K S RANGASAMY COLLEGE OF TECHNOLOGY
Tiruchengode – 637215
(An Autonomous Institution, Affiliated to Anna University, Chennai)
DEPARTMENT OF MECHANICAL ENGINEERING

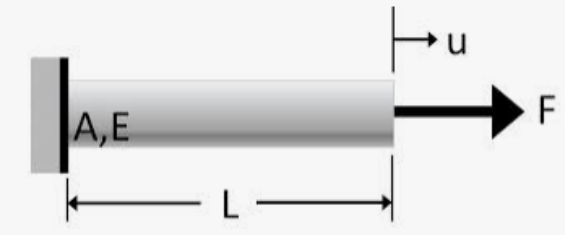
Date: 21.04.2023

Learning by Doing

Degree/Branch	: B.E. (Mechanical Engineering)
Year/Semester	: III / IV
Subject Code	: 50 ME 702
Subject Name	: Finite Element Analysis
Date	: 17.04.2023
Topic	: One Dimensional bar Element

Problem

A Steel bar of length 800 mm is subjected to an axial load of 3 kN as shown in the figure. Determine the elongation of the bar and compare the results with ansys software.



Solution

1. Create the working directory.
2. Select the element type.
3. Give the real constants.
4. Set the material properties.
5. Create the model as per given drawing.
6. Generate meshing.
7. Apply the boundary conditions.
8. Apply the load.
9. Solve the problem.
10. Animate and Plot the results.

1. ANALYSIS TYPE

Structural

2. ELEMENT TYPE

BEAM 188

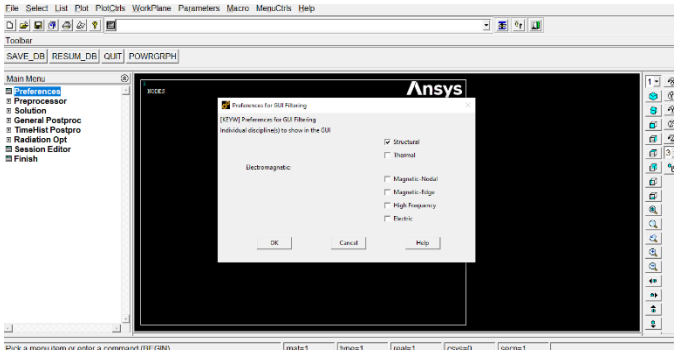
Options > Element behaviour > Cubic form>OK

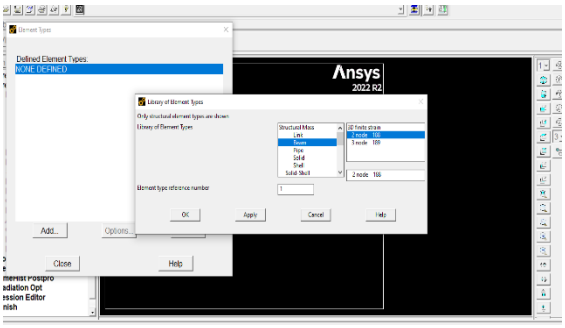
Sections > Beam > Common Sections > >width = Height = 10mm

3. REAL CONSTANTS

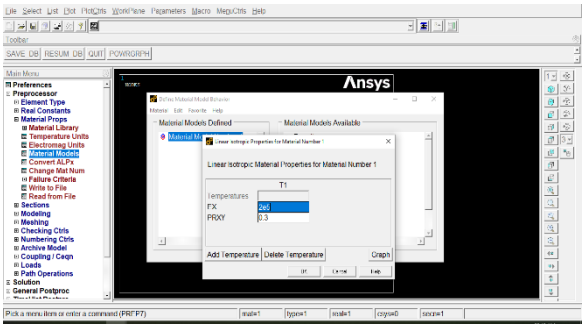
Breadth = 10 mm

Width = 30 mm





4.



MATERIAL PROPERTIES

Structural Linear Elastic Isotropic

EX = 2 x 10^5

PRXY = 0.3.

5. MODELLING

Keypoints = 1 and 2

Line = L1

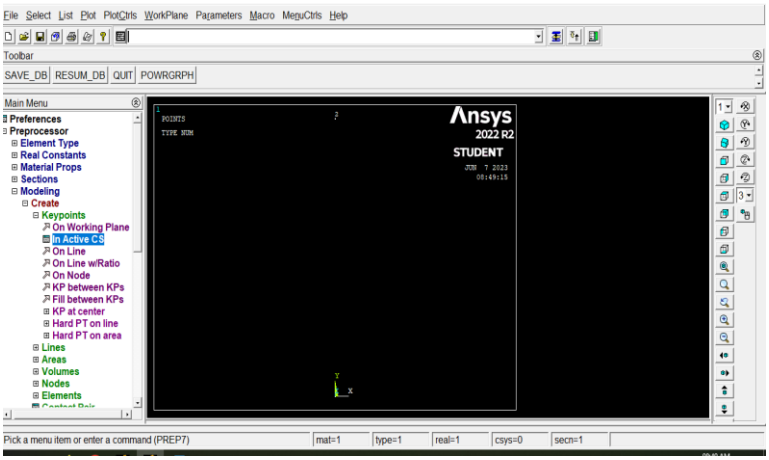
6. MESHING

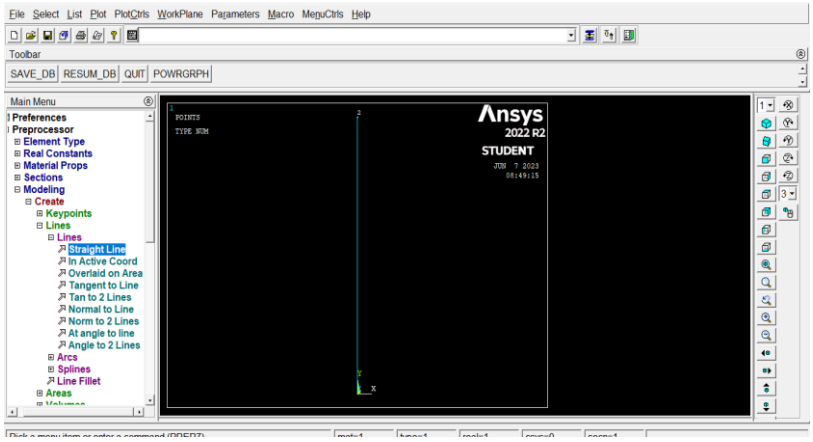
No of elements = 10

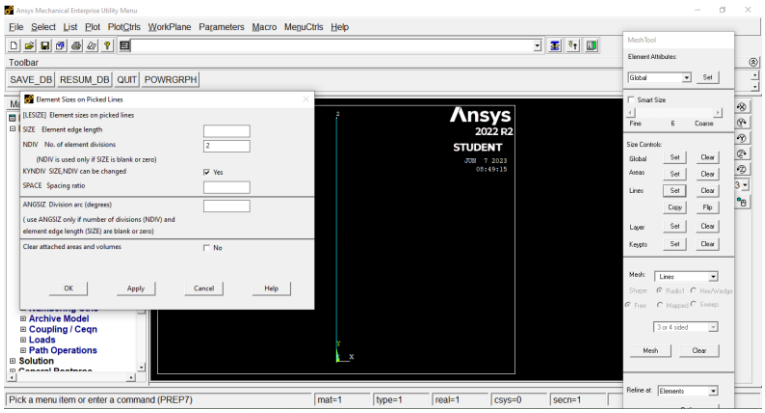
No of nodes = 11

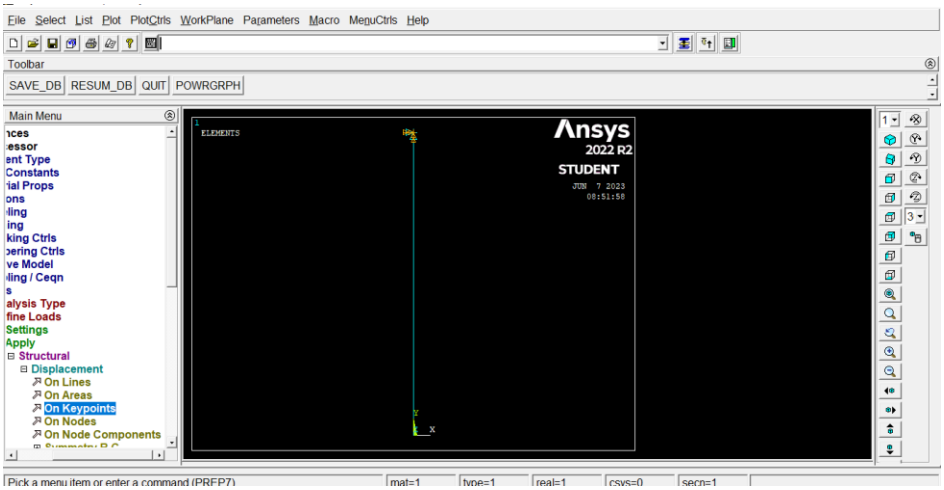
7. ANALYSIS TYPE

Static









8. BOUNDARY CONDITIONS

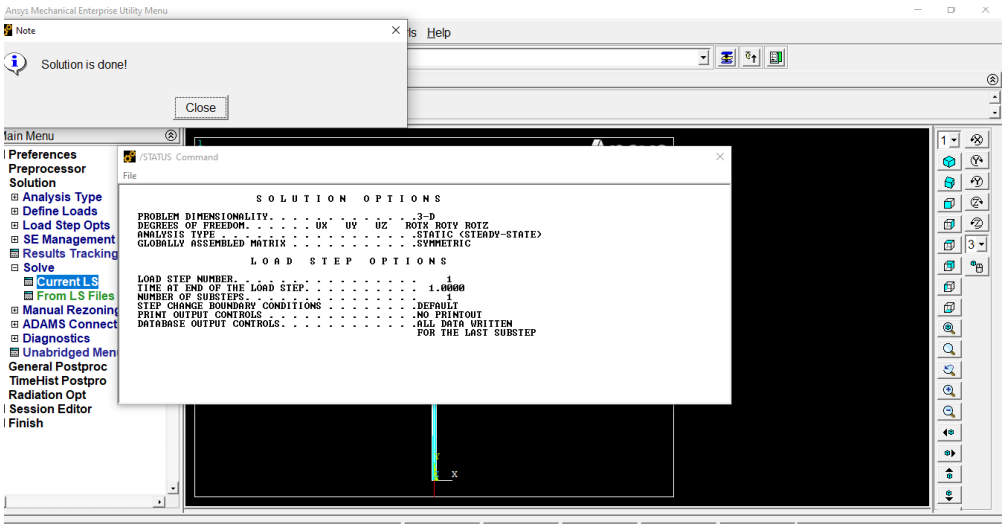
For Cantilever beam

At Node 1(left end), DOF to be constrained = ALL DOF

Displacement value = 0

At Node 2 (right end), Direction of force = FY

Force VALUE = -3000



9. SOLVE

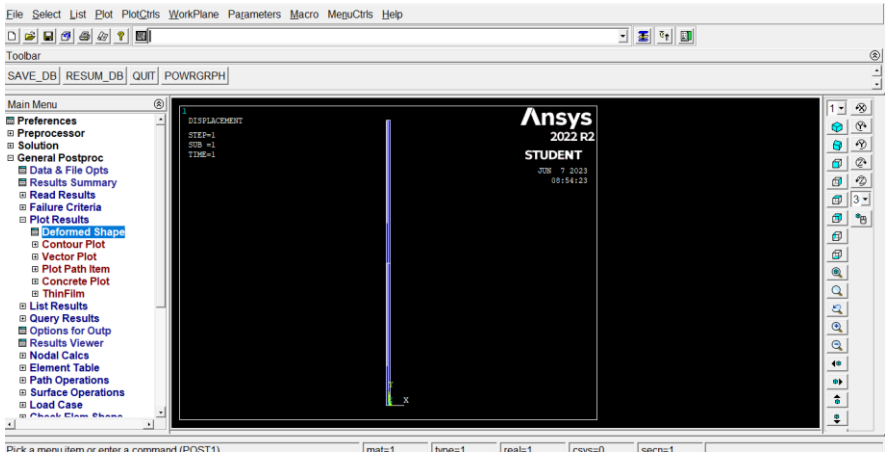
Current LS

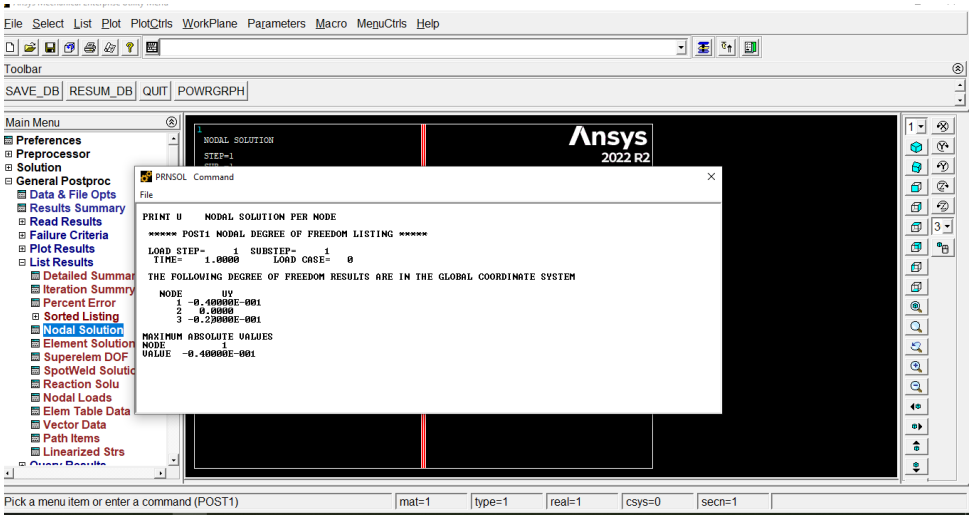
10. POST PROCESSING

NODAL DISPLACEMENTS

General post processor > Plot results > Contour plot > Nodal solution > DOF solution > Disp y direction

General post processor > List results > Nodal solution > DOF solution > Disp y direction





PRAVEEN KUMAR. C.
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II / B SEC - VI SEM

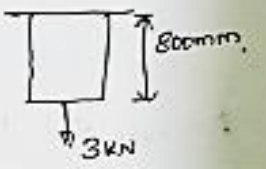
50 ME 702 - FINITE ELEMENT ANALYSIS.

LEARNING BY DOING

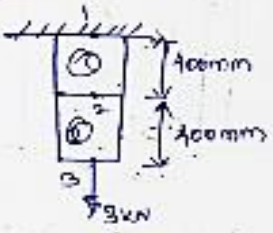
1. A Steel bar of length 800mm is subjected to an axis load of 3 kN as shown in the figure. Determine the elongation of the bar. and compare the result with Ansys Software.

Take $E = 2 \times 10^5$ N/mm^2.

$A = 300$ mm^2



Solution:



For one dimensional uni bar element:

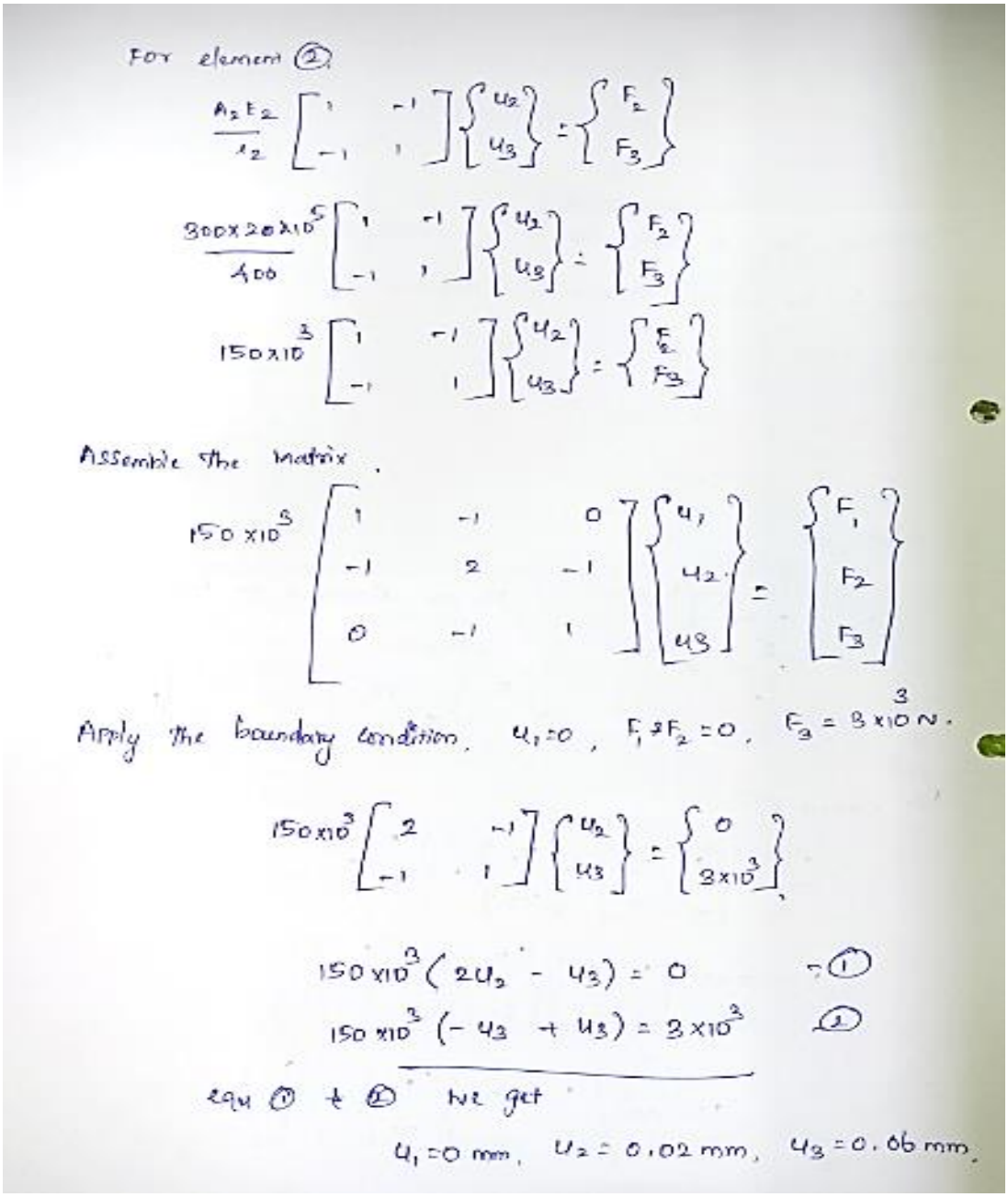
$$\begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} \times \frac{AE}{L} \begin{bmatrix} -1 & -1 \\ -1 & 1 \end{bmatrix} = \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix}$$

For element (1).

$$\frac{A_1 E_1}{L_1} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \times \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix}$$

$$\frac{300 \times 10^5 \times 2}{100} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix}$$

$$150 \times 10^3 \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix}$$



Impact Analysis:

After the learning by doing activity, our students were reinforces knowledge by linking it to concrete experiences, making it easier to remember and understand concepts.

Course Instructor

M.Prasath