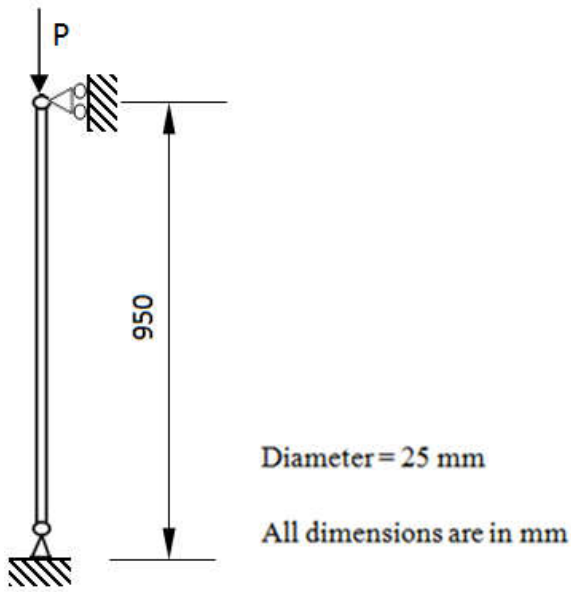
BUCKLING ANALYSIS OF A BEAM



Buckling analysis of a beam subjected to a load P as shown in figure. The compression member is pinned at both the ends. Material property; E = 207 GPa, ν = 0.3. Using Euler's formula for long columns find the critical load and use a design factor N = 3 to find P.

Euler's formula for critical load, $P_{cr} = \frac{n^2\pi^2 EI}{L_e^2}$

Where n = mode number

E = Young's modulus

I = Moment of inertia

L = Effective length

Hence P_{cr} = 43.4 kN

Considering design factor N = 3, P = 14.5

PROCEDURE

1. **Create key points**

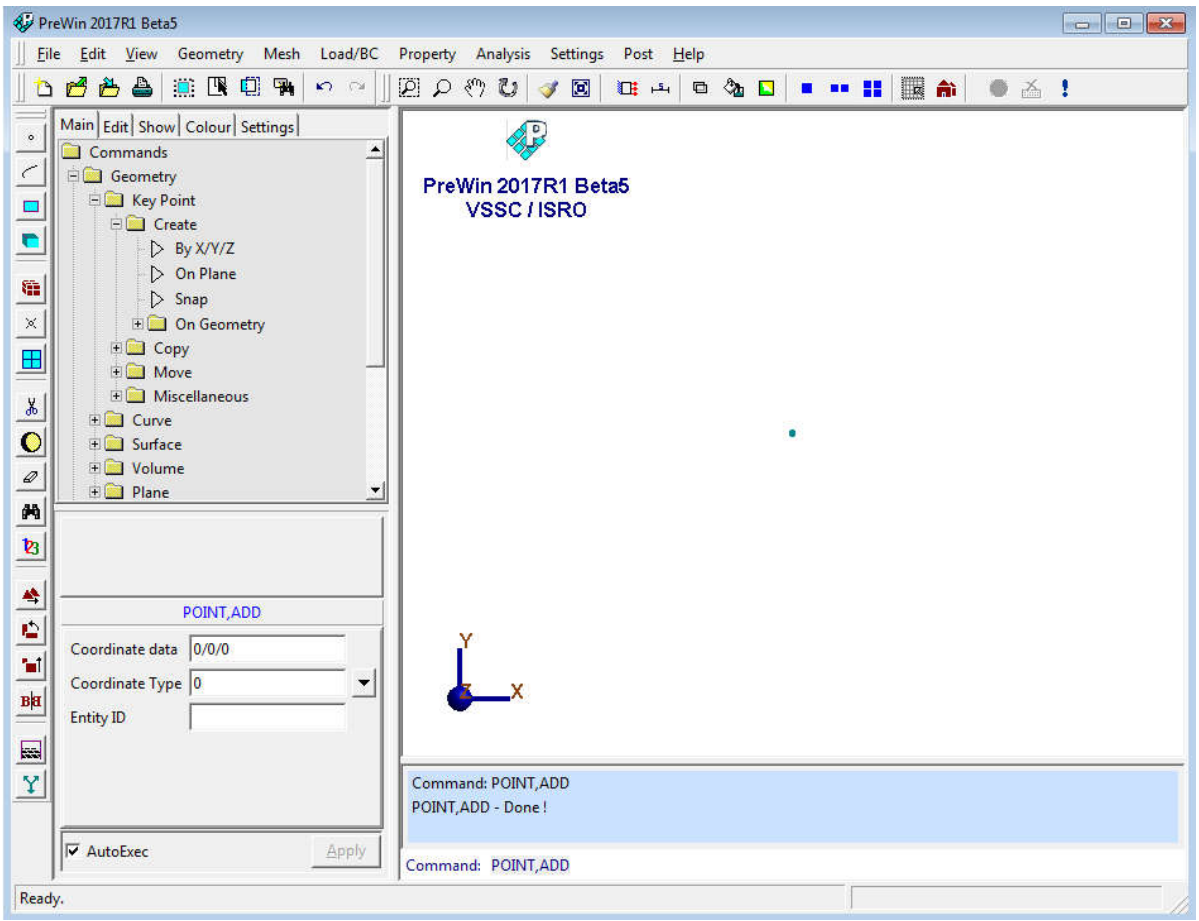
   Command : POINT,ADD

   Menu : Geometry → Keypoint → Create → By X/Y/Z

Parameters :

Coordinate data	0/0/0
Coordinate type	0
Entity ID	

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



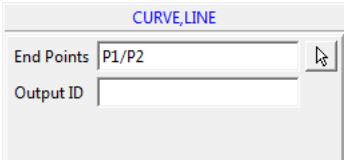
Similarly create a point at (0/950/0)

2. **Create curve**

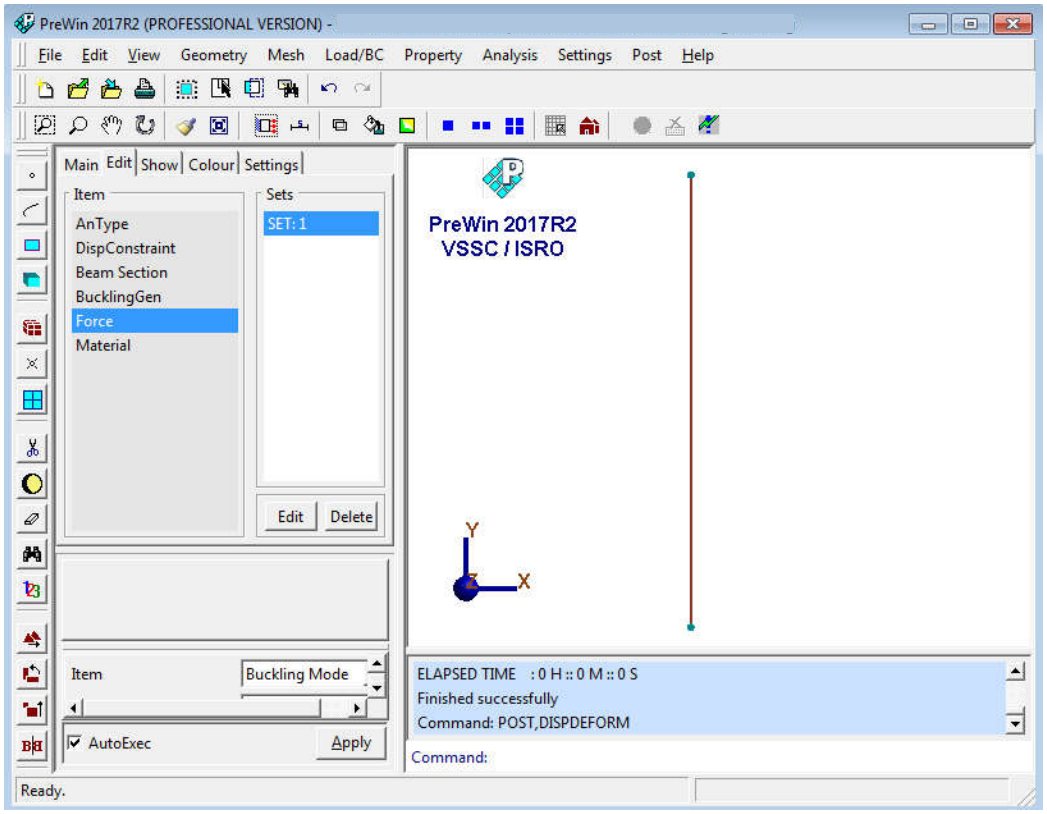
Command : CURVE,LINE

Menu : Geometry → Curve → Create → Line

Parameters :



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

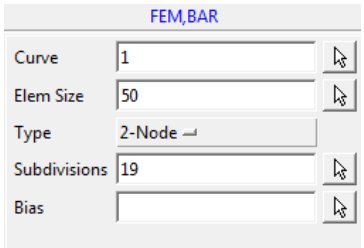


3. **Generate mesh**

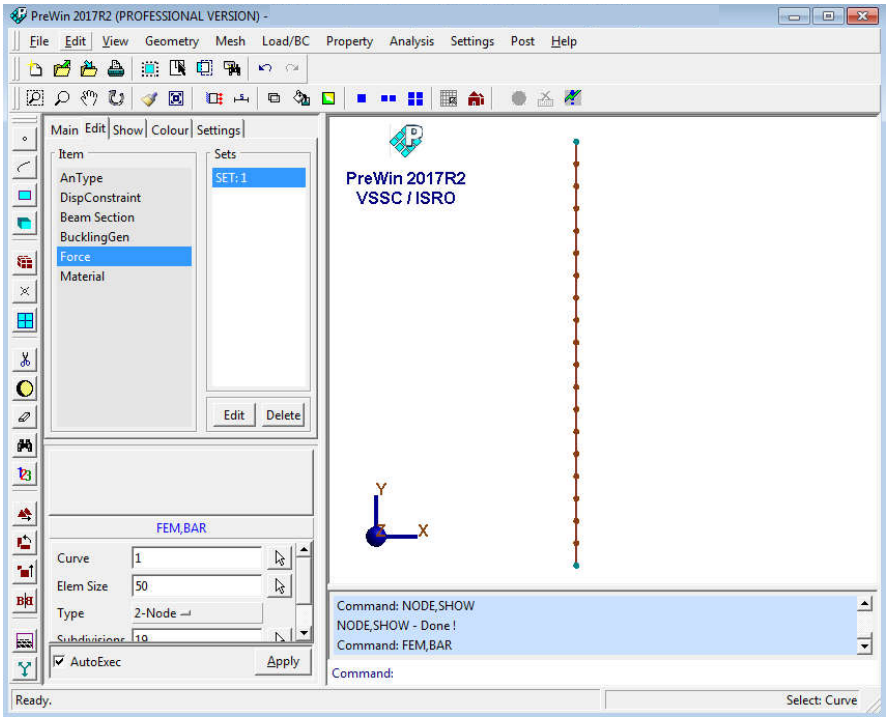
Command : FEM,BAR

Menu : Mesh → FE Mesh → Bar

Parameters :



At the end of the above operation your screen should like this

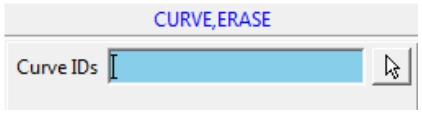


4. Erase curve

Command : CURVE,ERASE

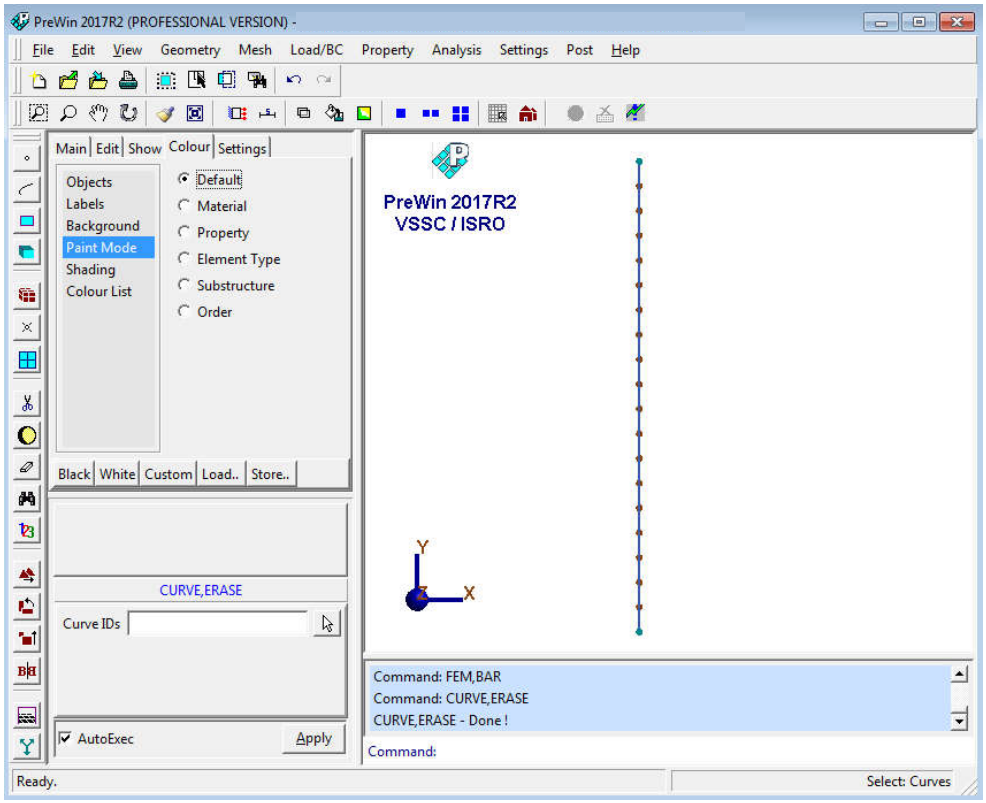
Menu : Geometry → Curve → Miscellaneous → Erase

Parameters :



Enter the curve ID in the box or pick the curve using mouse pointer.

At the end of the above operation your screen should like this

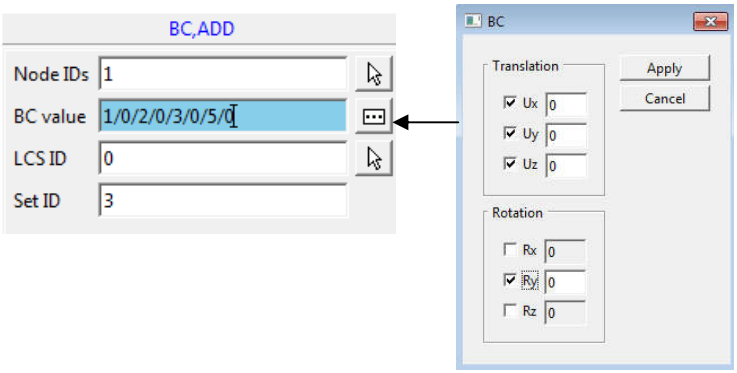


5. Apply boundary condition

Command : BC,ADD

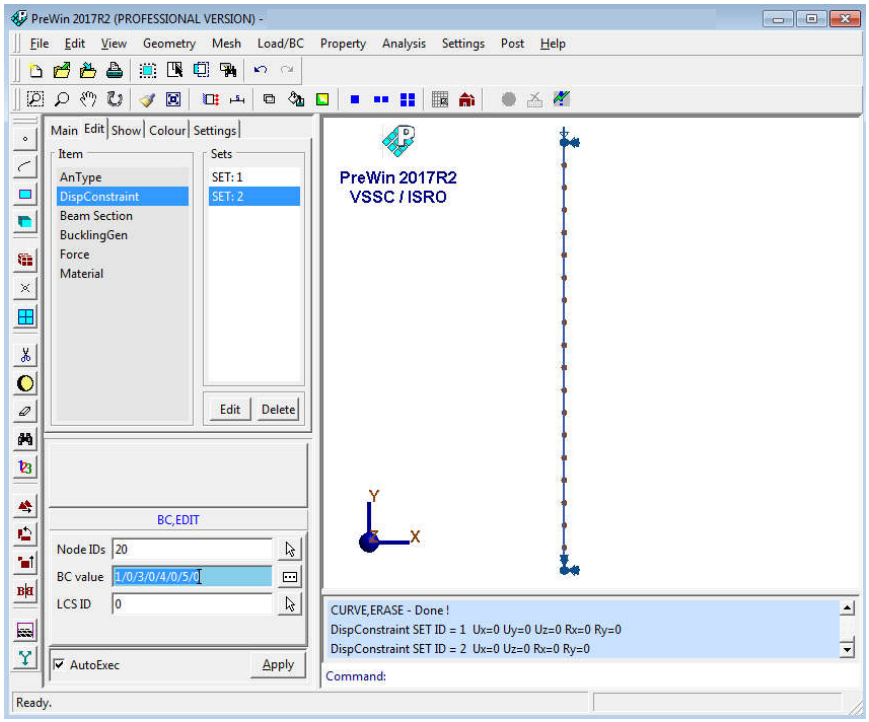
Menu : Load/BC → Displacement BC → Add

Parameters :



Similarly at the top end apply BC as (1/0/3/0/5/0)

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

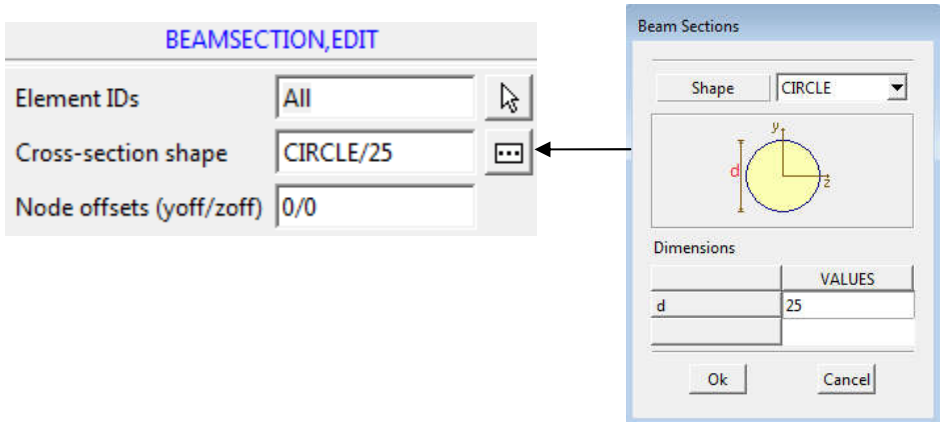


6. **Apply beam property**

Command : BEAMSECTION,ADD

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

Parameters :

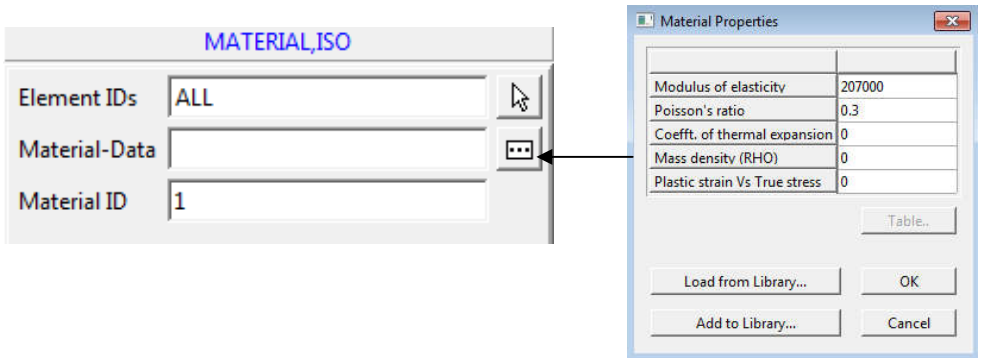


7. Apply material property

Command : MATERIAL,ISO

Menu : Property → Material → Isotropic → Add

Parameters :

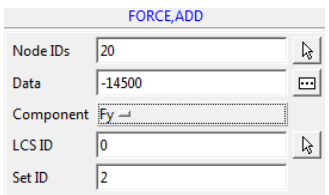


8. Specify load

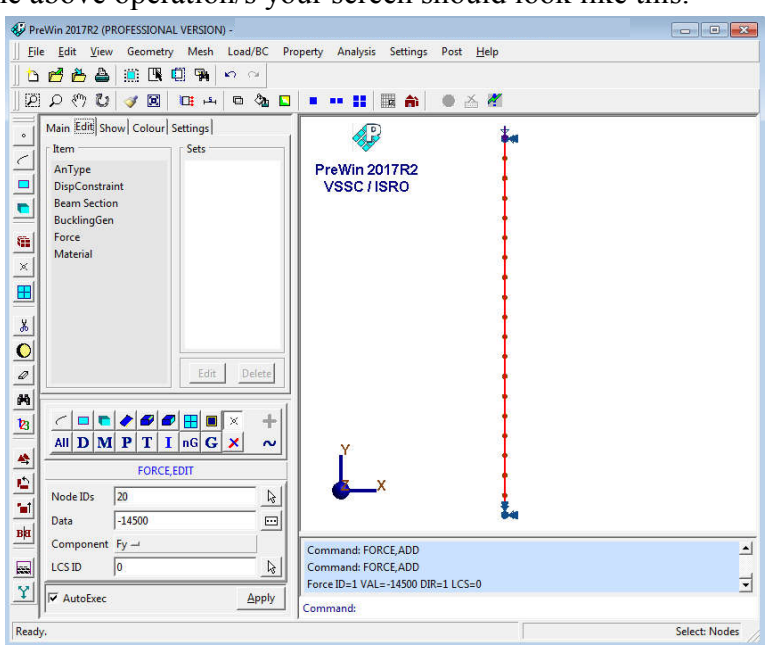
Command : FORCE,ADD

Menu : Load/BC → Point Load → Add

Parameters :



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

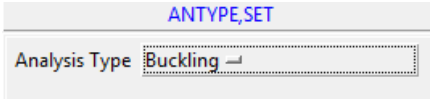


9. Set Analysis Type

Command : ANTYPE,SET

Menu : Analysis → Analysis Type

Parameters :

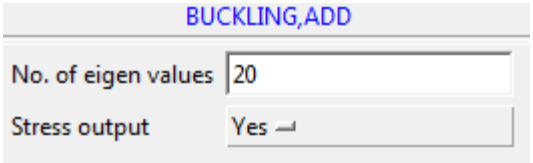


10. Specify buckling general data

Command : BUCKLING,ADD

Menu : Analysis → Buckling → General → Add

Parameters :

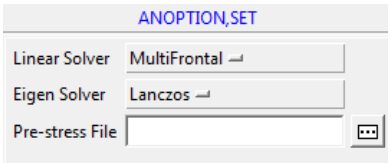


11. Set analysis Option

Command : ANOPTION,SET

Menu : Analysis → Analysis Option

Parameters :

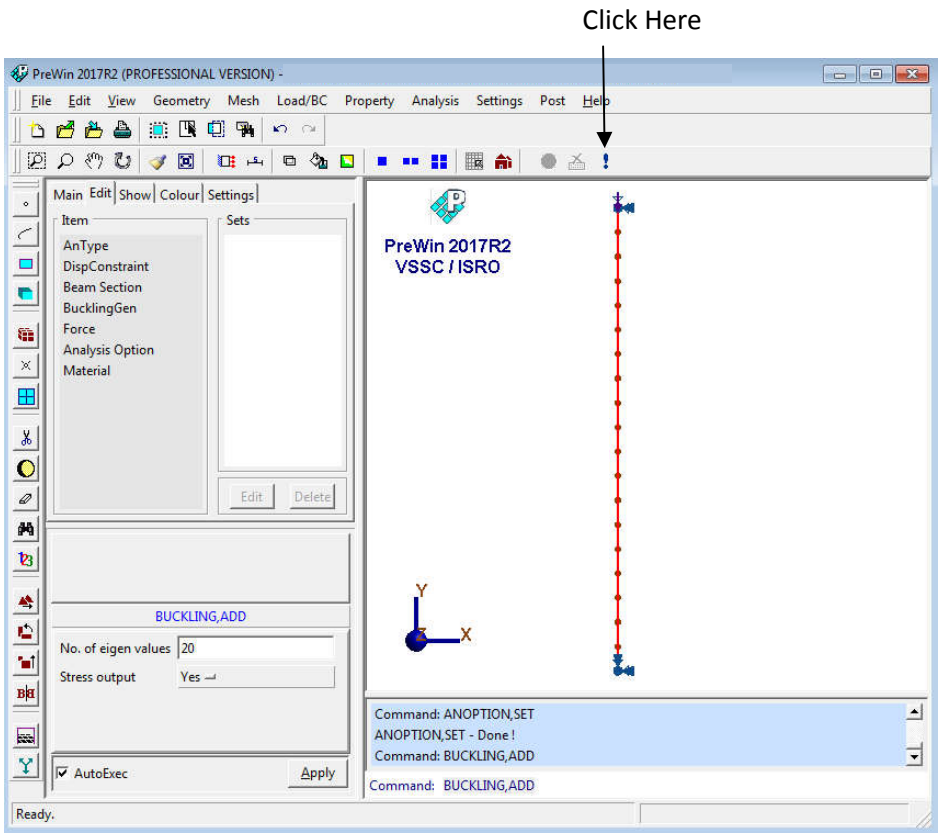


12. Save the project model

Menu : File → Save
Save the file to desired directory

13. Submit the job in to FEAST

Menu**: Analysis** → Run Solver



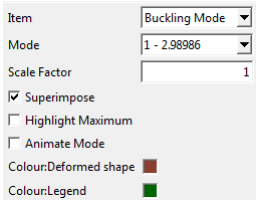
1. Post Processing

i. Deformed shape

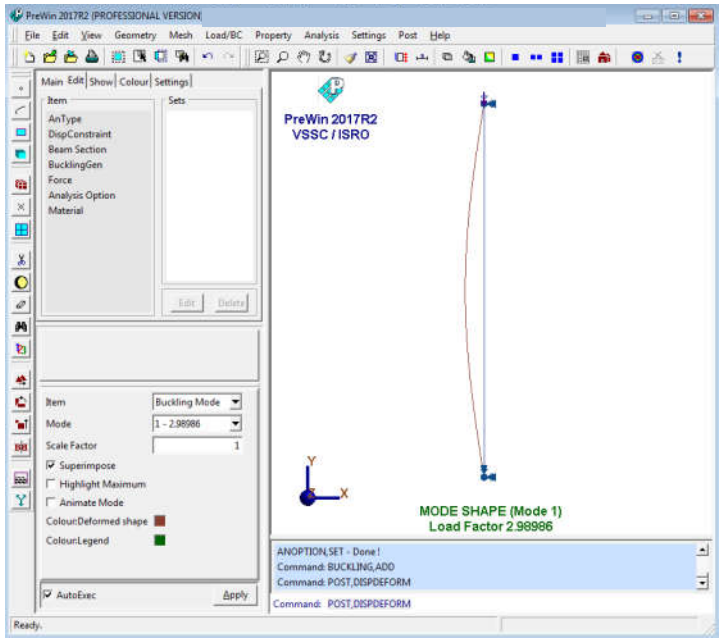
Command : POST,DISPDEFORM

Menu : Post → Deformed shape

Parameters :



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



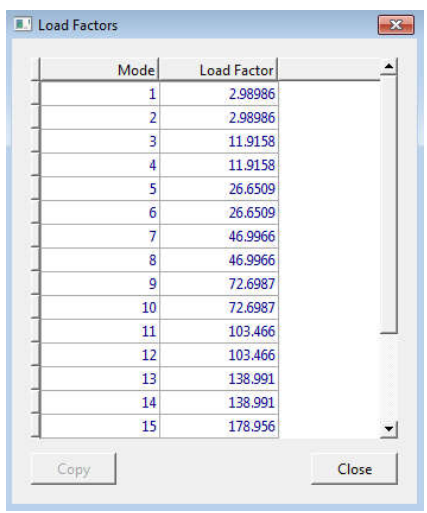
ii. View results

Command : POST,VIEWRESULTS

Menu : Post → View Results

Parameters : Item Critical Loads

The following table will be displayed



Load Factors

Mode	Load Factor
1	2.98986
2	2.98986
3	11.9158
4	11.9158
5	26.6509
6	26.6509
7	46.9966
8	46.9966
9	72.6987
10	72.6987
11	103.466
12	103.466
13	138.991
14	138.991
15	178.956

Copy Close

Output file can be seen in *.OUT

TRANSIENT RESPONSE ANALYSIS OF BEAM WITH SINUSOIDAL LOAD

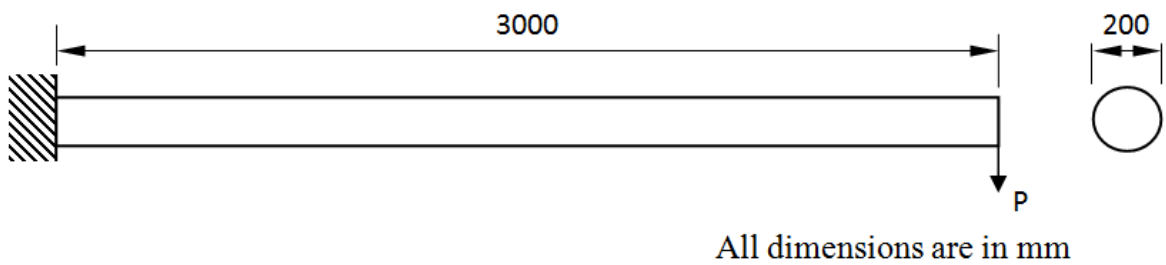


Figure 1

Material property: *E = 200 GPa, v = 0.3*; Load *P = sin(12.56t)*, (the load is having a frequency of *2Hz.*)

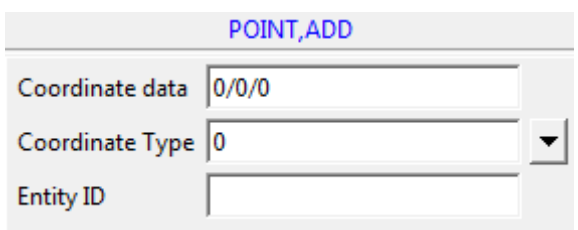
PROCEDURE

1. **Create key points**

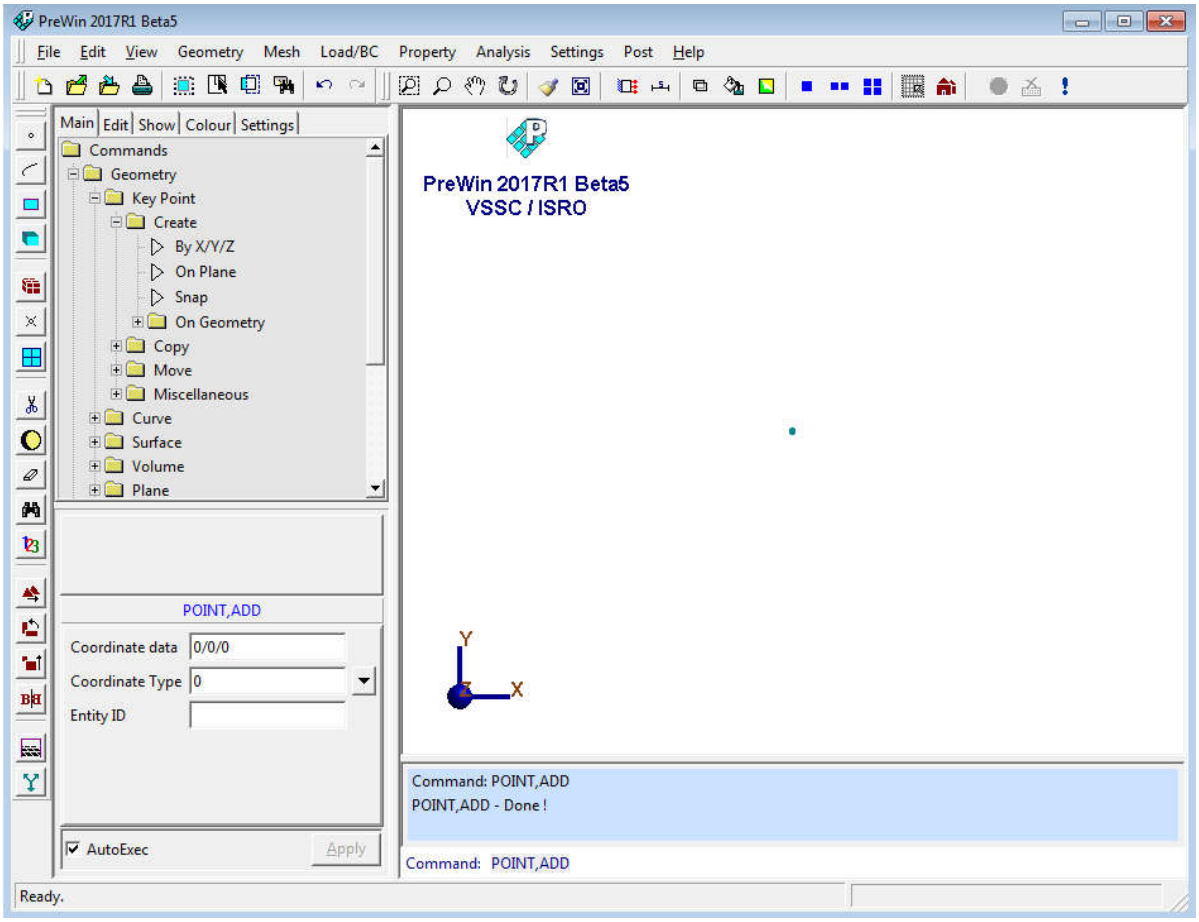
   Command : POINT,ADD

   Menu : Geometry → Keypoint → Create → By X/Y/Z

   Parameters :



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



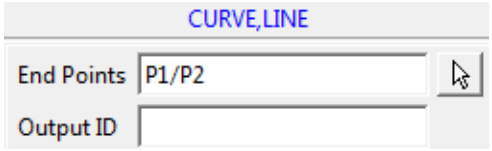
Similarly create key point at (3000/0/0)

2. **Create curve**

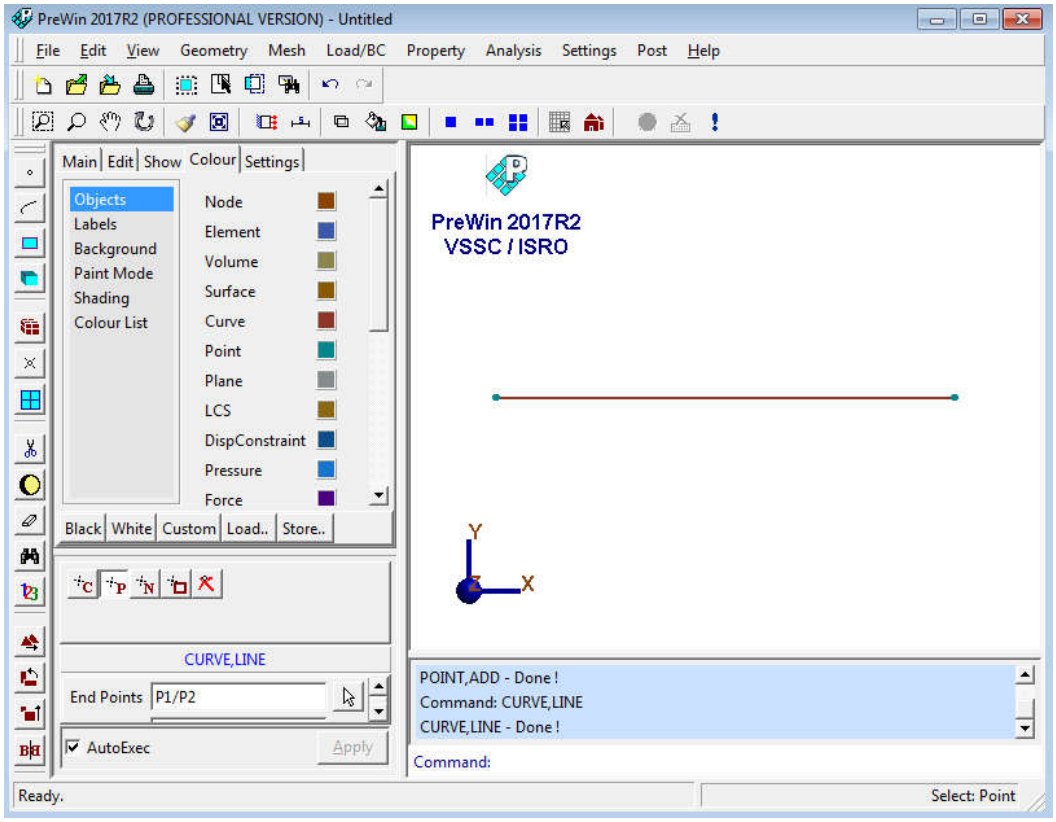
Command : CURVE,LINE

Menu : Geometry → Curve → Create → Line

Parameters :



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

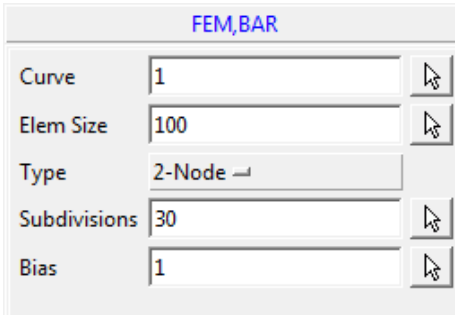


3. **Generate mesh**

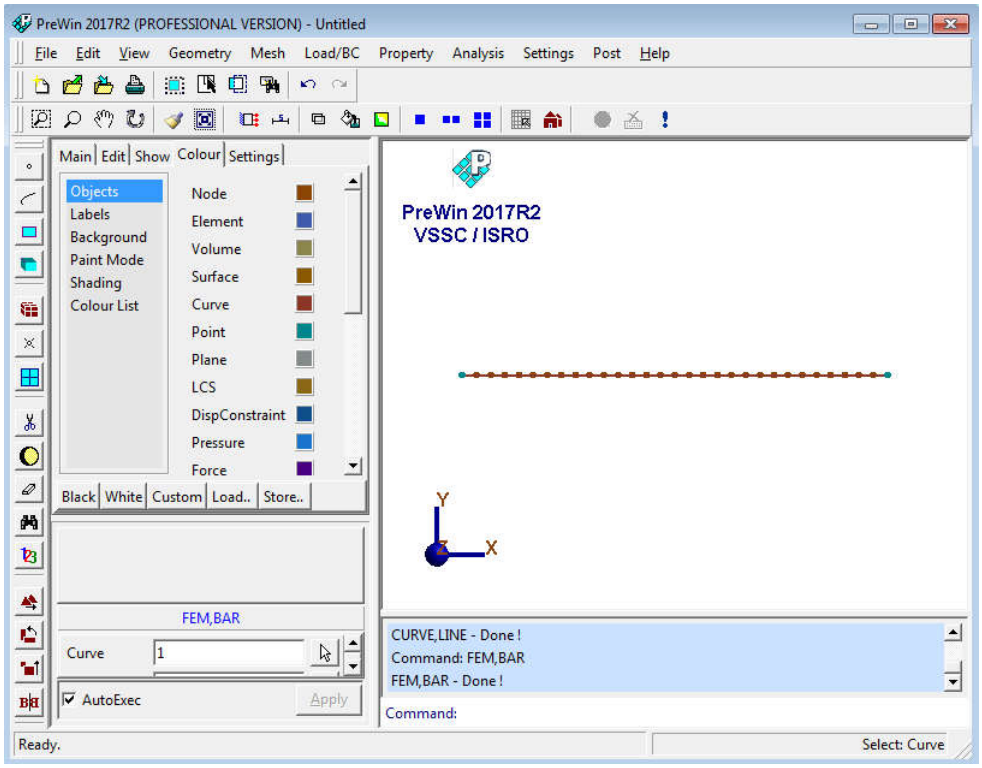
Command : FEM,BAR

Menu : Mesh → FE Mesh → BAR

Parameters :



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

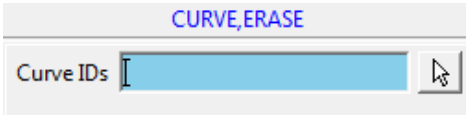


4. Erase curve

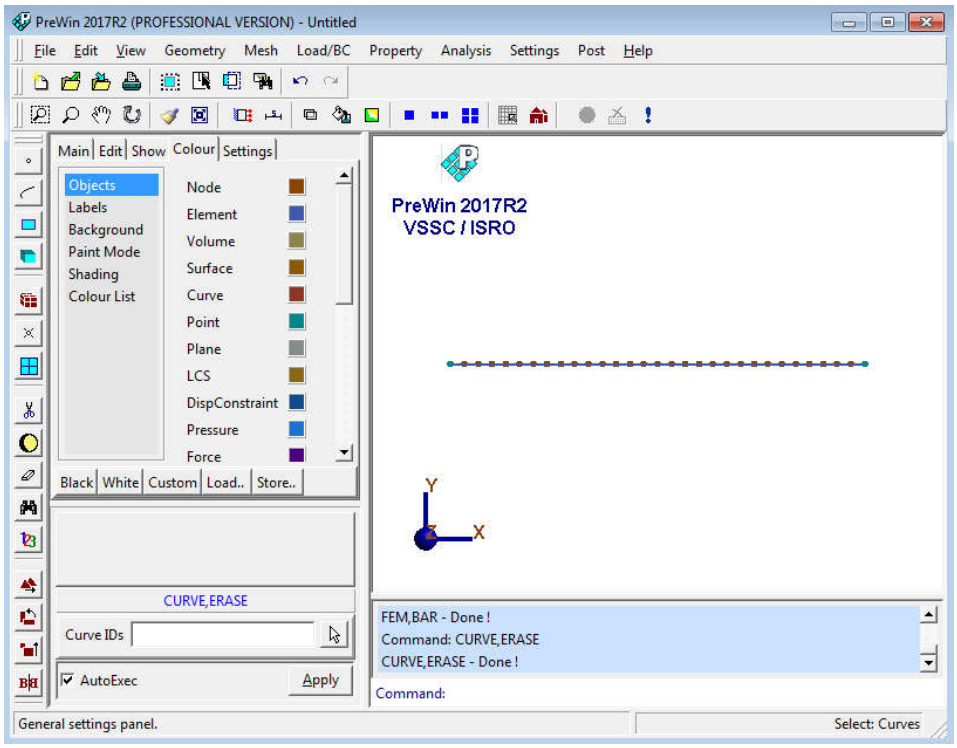
Command : CURVE,ERASE

Menu : Geometry → Curve → Miscellaneous → Erase

Parameters :



Type in the curve ID or pick the curve after clicking the arrow in the surface ID box



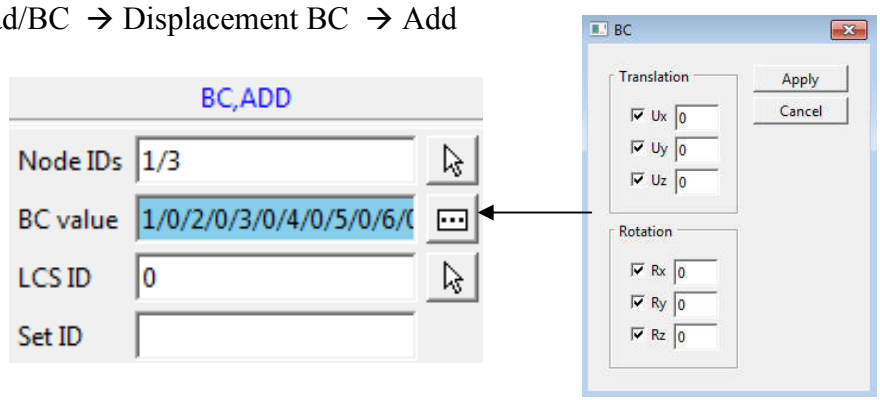
At the end of the operation/s your screen should look like this.

5. Apply boundary condition

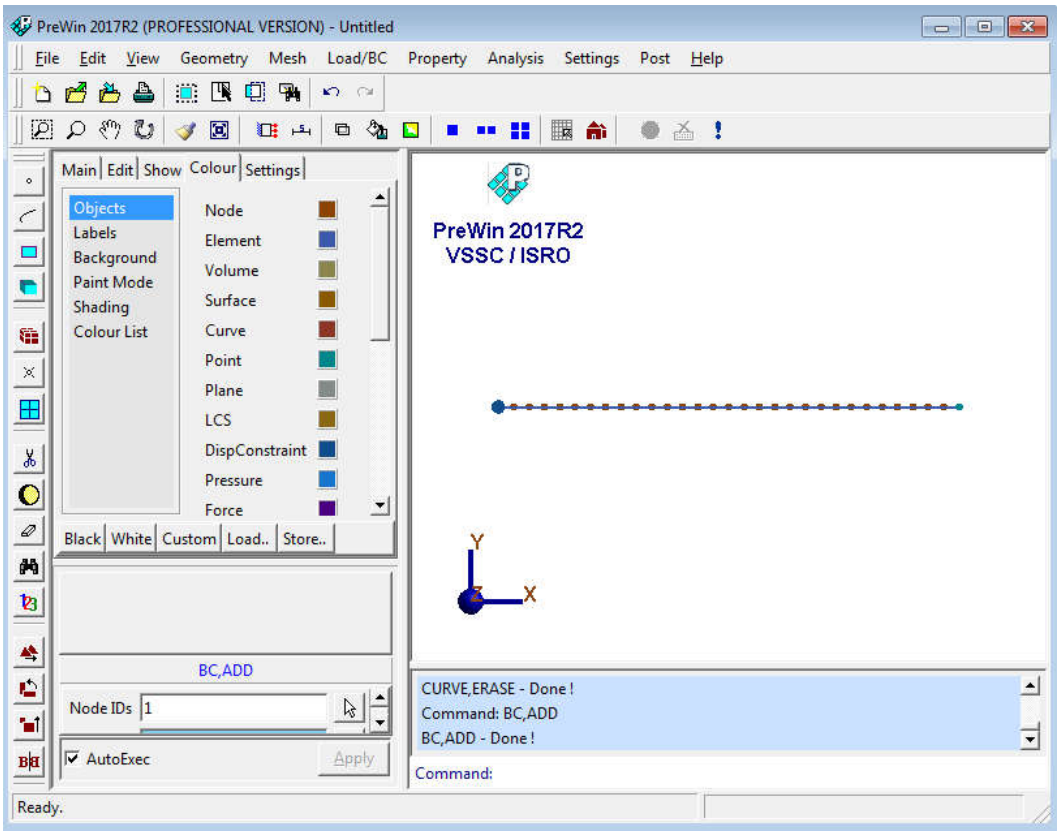
Command : BC,ADD

Menu : Load/BC → Displacement BC → Add

Parameters :



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

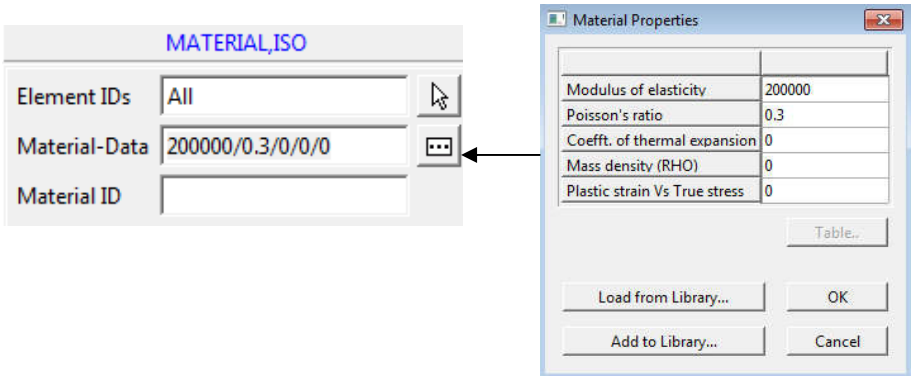


6. Specify material property

Command : MATERIAL,ISO

Menu : Property → Material → Isotropic → Add

Parameters :

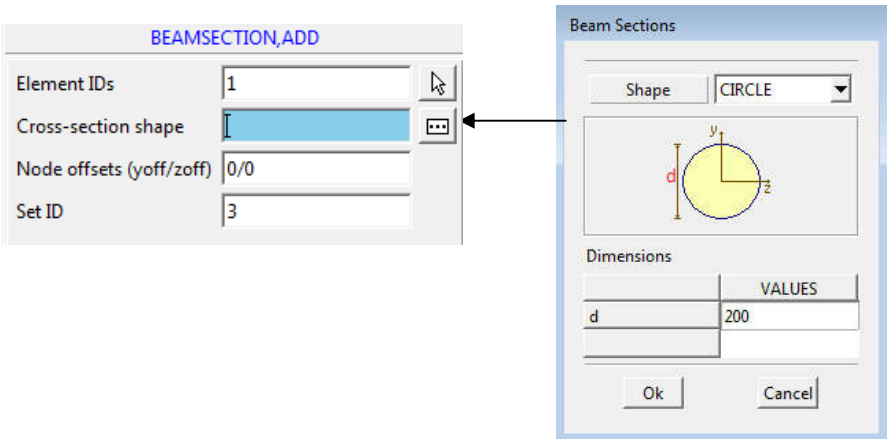


7. Specify beam section

Command : BEAMSECTION,ADD

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

Parameters :



8. Specify load

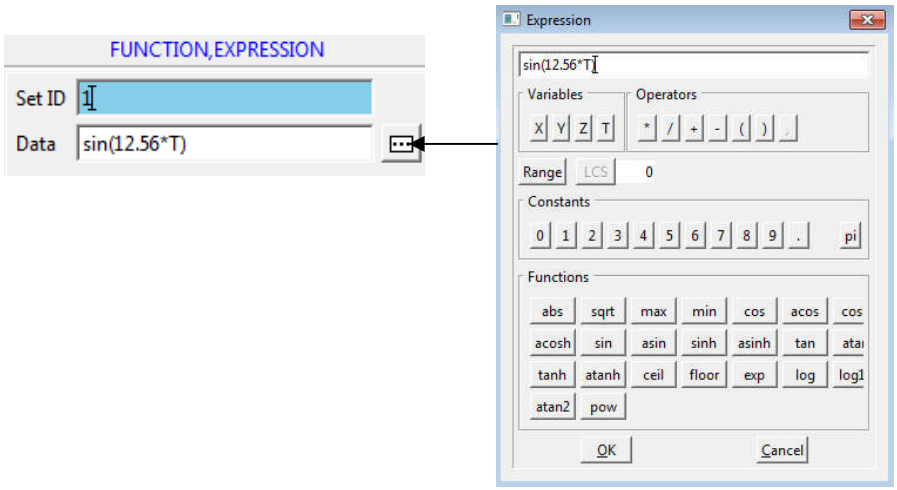
i) Define sine function

In order to specify the sinusoidal load a sine function has to be defined

Command : FUNCTION,EXPRESSION

Menu : Property → Function → Expression

Parameters :

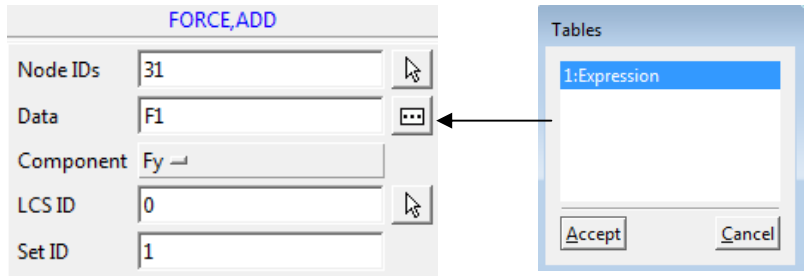


ii) Define load

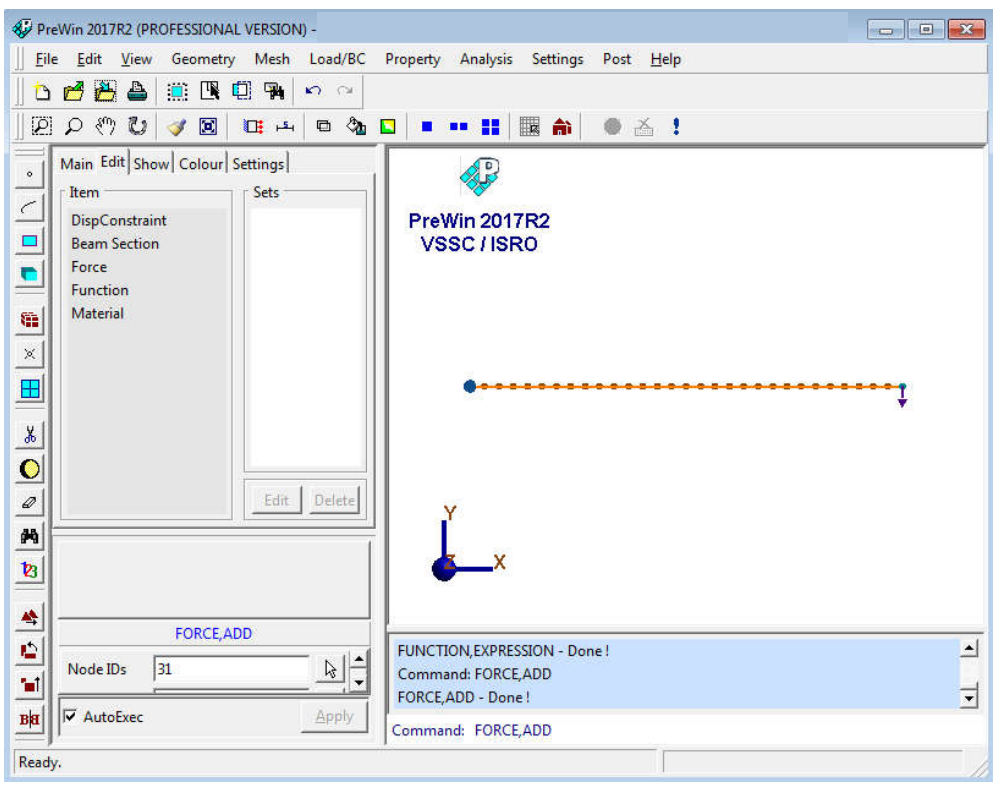
Command : FORCE,ADD

Menu : Load/BC → Point Load → Add

Parameters :



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

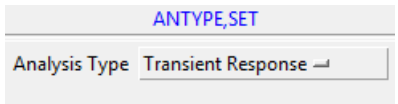


9. Set analysis type

Command : ANTYPE,SET

Menu : Analysis → Analysis Type

Parameter :

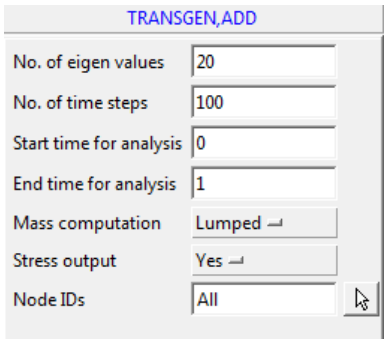


10. Specify transient response general data

Command : TRANSGEN,ADD

Menu : Analysis → Transient Response → General → Add

Parameters :

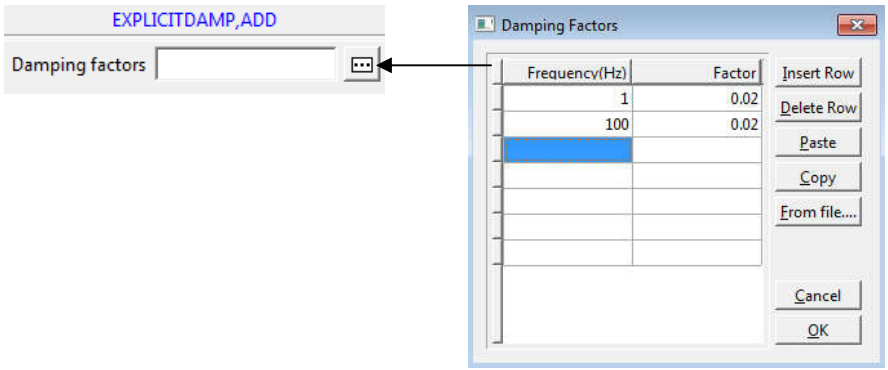


11. Specify damping

Command : TRANSGEN,ADD

Menu : Analysis → Transient Response → Damping→ Add

Parameters :

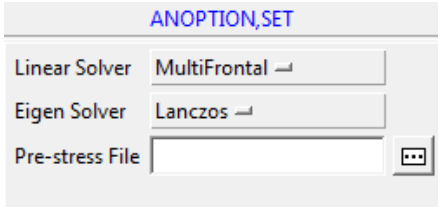


12. Set analysis option

Command : ANOPTION,SET

Menu : Analysis → Analysis Option

Parameters :

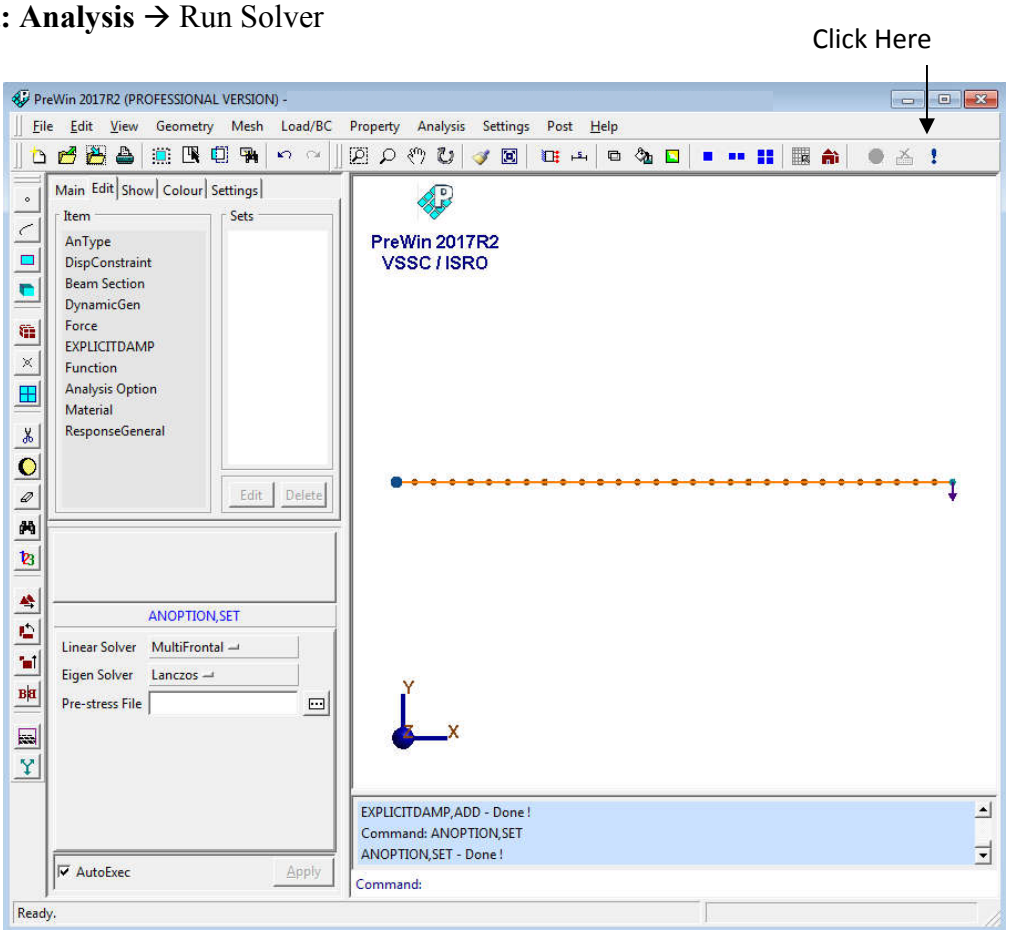


13. Save the project model

Menu : File → Save

14. Submit the job in to FEAST

Menu**: Analysis** → Run Solver



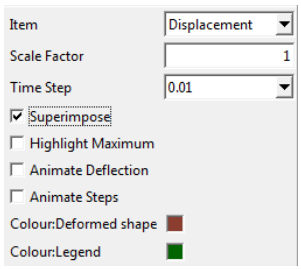
15. Perform Post Processing

i) Displacement

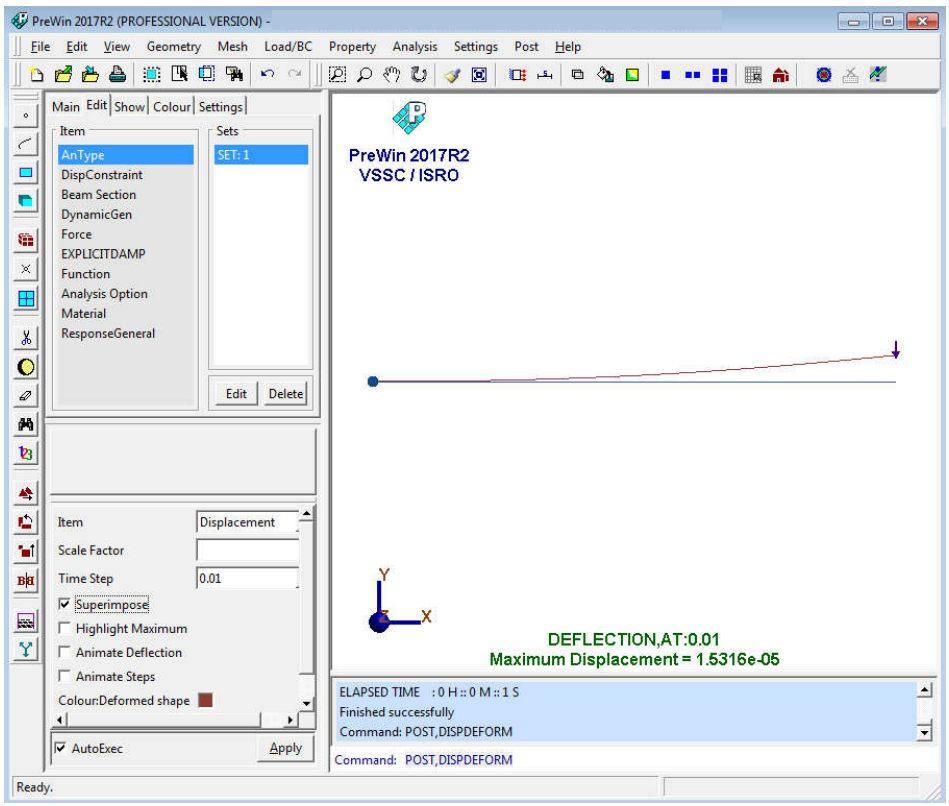
Command : POST,DISPDEFORM

Menu : Post → deformed Shape

Parameters :



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

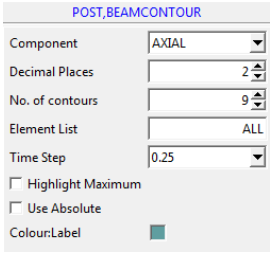


ii) Beam stress

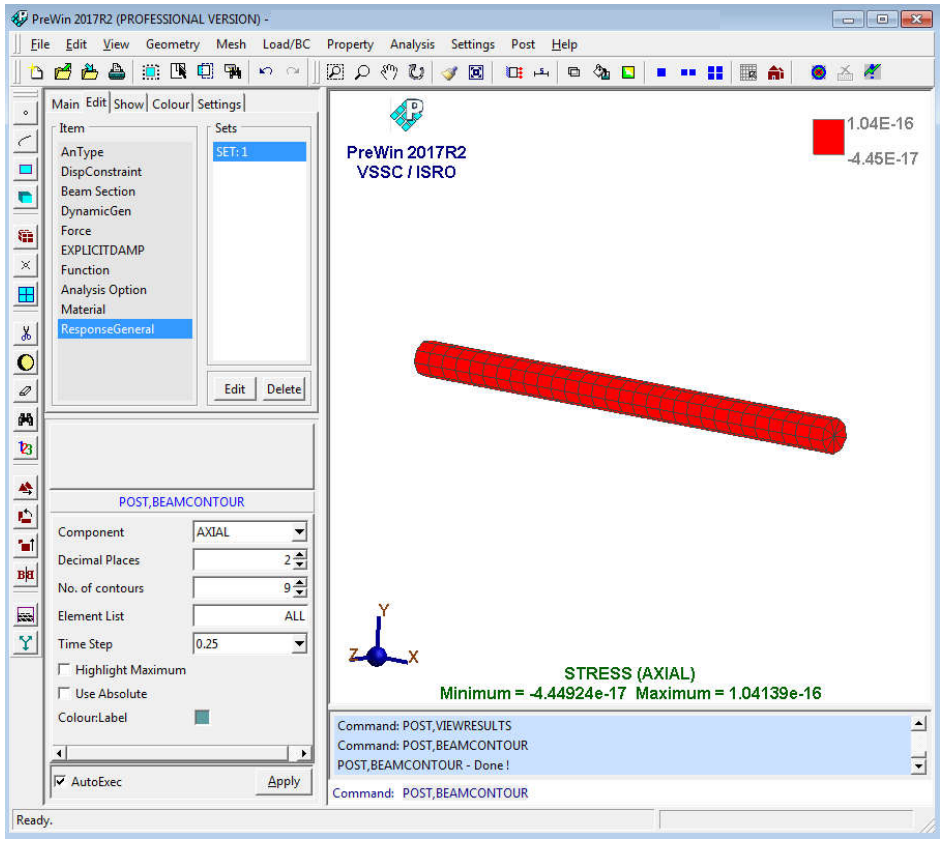
Command : POST,BEAMCONTOUR

Menu : Post → Beam Plots → Stress Contour

Parameters :



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

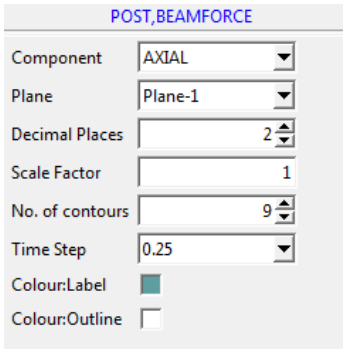
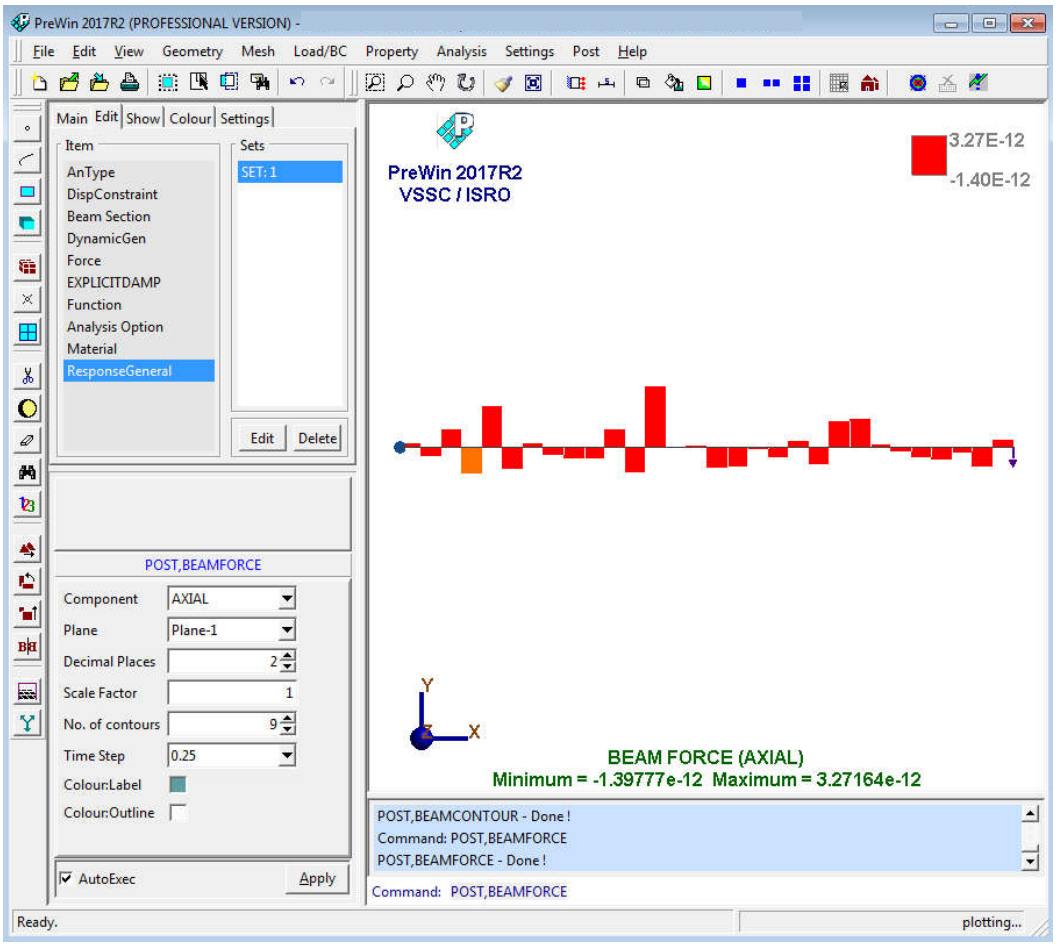


iii) Beam force.

Command : POST,BEAMFORCE

Menu : Post → Beam Plots → Force diagram

Parameters :



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