



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 mmWidth = 30 mm







4.

MATERIAL PROPERTIES

Structural Linear Elastic Isotropic $EX = 2 \times 10^5$ 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





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Solution	<u> </u>				







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



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PRAVGEN KOME. C. 73772011123. III /B SEC-VISEN 50 ME 702 - FINITE ELEMENT ANALYSIS. I. A Steel bas of length Boomm 1's subjected to an axis load of 2 km as shown in the ofgane. Determine the elongation of the bar, and compare (No the result with Ansys Software. 800mm Take E= 2x105 Nimm2. A = 300 mm2 Solution :-For element O. $\frac{F_{i}E_{i}}{k} \begin{bmatrix} 1 & -1 \\ -1 \end{bmatrix} + \begin{bmatrix} i \\ i \\ i \\ i \end{bmatrix} + \begin{bmatrix} F_{i} \\ F_{i} \end{bmatrix}$ $\frac{900\times10\times2}{100} \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix} \begin{cases} 41 \\ 42 \\ 42 \end{bmatrix} = \begin{cases} F, \\ F_2 \\ F_2 \end{cases}$ 150x10 [1 -1] 41]= [F]





For element (2) $\frac{A_2E_2}{4\pi} \begin{bmatrix} 1 & -1 \\ -1 \end{bmatrix} \begin{bmatrix} U_2 \\ U_3 \end{bmatrix} = \begin{bmatrix} F_2 \\ F_2 \end{bmatrix}$ $\frac{300\times20\lambda10^{5}}{400}\begin{bmatrix}1&-1\\-1&1\end{bmatrix}\begin{bmatrix}42\\4g\end{bmatrix}=\begin{bmatrix}F_{2}\\F_{3}\end{bmatrix}$ $150\times10^{3} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 14_{2} \\ 4_{3} \end{bmatrix} = \begin{bmatrix} 5 \\ F_{3} \end{bmatrix}$ Assemble the Matrix Apply the boundary condition, 4, =0, F, =F_2=0, F_3= 3x10N. $\frac{150\times10^3}{1-1} \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} u_2 \\ u_3 \\ u_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 2\times10^3 \end{bmatrix}$ $(-4_{3} - 4_{3}) = 0$ - (1) $(-4_{3} - 4_{3}) = 3 \times 10^{3}$ (2) $(-4_{3} - 4_{3}) = 3 \times 10^{3}$ (2) 4,00 mm, 42=0,02 mm, 43=0.06 mm

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.

M. Emt

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