

FIXED BEAM SUBJECTED TO AXIAL LOAD

Find the nodal displacement, stress in each material and reaction force at the support for the bar shown in Figure 1. Consider the self weight of the plate in addition to the load $P = 200 \times 10^3 \text{ N}$. (Material property, Material 1(Aluminium): $E_1 = 70 \text{ GPa}$, $\nu_1 = 0.3$; Material 2(Steel): $E_2 = 200 \text{ GPa}$, $\nu_2 = 0.3$)

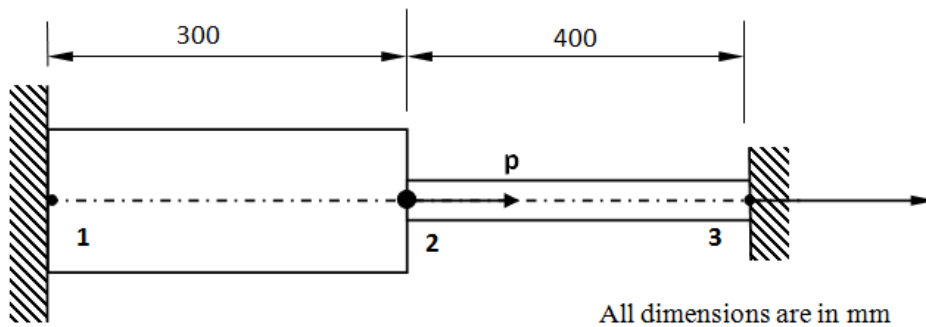


Figure 1

REFERENCE: Tirupathi R. Chandraupatla, Ashok D. Belegundu, Finite elements in engineering, PrinticeHall of India, 1997, New Delhi.

PROCEDURE

1. Create key points

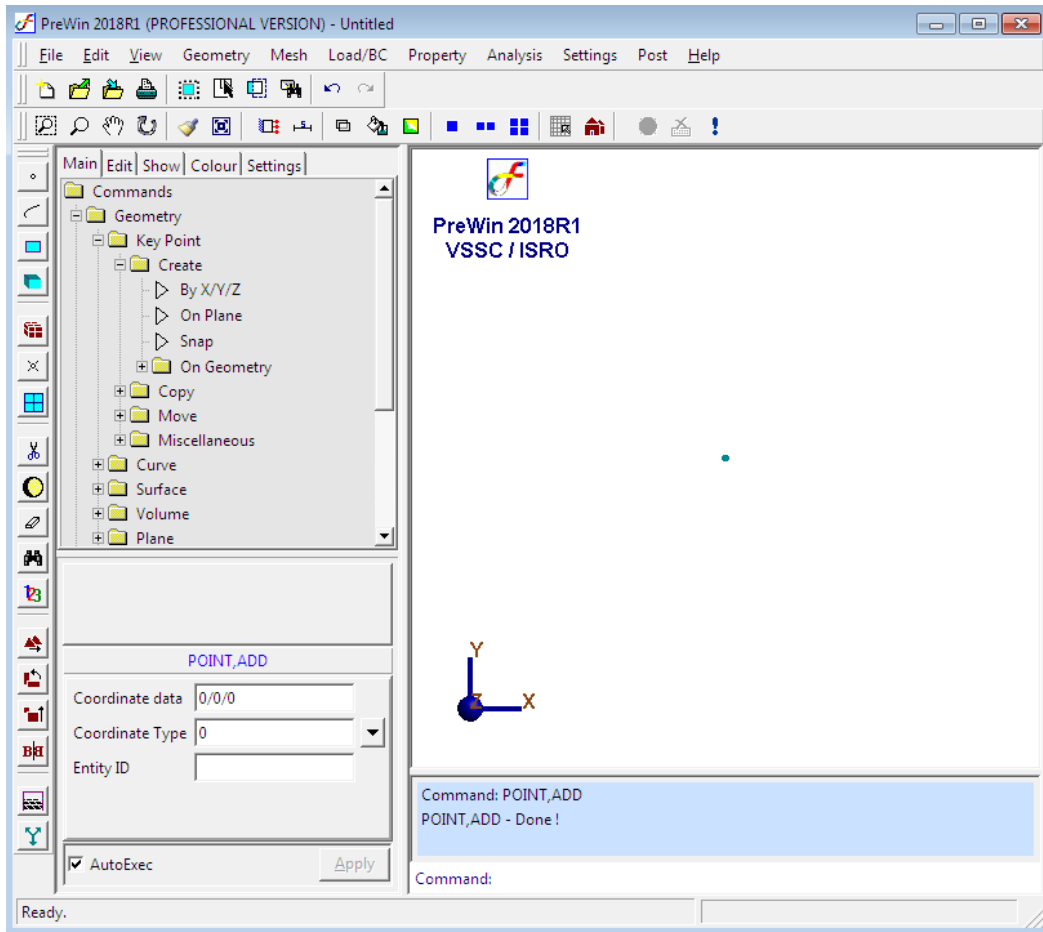
Command : POINT, ADD

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

Parameters :

POINT,ADD	
Coordinate data	0/0/0
Coordinate Type	0
Entity ID	

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



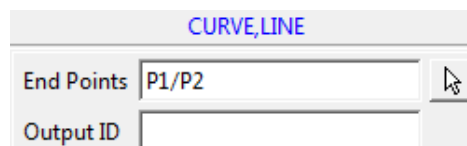
Similarly create key point at (300/0/0) & (700/0/0)

2. Create curve

Command : CURVE, LINE

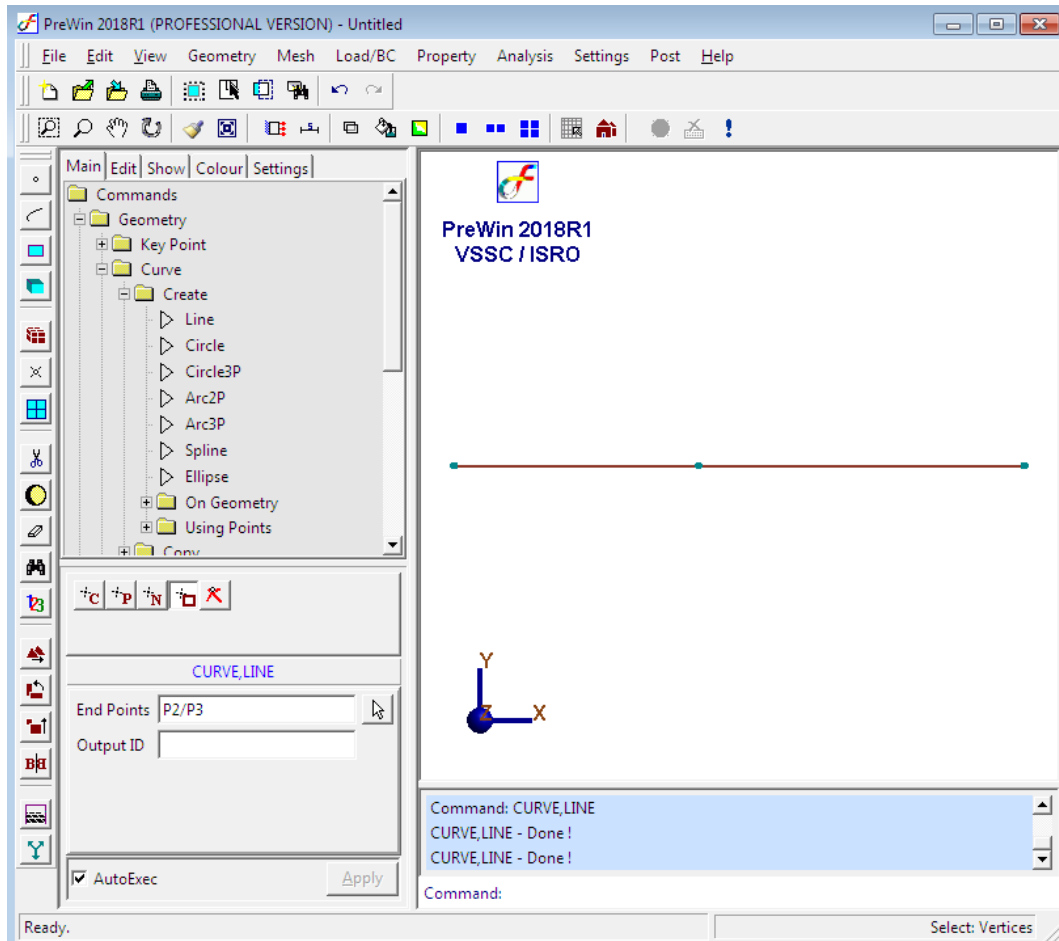
Menu : Geometry → Curve → Create → Line

Parameters :



Create line with key points (P2/P3) also.

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

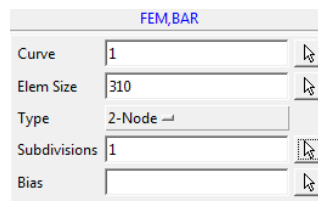


3. Generate mesh

Command : FEM, BAR

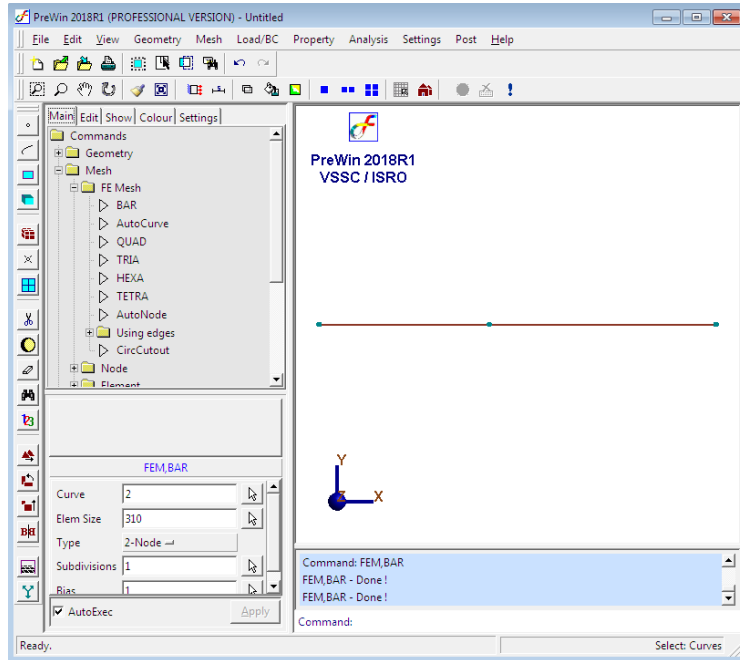
Menu : Mesh → FE Mesh → BAR

Parameters :



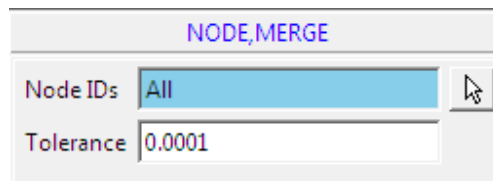
Create mesh on curve 2 also with only 1 subdivision

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



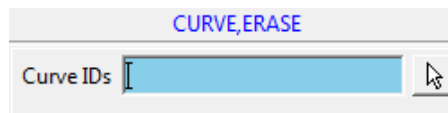
4. Merge duplicate nodes

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



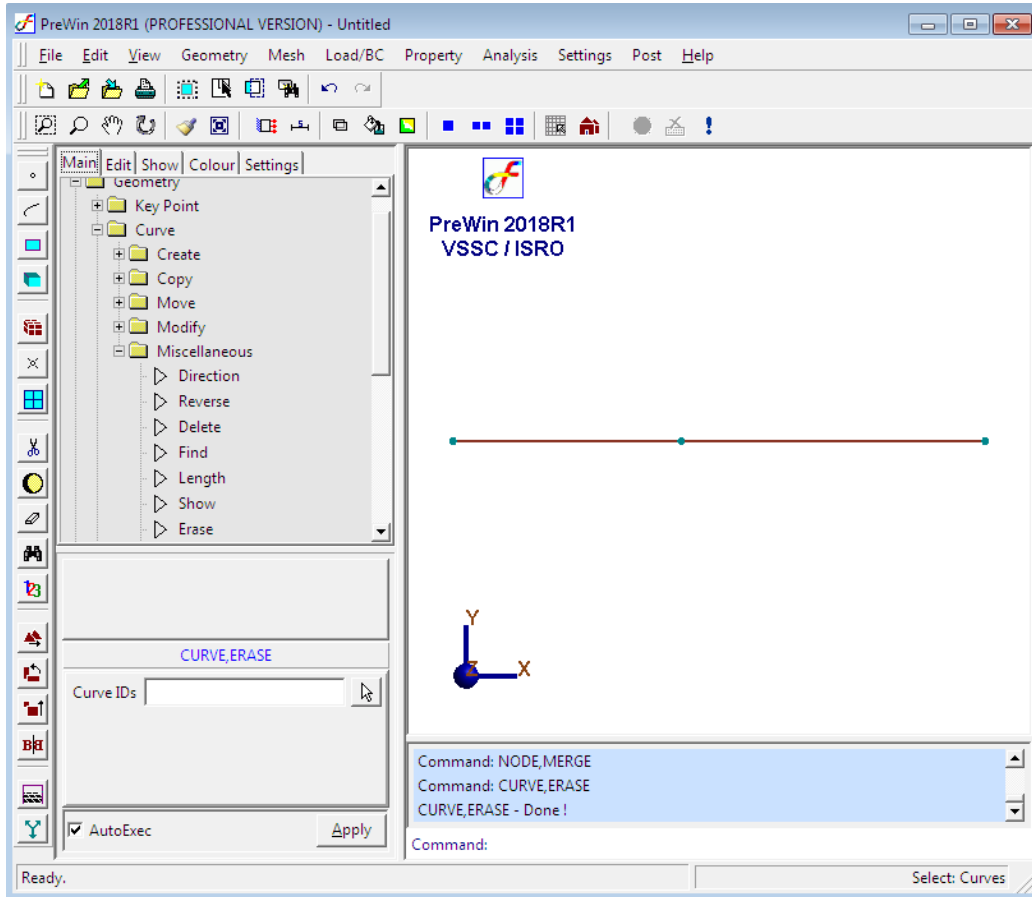
5. Erase curve

- 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.

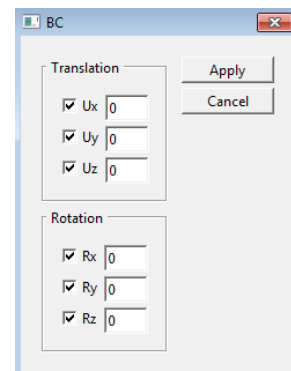
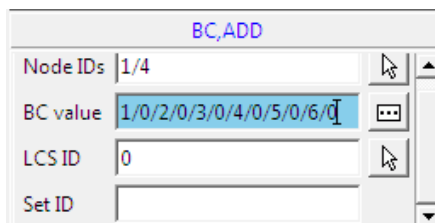


6. Apply boundary condition

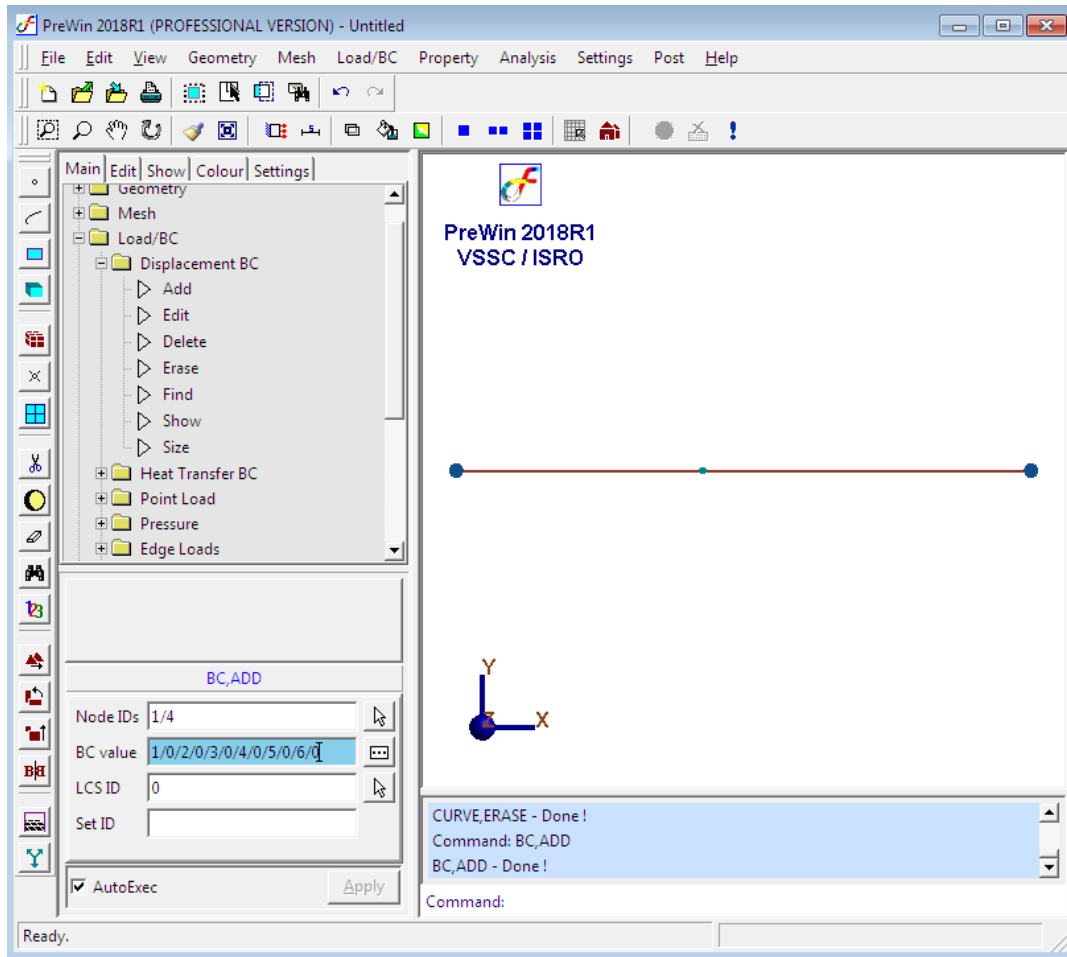
Command : BC, ADD

Menu : Load/BC → Displacement BC → Add

Parameters :



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



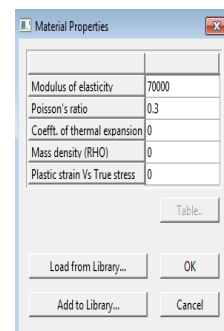
7. Specify material property

Command : MATERIAL, ISO

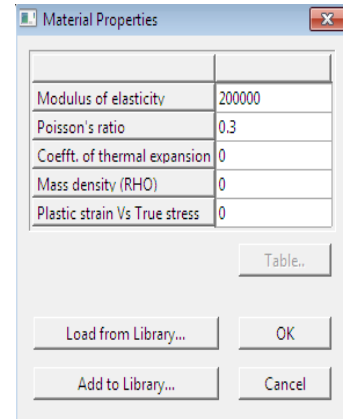
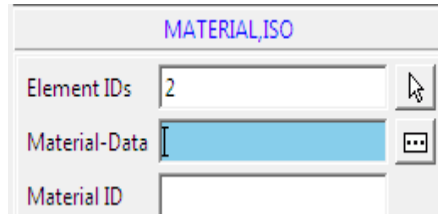
Menu : Property → Material → Isotropic

Parameters :

MATERIAL, ISO	
Element IDs	1
Material-Data	70000/0.3/0/0/0



Similarly specify material property for the second element with input data as $E = 200$ GPa, $\nu = 0.3$

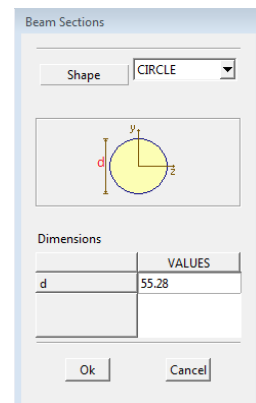
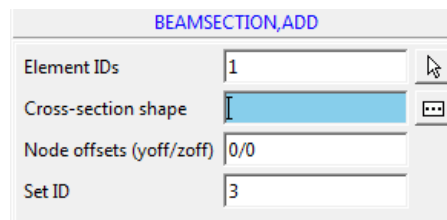


8. Specify beam section

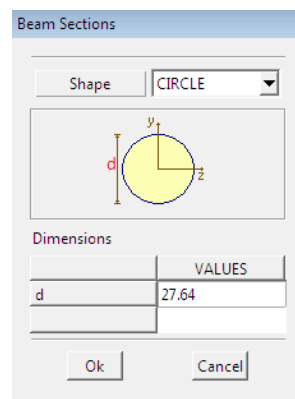
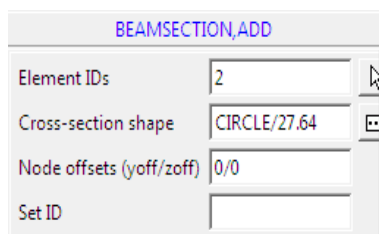
Command : BEAMSECTION, ADD

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

Parameters :



Similarly specify beam property for the second element with $d = 27.64$ mm

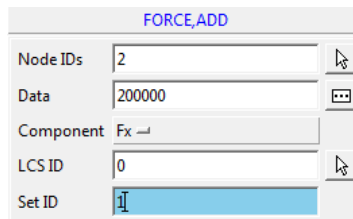


9. Specify load

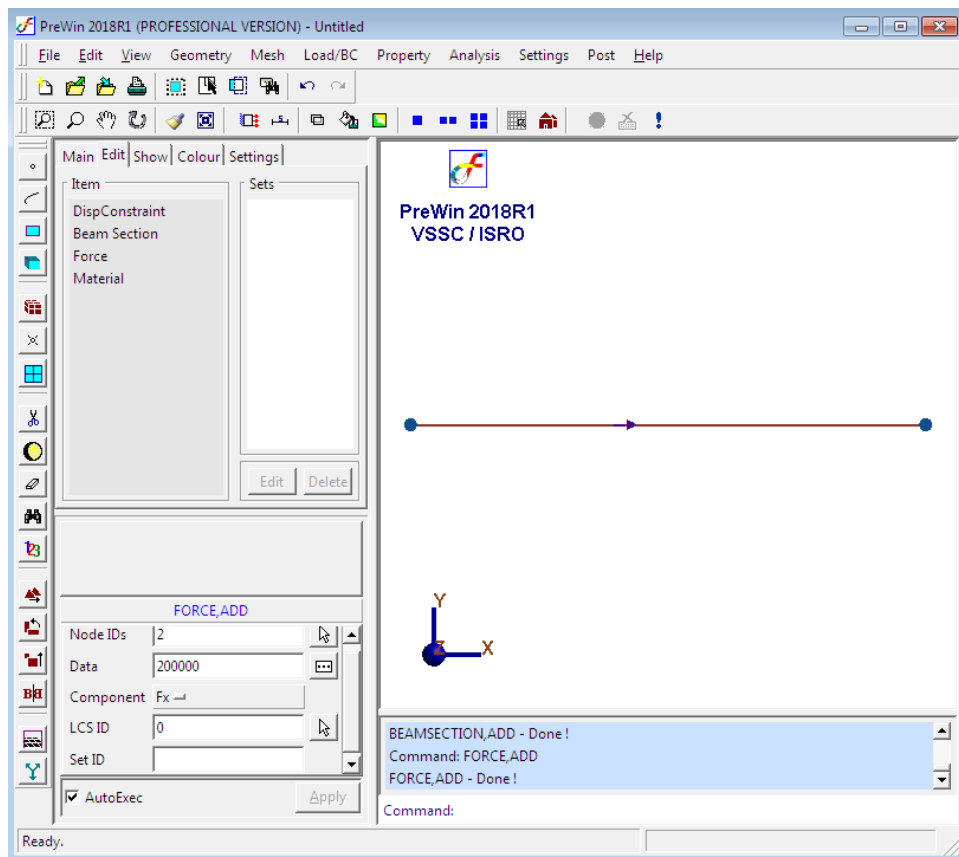
Command : FORCE, ADD

Menu : Load/BC → Point Load → Add

Parameters :



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

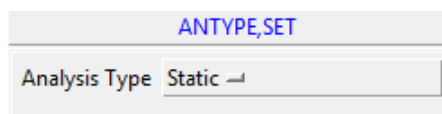


10. Set analysis type

Command : ANTYPE, SET

Menu : Analysis → Analysis Type

Parameter :

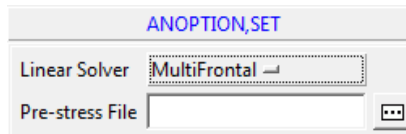


11. Set analysis option

Command : ANOPTION, SET

Menu : Analysis → Analysis Option

Parameters :



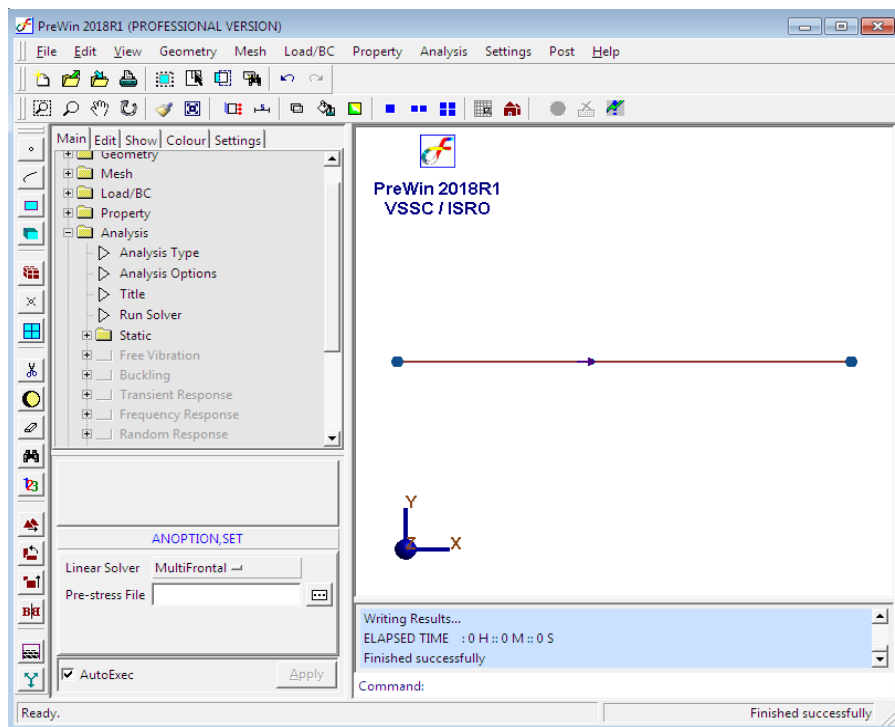
12. Save the project model

Menu : File → Save

13. Submit the job in to FEAST

Menu: **Analysis** → Run Solver

[Click here](#)



14. Perform Post Processing

i) Displacement

Command : POST, VIEWRESULTS

Menu : Post → View Results

Parameters :

	Node ID	TX	TY	TZ	RX	RY	RZ	T-RES	R-RES
1	2	0.23255	0	0	0	0	0	0.23255	0

ii) Stress

Command : POST, VIEWRESULTS

Menu : Post → View Results

Parameters :

	Node ID	SIGMA-X	SIGMA-Y	SIGMA-Z	TAU-XY	TAU XZ	TAU YZ	PRINCIPAL 1	PRINCIPAL 2	PRINCIPAL 3
1	1	54.2617	0	0	-0	0	0	54.2617	0	0
2	2	-31.0067	0	0	-0	0	0	0	0	-31.0067
3	3	-116.275	-0	-0	-0	0	0	-0	-0	-116.275

iii) Reaction force.

Command : POST,VIEWRESULTS

Menu : Post → View Results

Parameters :

Item	Reaction Forces ▼
Components	
Nodes	ALL
LCS	Global Cartesian ▼

Node ID	TX	TY	TZ	RX	RY	RZ
1	-130233	0	0	0	0	0
3	-69767.4	0	0	0	0	0
TOTAL:	-200000	0	0	0	0	0

Copy Close

iv) Stress contour

Command : POST, BEAMCONTOUR

Menu : Post → Beam plots → Stress Contour

Parameters :

POST, BEAMCONTOUR	
Component	AXIAL ▼
Decimal Places	2 ▲▼
No. of contours	9 ▲▼
Element List	ALL
<input type="checkbox"/> Highlight Maximum	
<input type="checkbox"/> Use Absolute	
Colour:Label	■

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

