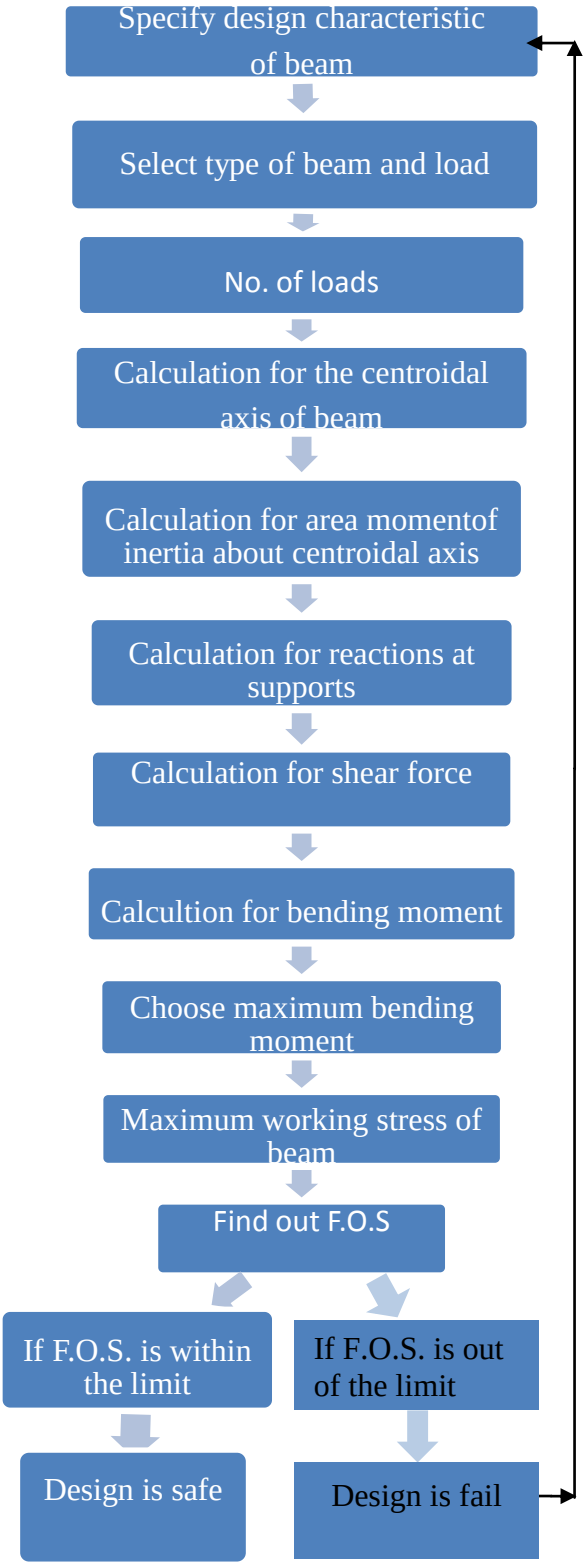
MATLAB (MATrixLABoratory) is an interactive system for matrix-based computation, designed for scientific and engineering use. MATLAB is a high performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notations. Typically uses include: Math and computation Algorithm development modeling, simulation, and prototyping Data analyzing, exploration and visualization Scientific and engineering graphics Application development including graphical user interface building MATLAB is a software package for high-performance numerical computation and visualization. It provides an interactive environment with hundreds of built-in functions for technical computation, graphics, and animation. Best of all, it also provides easy extensibility with its own high-level programming language. MATLAB is an interactive system whose basic data element is an array that does not requires dimensioning. This allows solving many technical computing problems especially those with matrix and vectoring foundation.

3.1 Matrix Operators

MATLAB has several operators for our use

. + addition
- substraction
* matrix multiplication
/ division
^ exponentiation
.* term-by-term multiplication
./ term-by term division
. term-by term exponentiation
>> MATLAB prompt

## IV. PROCESS FLOW CHART- BEAM ANALYSIS




Flow Chart.1

## V. ANALYSIS OF BEAM

This indicates that the stress in a beam depends on the bending moment and so the maximum stress will occur where the bending moment is a maximum along the length of the beam. It also indicates that stress is related to distance y from the neutral axis so it varies from zero to a maximum at the top or bottom of the section.

### 5.1. Matlab Output Window

The Matlab program we designed takes the input values as shown in the below figure and the logic that we have formulated gives the output values such Maximum deflection and the remaining required parameters with minimum input variables.

It also gives the shear force and bending moment diagram of the beam with given values and also tells weather the design of the beam is safe or not.

The input values given such as no. of loads, value of loads, length of beam, FOS etc. and the output values such as deflection and other parameters are shown as below.

#### 5.1.1Analysis for simply supported with point load

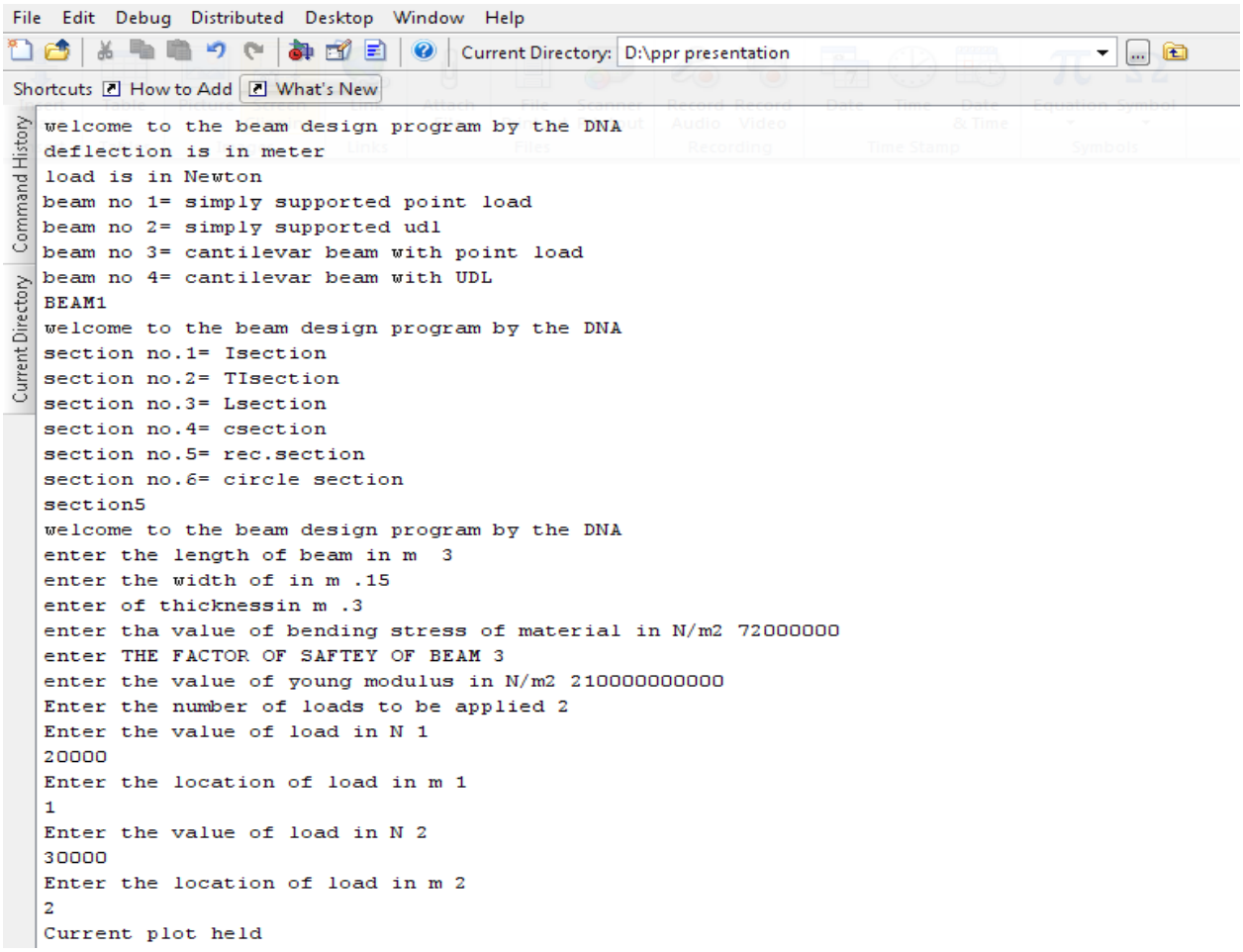



Figure.5.1.1a Inputs to Matlab code

The output beam parameters we attain through this are as follows-

Reaction Forces

Deflections at different points

Max. Deflection

Bending Moment Diagram

Shear Force Diagram

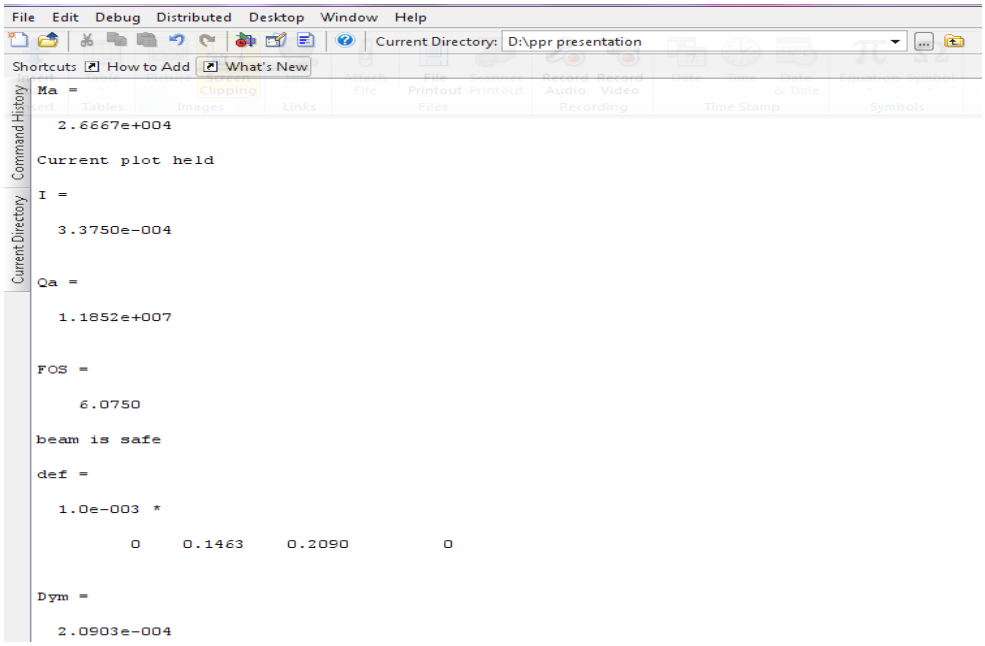



Figure.5.1.1b Output of the code

a) Shear Force Diagram for Simply Supported Beam fromMatlab Code

The generated shear force diagram using Matlab is as shown below. It gives the diagrammatic representation of shear forces at different points of beam.

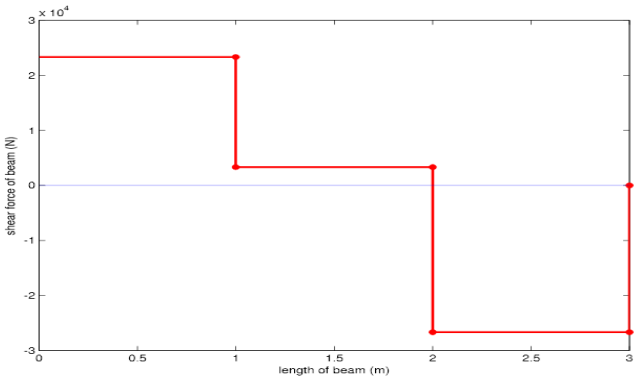



Figure.5.1.1c Shear Force Diagram for Simply Supported Beam Point Load

b) Bending Moment Diagram for simply supported beam with point load

The generated shear force diagram using Matlab is as shown below. It gives the diagrammatic representation of bending moments at different points of beam.

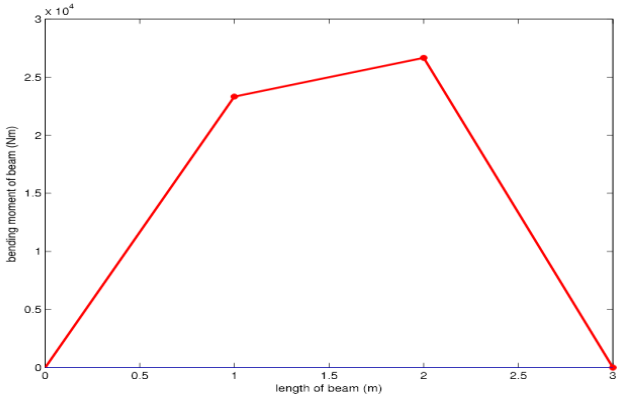



Figure.5.1.1dBending Moment Diagram for Simply Supported Beam Point Load

5.1.2 Simply Supported Beam with Uniformly Distributed Load

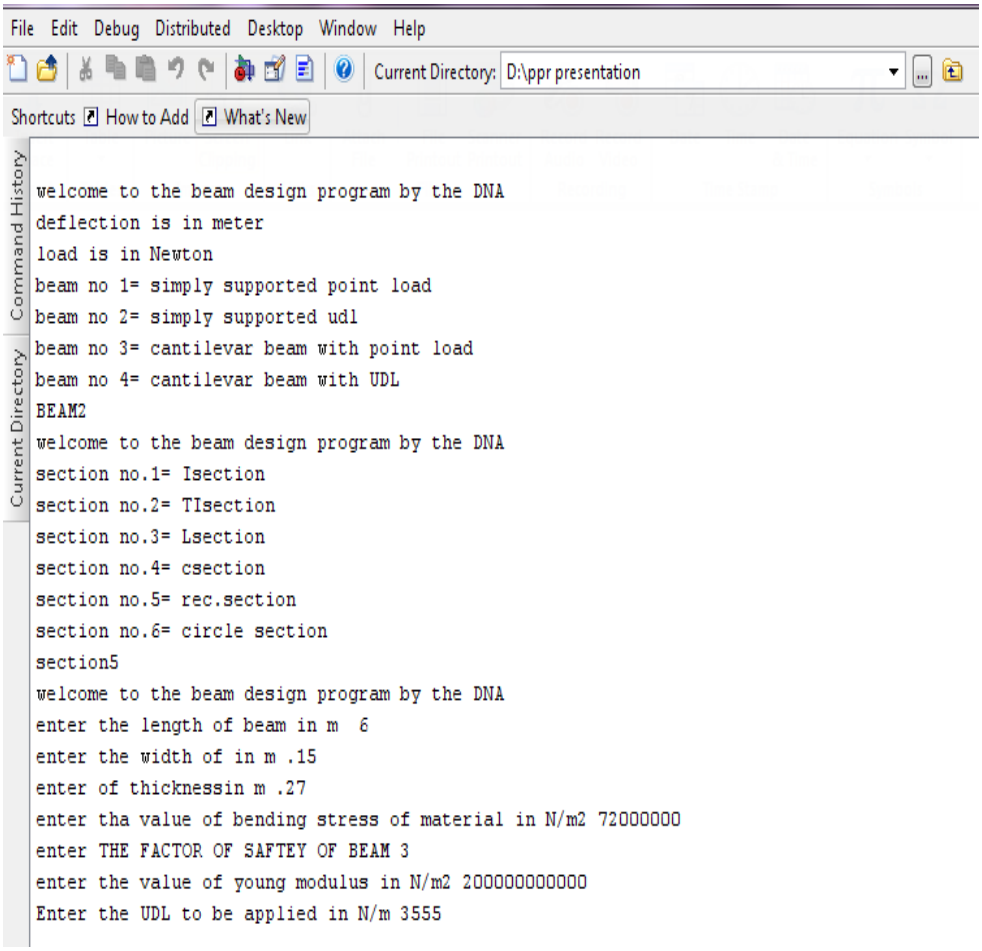



Figure. 5.1.2a Inputs to Matlab code

The output beam parameters we attain through this are as follows

Reaction Forces

Deflections at different points

Max. Deflection

Bending Moment Diagram

Shear Force Diagram

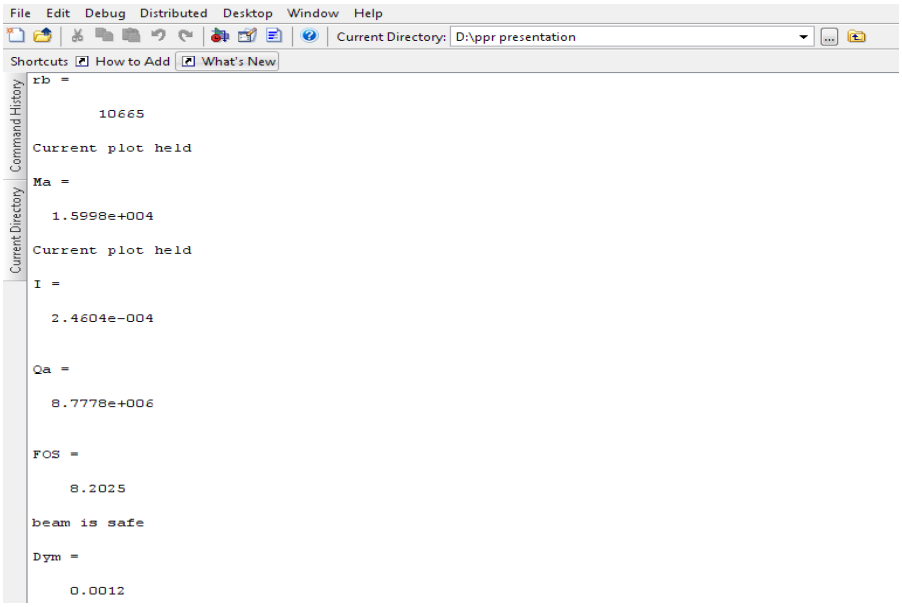



Figure.5.1.2b Output of the program

a) Shear Force Diagram for simply supported beam with UDL

The generated shear force diagram using Matlab is as shown below. It gives the diagrammatic representation of shear forces at different points of beam.

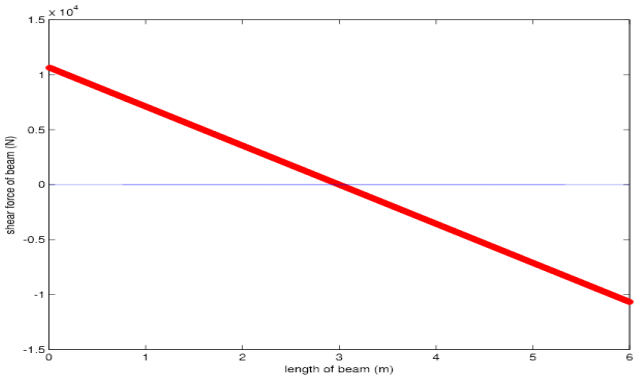



Figure.5.1.2c Shear Force Diagram for Simply Supported Beam with UDL

b) Bending Moment Diagram for simply supported beam with UDL

The generated bending moment diagram using Matlab is as shown below. It gives the diagrammatic representation of bending moments at different points of beam.

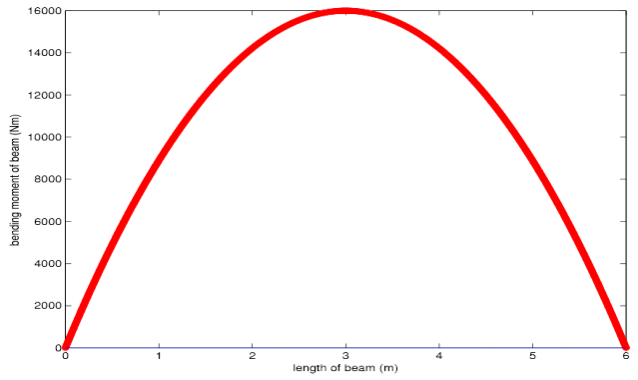



Figure.5.1.2d Bending Moment Diagram for Simply Supported Beam with UDL

5.1.3Analysis for Cantilever with Point Load

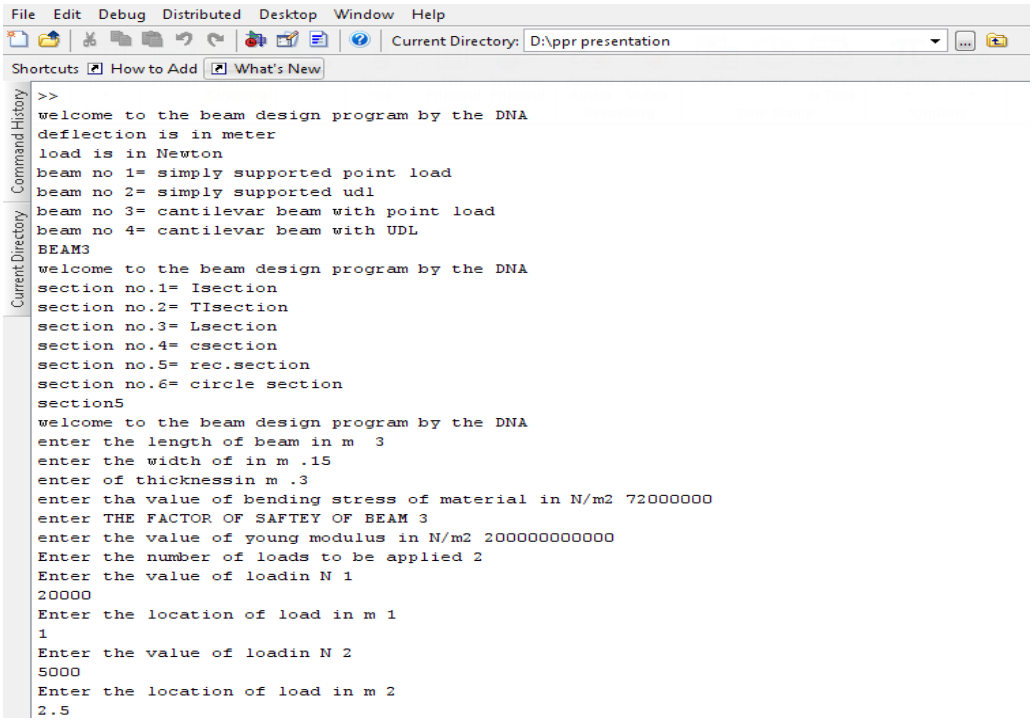



Figure 5.1.3a. Inputs given to Matlab Program

The output beam parameters we attain through this are as follows

Reaction Forces

Deflections at different points

Max. Deflection

Bending Moment Diagram

Shear Force Diagram

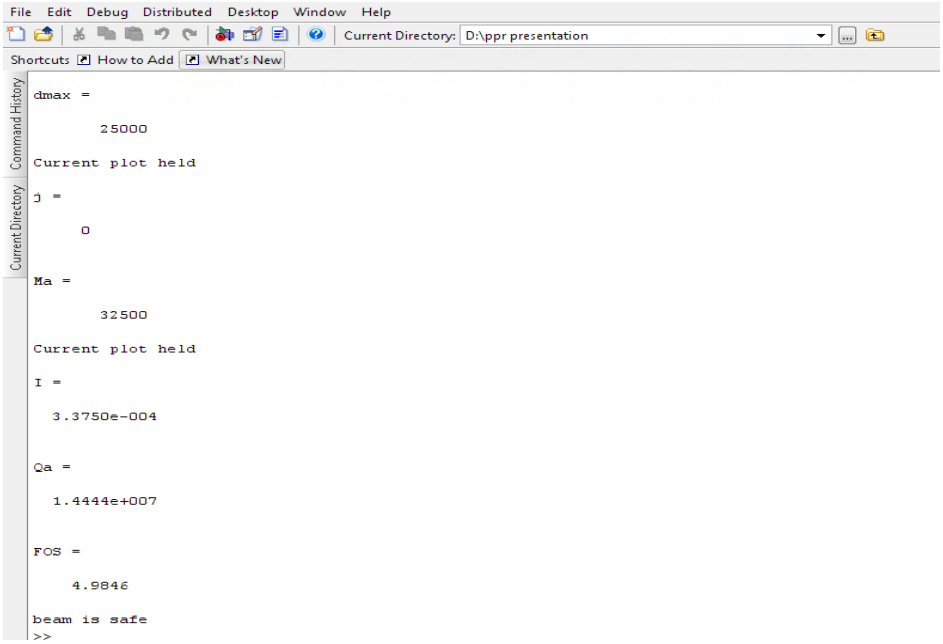



Figure.5.1.3b Output of the program

a) Shear Force Diagram for cantilever beam with point load

The generated shear force diagram using Matlab is as shown below. It gives the diagrammatic representation of shear forces at different points of beam.

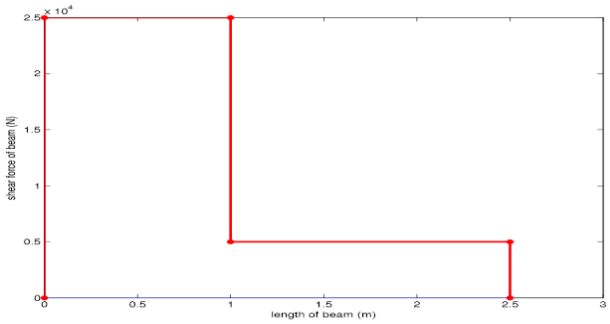



Figure.5.1.3c Shear Force Diagramfor Cantilever with Point Load

b) Bending Moment Diagram for cantilever beam with point load

The generated bending moment diagram using Matlab is as shown below. It gives the diagrammatic representation of bending moments at different points of beam.

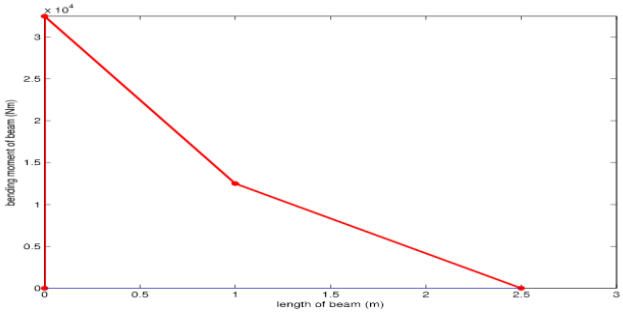



Figure.5.1.3d Bending Moment Diagram

5.1.4 Analysis for Cantilever with UDL

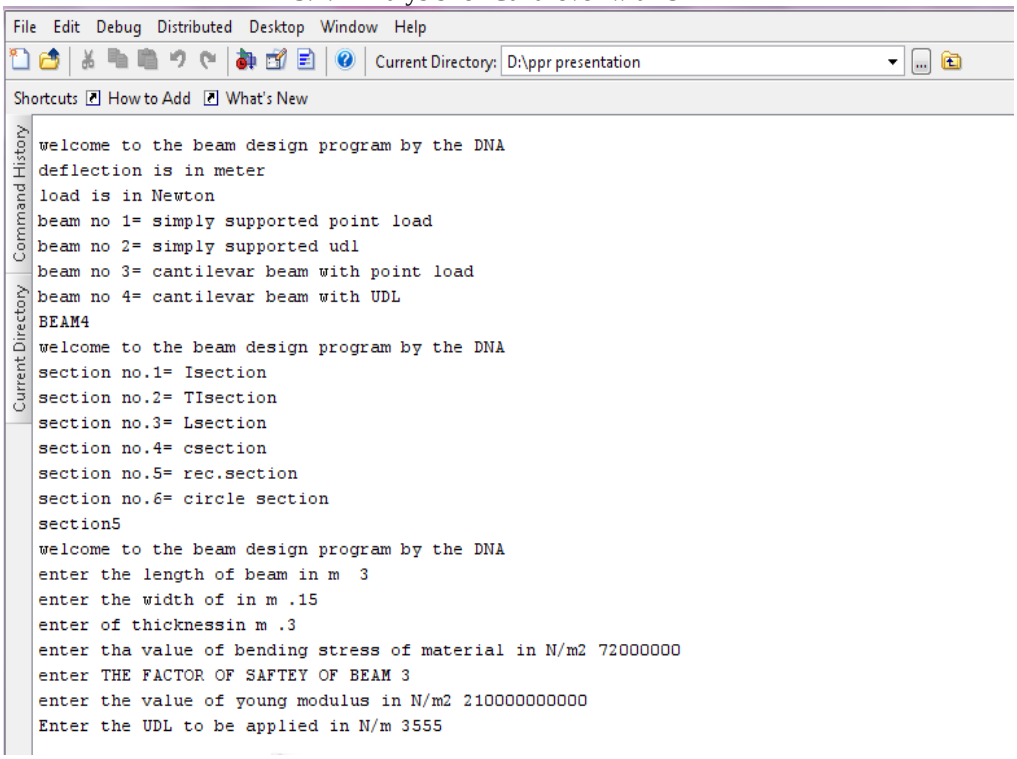



Figure.5.1.4a Inputs given to Matlab Program

The output beam parameters we attain through this are as follows

Reaction Forces
Deflections at different points
Max. Deflection
Bending Moment Diagram
Shear Force Diagram

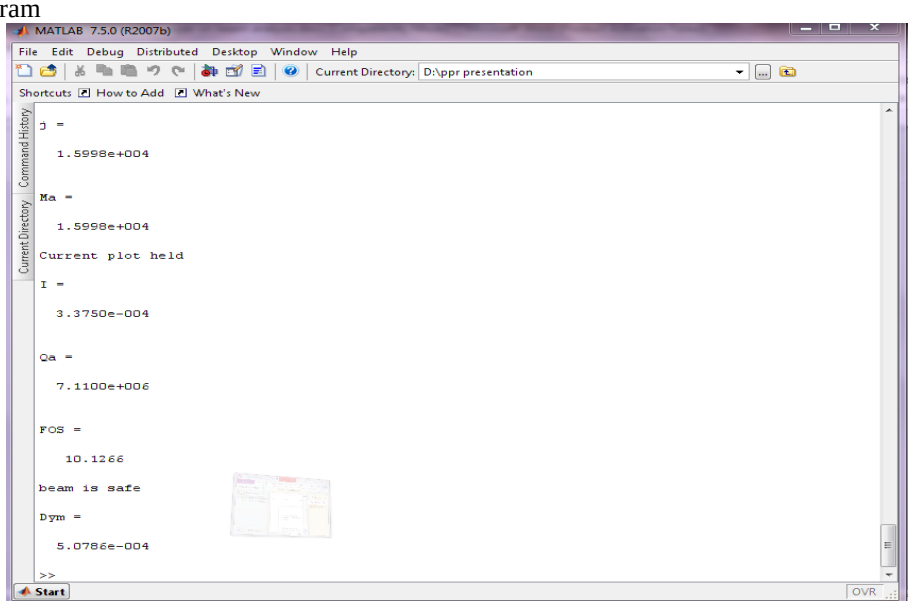



Figure.5.1.4b Output of the program

a) Shear Force Diagram for cantilever beam with UDL

The generated shear force diagram using Matlab is as shown below. It gives the diagrammatic representation of shear forces at different points of beam.

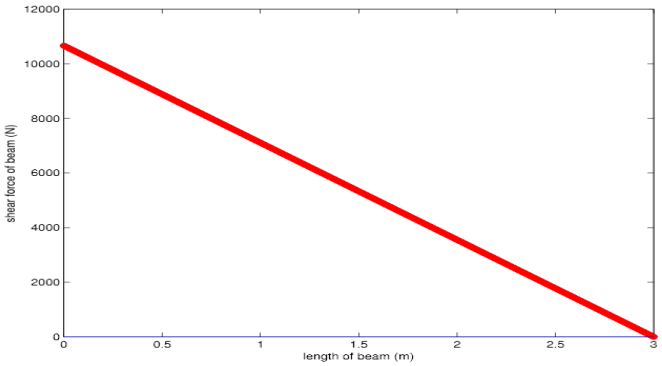



Figure.5.1.4c Shear Force Diagram

b) Bending Moment Diagram for cantilever beam with UDL

The generated bending moment diagram using Matlab is as shown below. It gives the diagrammatic representation of bending moments at different points of beam.

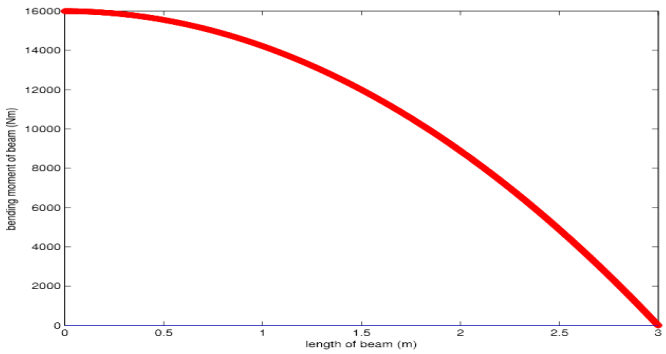



Figure.5.1.4d Bending Moment Diagram

## VI. CONCLUSION

A quick and efficient way of analyzing the beam design is developed through MATLAB code which can be use to solve beam design problems faster and errorless

## REFERENCES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