

STATIC ANALYSIS OF A SIMPLY SUPPORTED BEAM

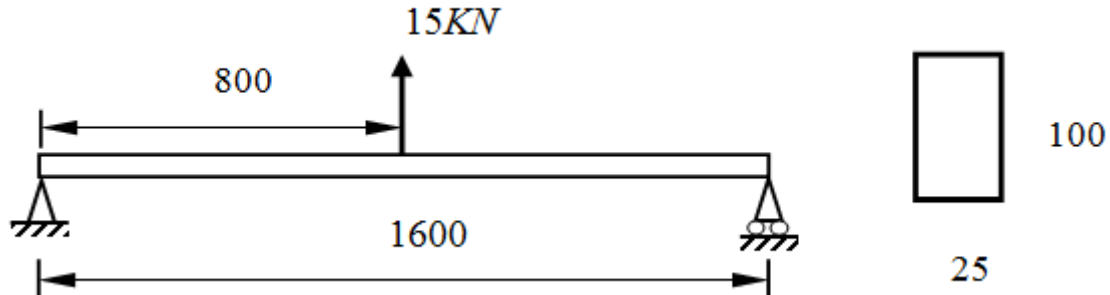


Figure 1

All dimensions are in *mm*

Objective: To find the deflection, stress, strain, shear force and bending moment diagram of simply supported beam with concentrated load as shown in **Figure 1**.

Analysis Type : Static

Modulus of elasticity, $E = 207 \text{ GPa}$

Poisson's ratio, $\nu = 0.3$

PROCEDURE

STEP

1. Create three points at $(0, 0, 0)$, $(800, 0, 0)$ and $(1600, 0, 0)$

Commands : POINT, ADD

Menu : Geometry → Key point → Create → By X/Y/Z

Parameters : (To be filled by the user)

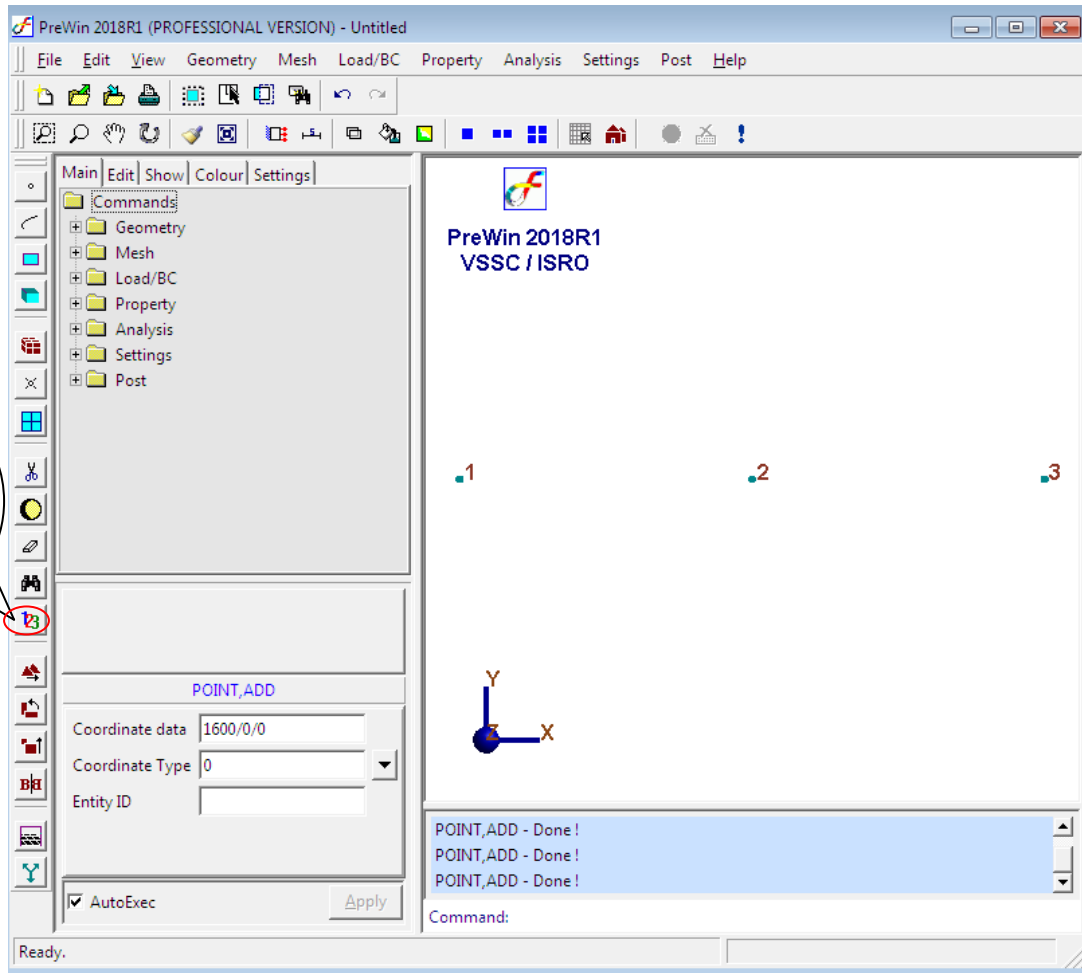
Coordinate Data	0/0/0
Coordinate Type	0
Entity ID	

Similarly create points $(800/0/0)$ and $(1600/0/0)$

Note:

Click "**Apply**" button or press **ctrl+enter** key after completing each step. "Done" message appears on message box for every step executed successfully.

At the end of the above operation/s, your screen should look like this.



2. Create a line

Commands : CURVE, LINE

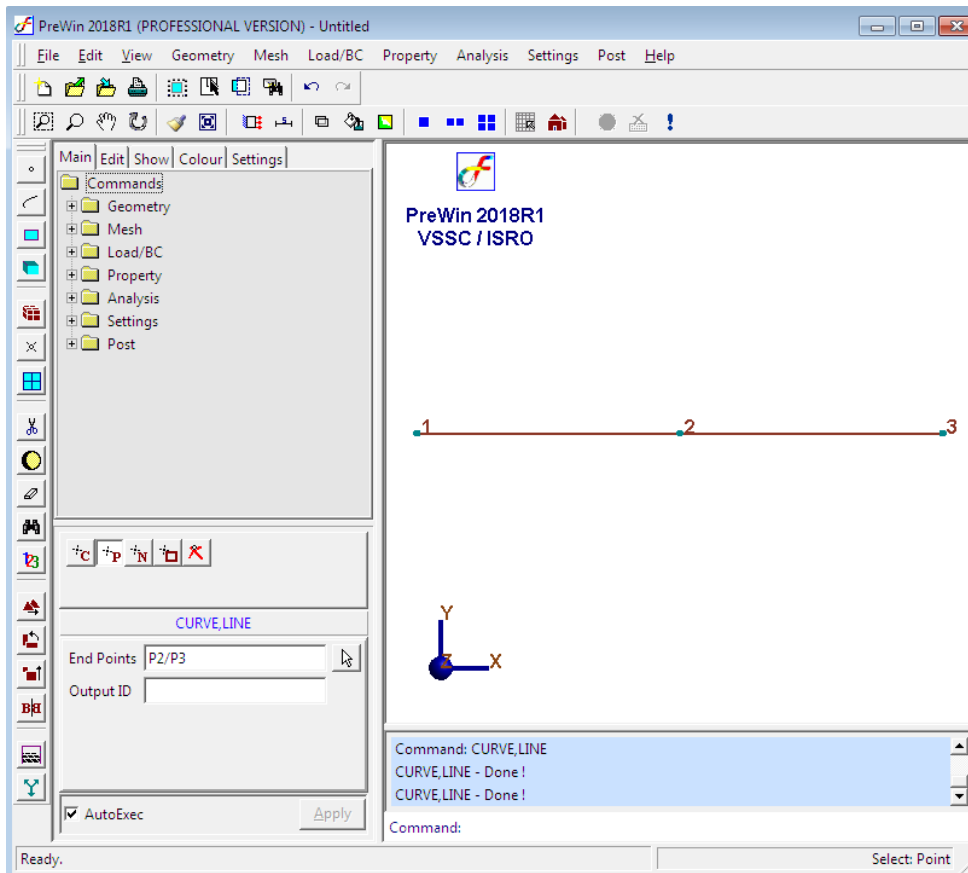
Menu : Geometry → Curve → Create → Line

Parameters :

End points	Use Mouse to pick the end points;P1/P2
Entity ID	1

Similarly create curve using points P2 and P3.

At the end of the above operation/s, your screen should look like this.



3. Meshing using beam elements

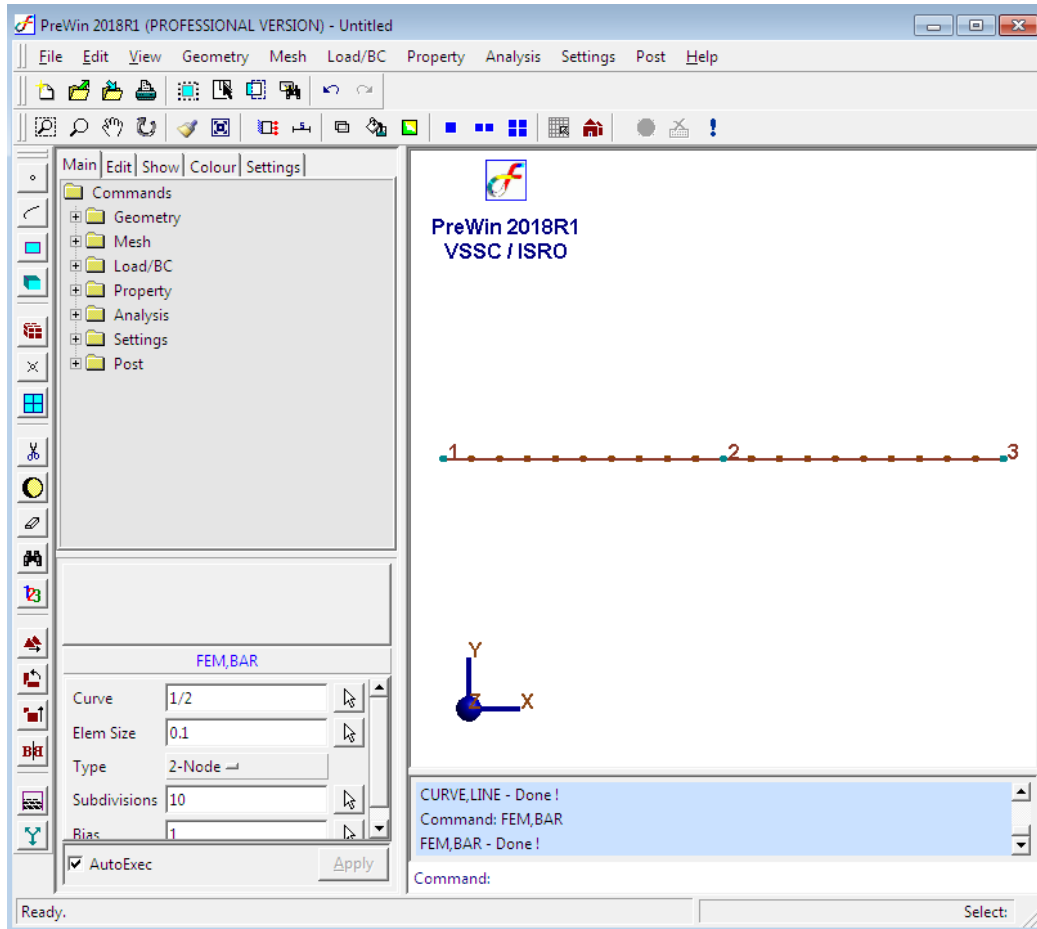
- Commands : FEM, BAR
 Menu : Mesh → FE Mesh → Bar
 Parameters :

Curve	1/2
Element Size	0.1
Type	2-node
Subdivisions	10
Bias	1.0

Note:

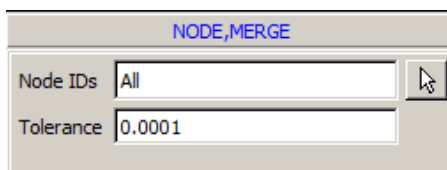
Right click/left click mouse point to alter sub-divisions.

At the end of the above operation/s, your screen should look like this.



4. Merge duplicate nodes

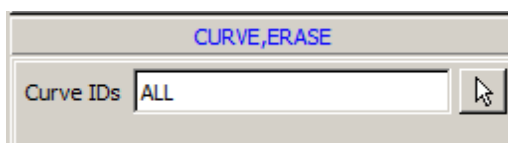
- Commands : NODE, MERGE
- Menu : Mesh → Node → Modify → Merge
- Parameters :



Duplicate nodes being merged will be highlighted.

5. Erase curve

- Commands : CURVE, ERASE
- Menu : Geometry → Curve → Miscellaneous → Erase
- Parameters :



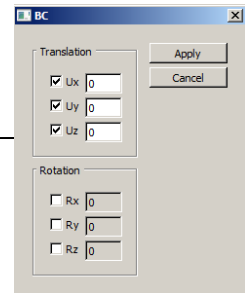
Note:

Likewise erase key points by POINT, ERASE, ALL command.

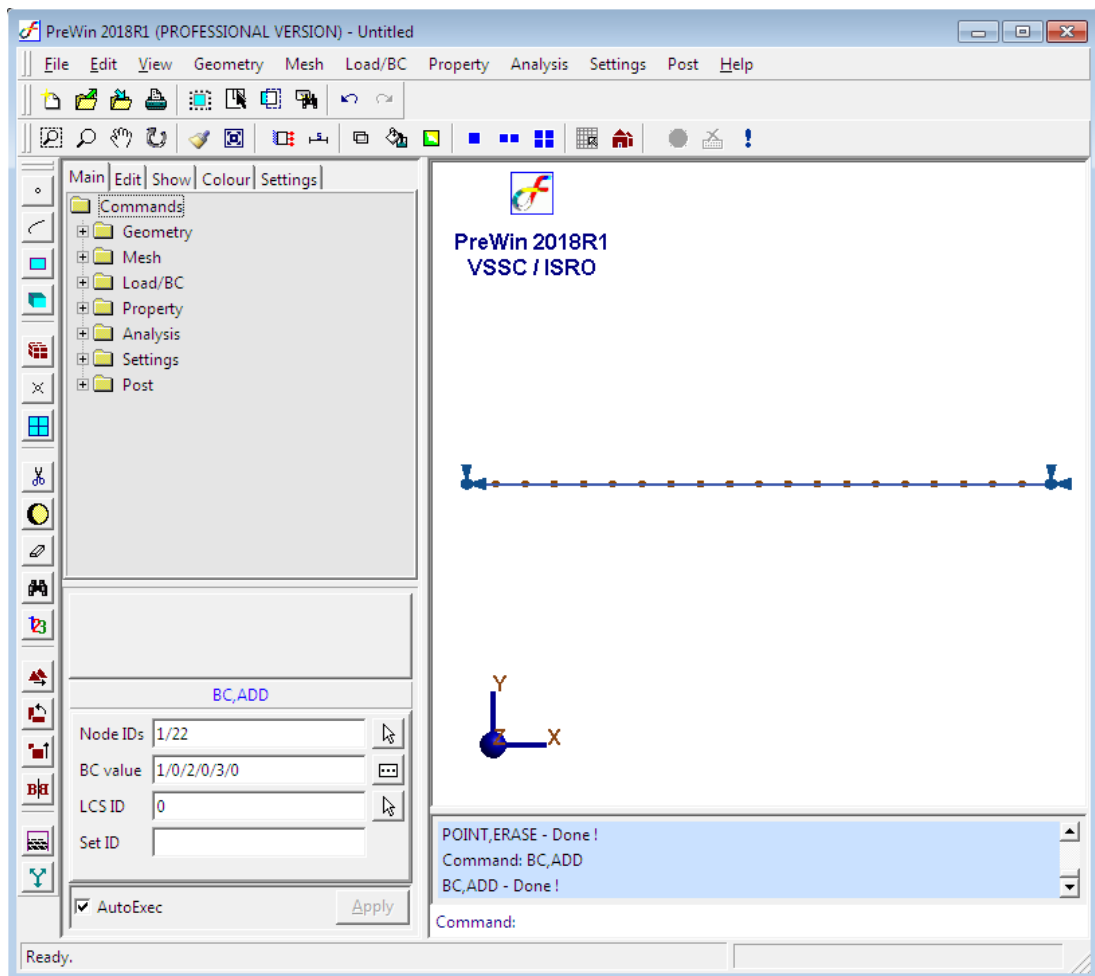
6. Specify displacement boundary conditions

- Commands : BC, ADD
- Menu : Load/BC → Displacement BC → Add
- Parameters :

Node IDs	Select the end nodes ;1/22
BC Value	1/0/2/0/3/0
LCS ID	0



At the end of the above operation/s, your screen should look like this.




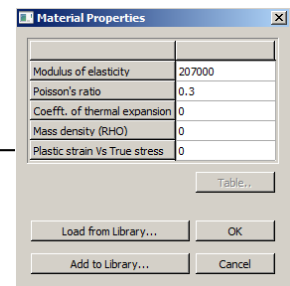
7. Specify material properties

Command : MATERIAL, ISO

Menu : Property → Material → Isotropic

Parameters :

Element IDs	All
Material Data	207000/0.3/0/0/0 
Material ID	1




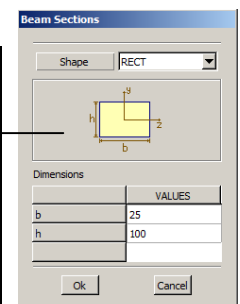
8. Specify Beam Properties

Command : BEAMSECTION, ADD

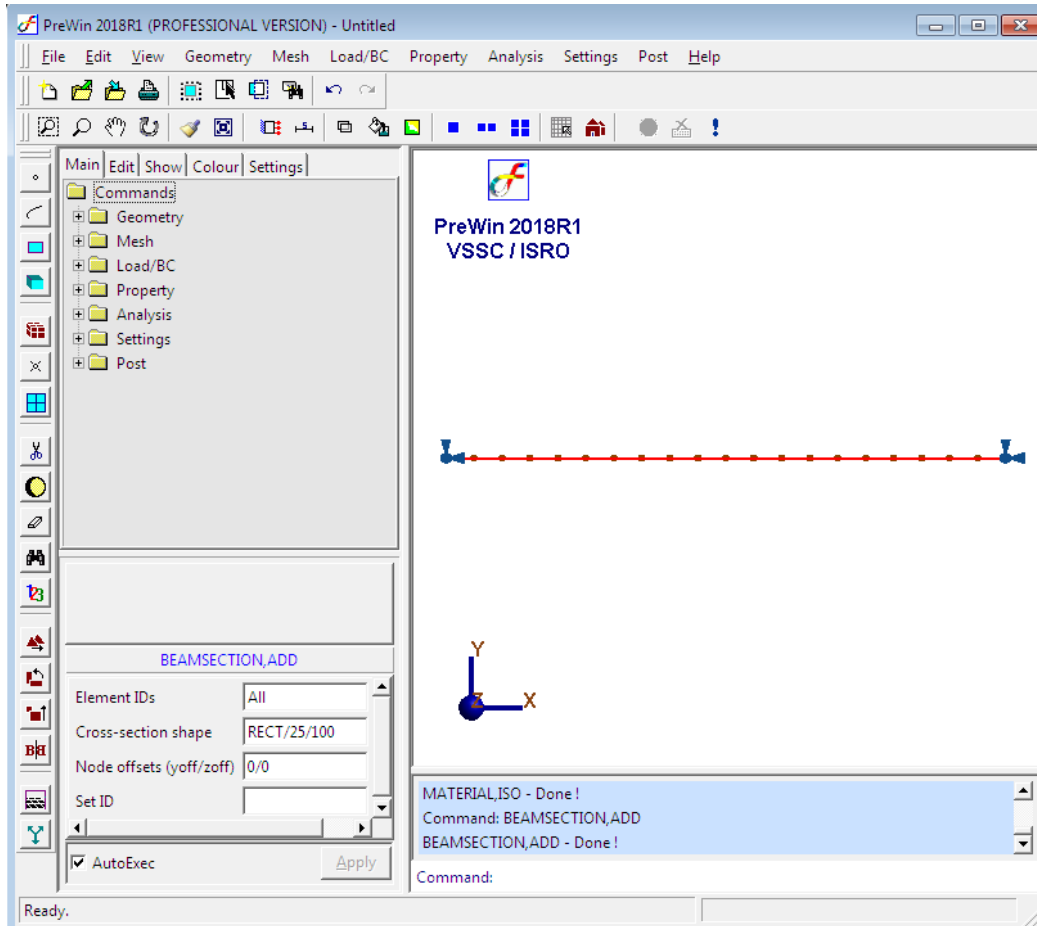
Menu : Property → Physical → Beam Properties → Standard Section
→ Add

Parameters :

Element IDs	All
Cross section Shape	RECT/25/100 
Angle about axis	0
Node offsets (yoff/zoff)	0/0



At the end of the above operation/s, your screen should look like this.

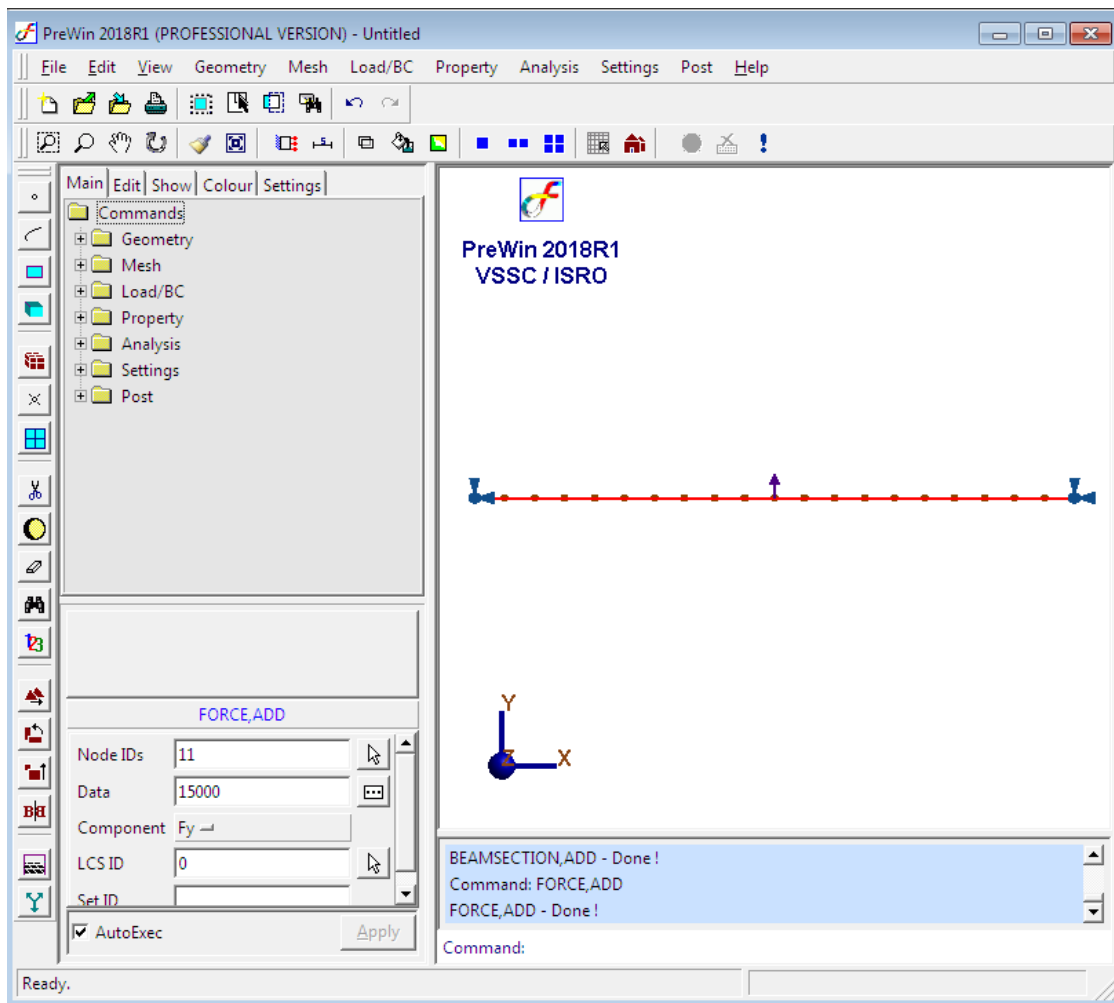


9. Specify point load

- Command : FORCE, ADD
- Menu : Load/BC → Point Load → Add
- Parameters :

Node IDs	11
Data	15000
Component	Fy
LCS ID	0
Set ID	1

At the end of the above operation/s, your screen should look like this.



10. Set the analysis type

- Command : ANTYPE, SET
- Menu : Analysis → Analysis Type
- Parameters :

Analysis Type	Static
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11. Set the analysis options

- Command : ANOPTION, SET
- Menu : Analysis → Analysis Options
- Parameters :

Linear Solver	Multi Frontal
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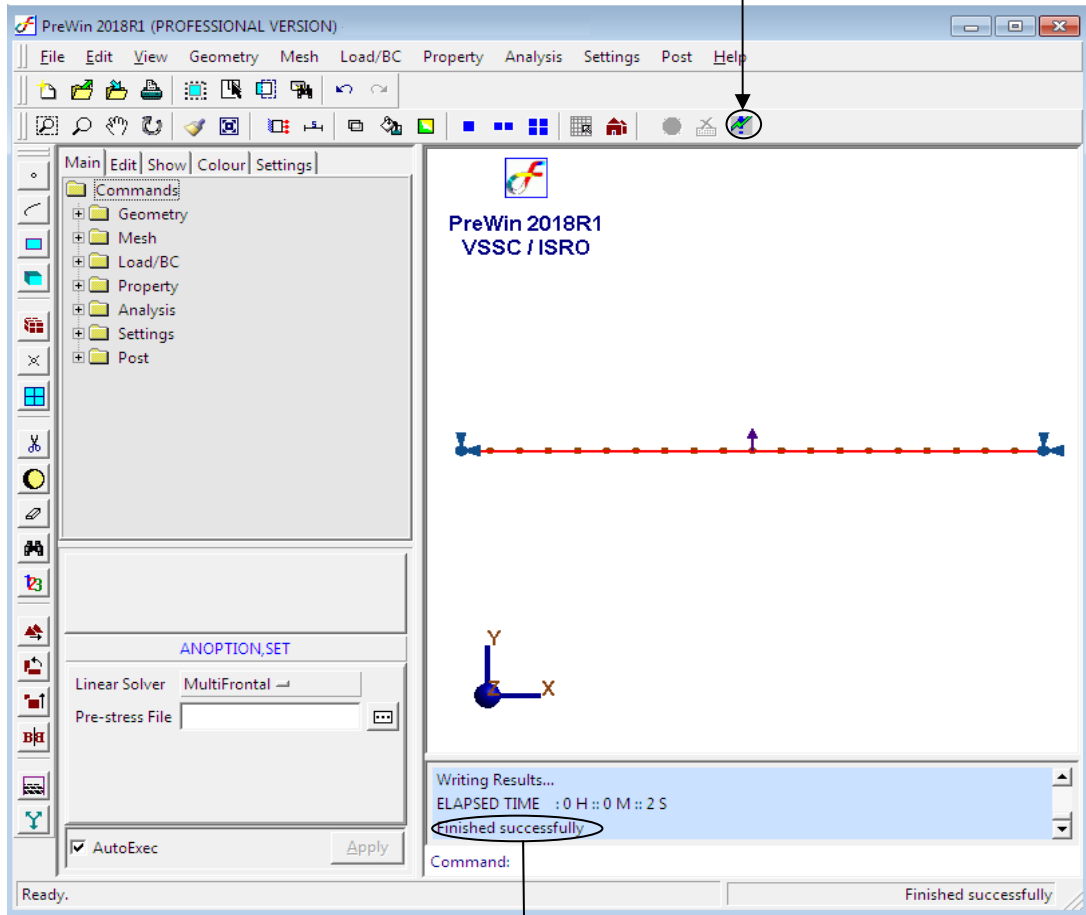
12. Save the project model

Menu : File → Save

13. Submit the job into FEAST

Menu : Analysis → Run solver

Click here



Click here

Note:

"Finished successfully" message appears on message box after executing is completed.

14. Perform post processing

i) **Deformed shape**

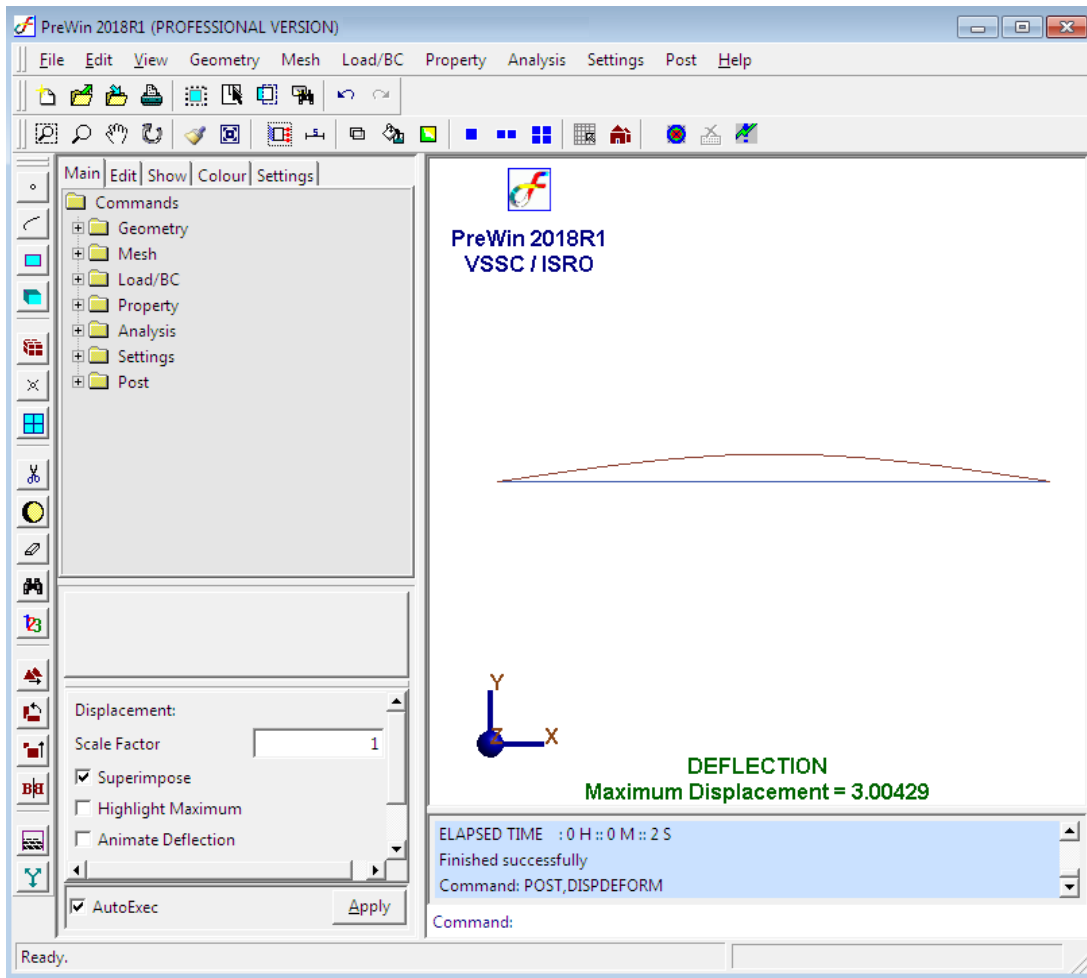
Command : POST, DISPDEFORM

Menu : Post → Deformed shape

Parameters :

Scale factor	1
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At the end of the above operation/s, your screen should look like this.



ii) Stress contour

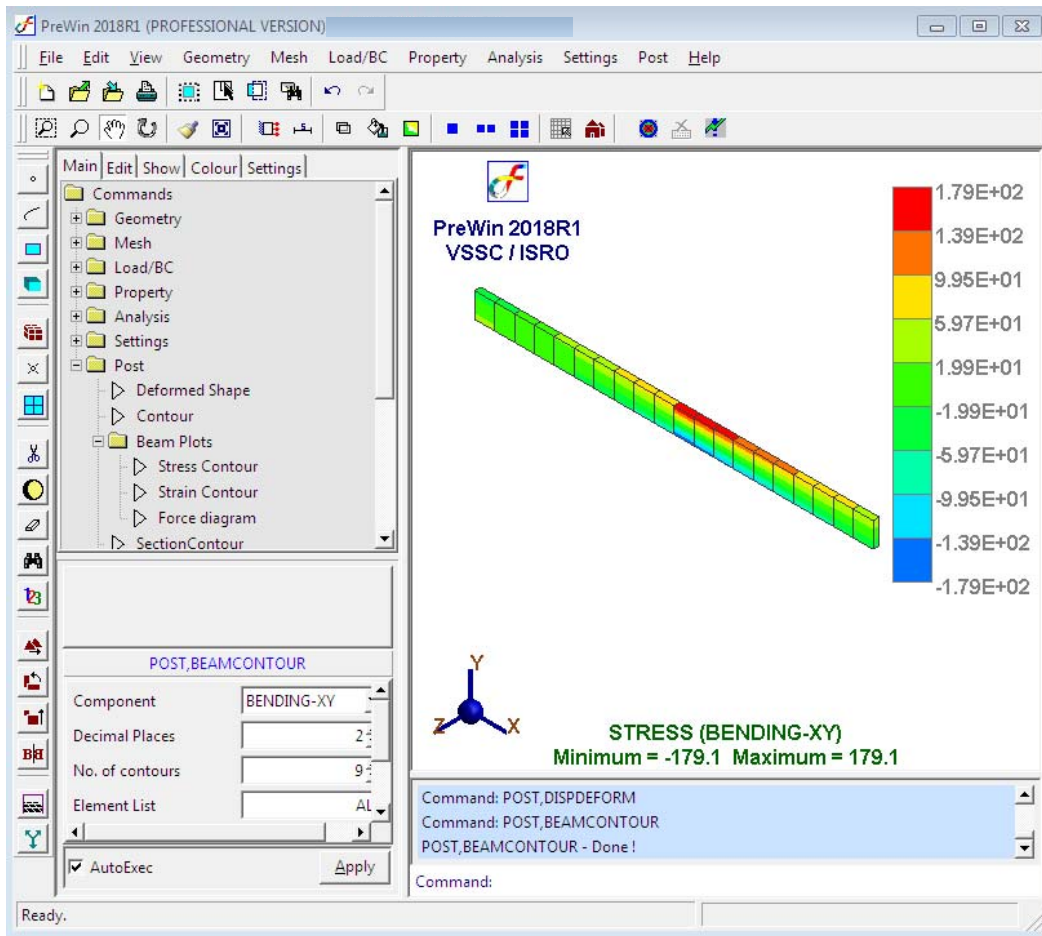
Command : POST, BEAMCONTOUR

Menu : Post → Beam Plots → Stress Contour

Parameters :

Component	BENDING-XY
Decimal Places	2
No. of contours	9
Element List	All

At the end of the above operation/s, your screen should look like this.



iii) Strain contour

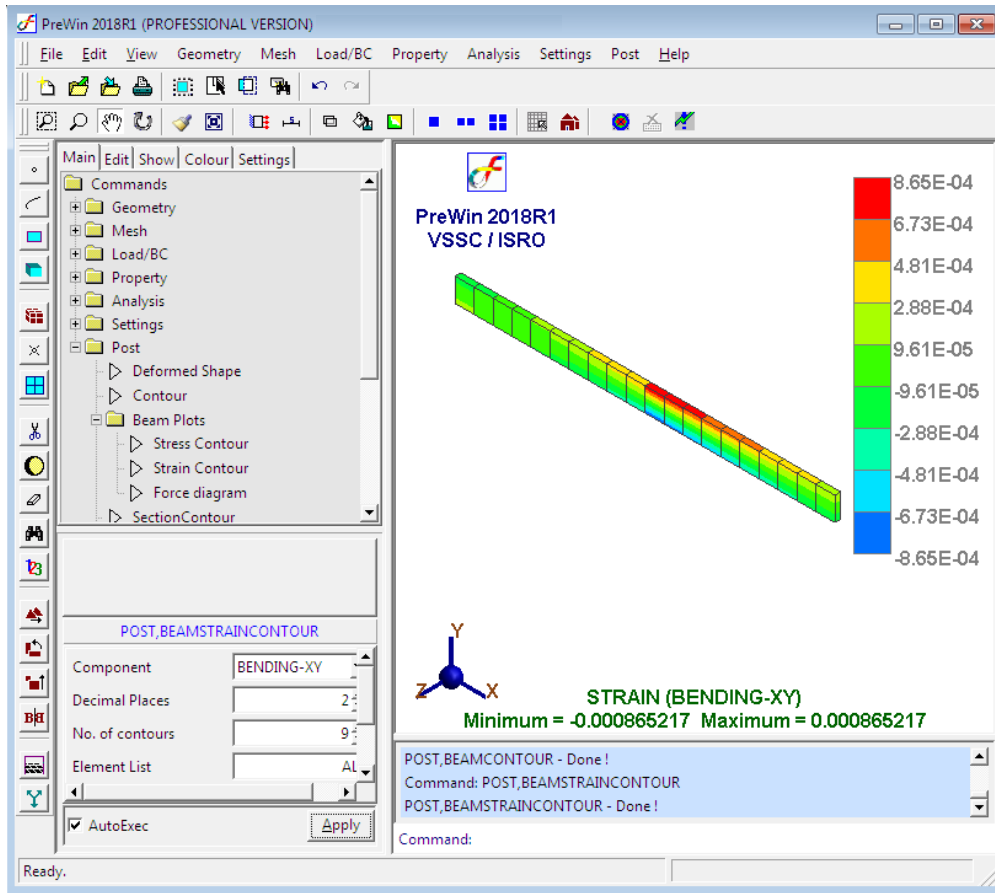
Command : POST, BEAMSTRAINCONTOUR

Menu : Post → Beam Plots → Strain Contour

Parameters :

Component	BENDING-XY
Decimal Places	2
No. of contours	9
Element List	All

At the end of the above operation/s, your screen should look like this.



iv) Beam force

a. Shear force diagram

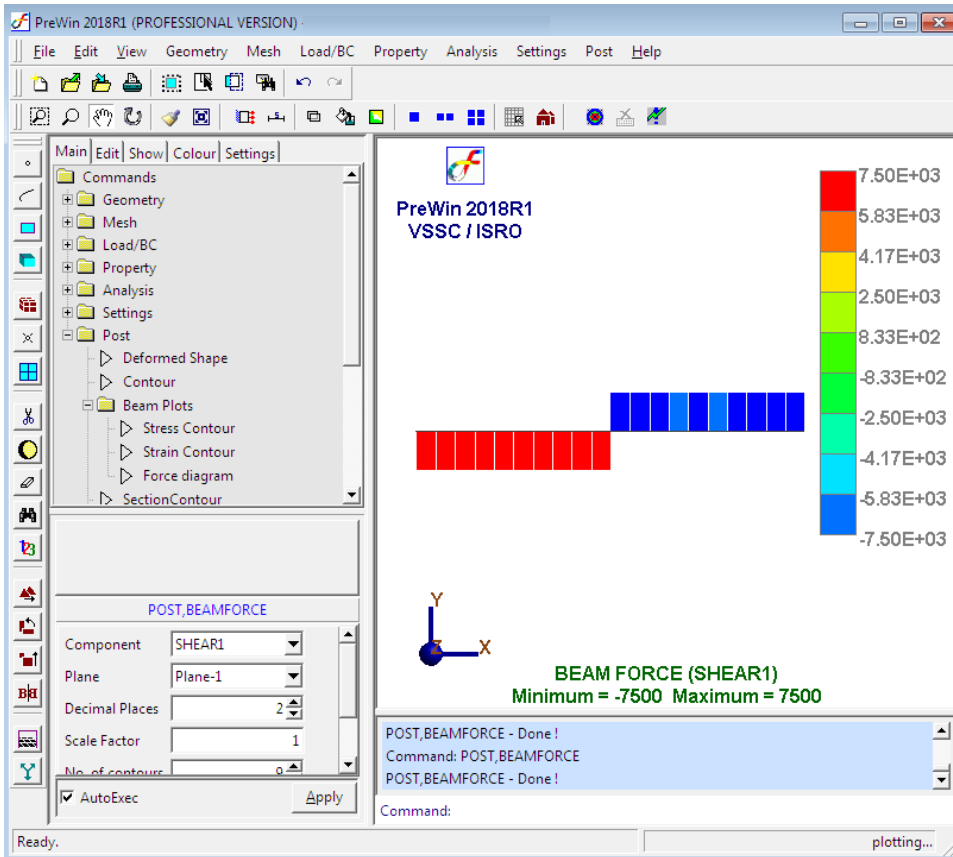
Command : POST, BEAMFORCE

Menu : Post → Beam Plots → Force Diagram

Parameters :

Component	SHEAR 1
Plane	Plane-1
Decimal Places	2
Scale Factor	1
No. of contours	9

At the end of the above operation/s, your screen should look like this.

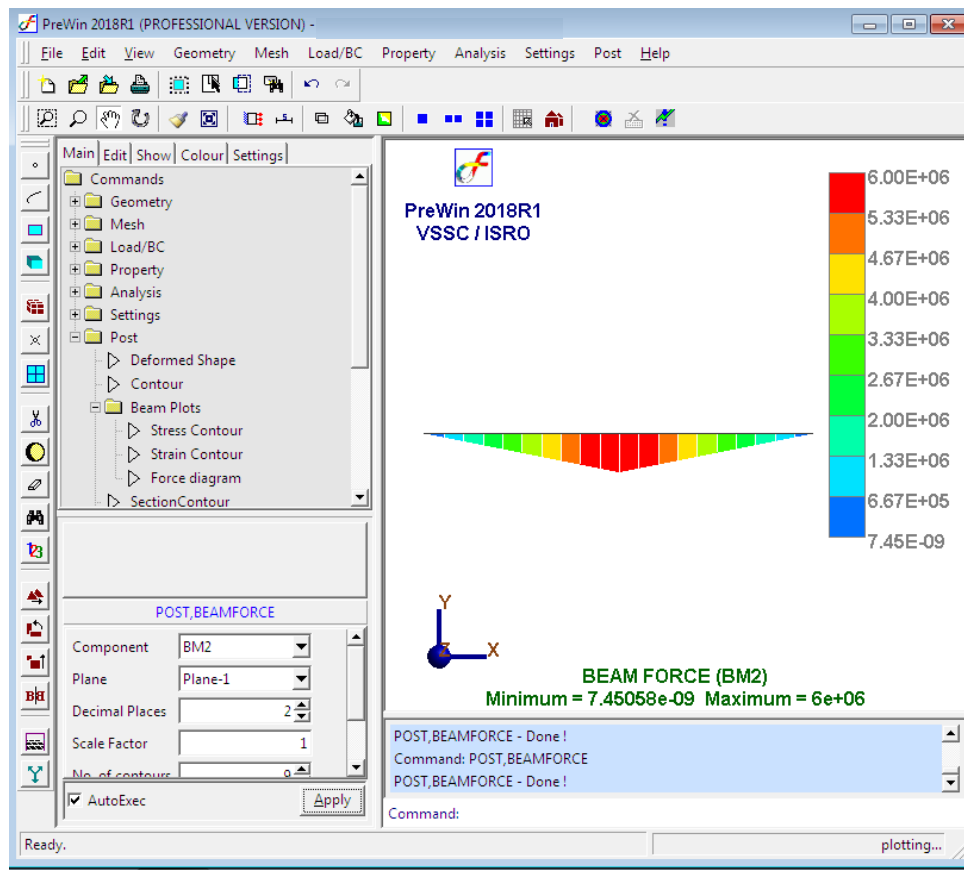


b. Bending moment diagram

- Command : POST, BEAMFORCE
- Menu : Post → Beam Plots → Force Diagram
- Parameters :

Component	BM2
Plane	Plane-1
Decimal Places	2
Scale Factor	1
No. of contours	9

At the end of the above operation/s, your screen should look like this.



c. *.DAT file shows the input data and *.OUT file shows the output file.

Hint: Deflection, $\delta = \frac{PL^3}{48EI}$