STATIC ANALYSIS OF A HANGING PLATE

Objective : To find the nodal displacement, stress in each material and reaction force at the support for the plate shown below. Consider the self weight of the plate in addition to the load $P = 444.82\ N$.(Material property: E = $206.842\ GPa$, $\nu = 0.3$, $\rho = 7850\ kg/m^3$)

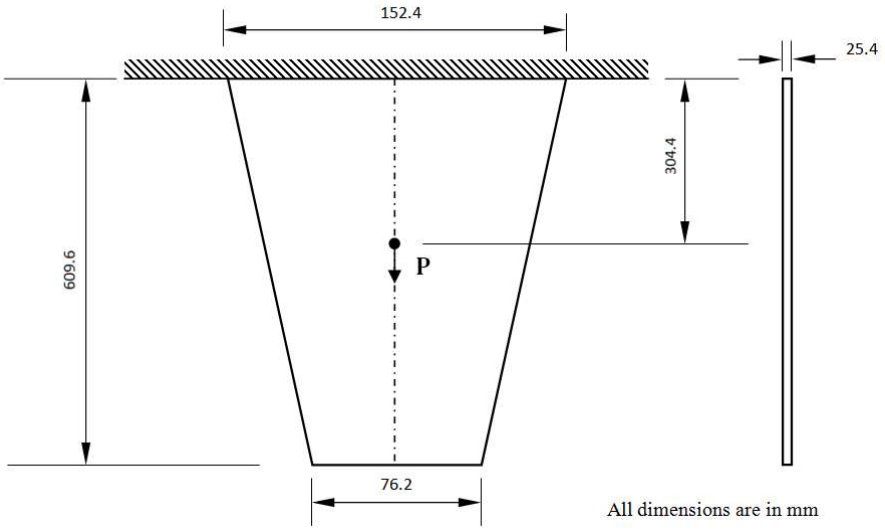


Figure 1

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

PROCEDURE

1. Create keypoints

Command : POINT,ADD

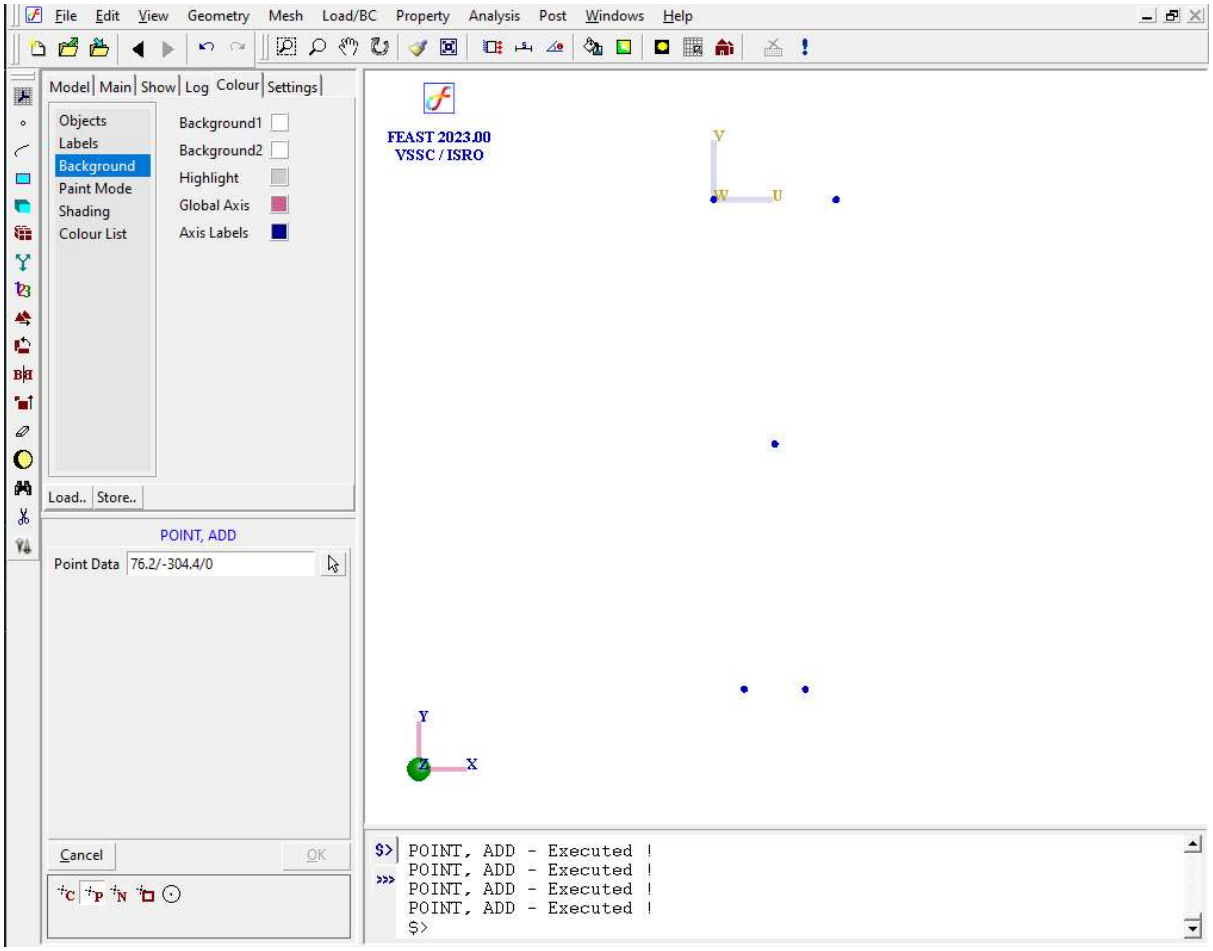
Menu : Geometry →Keypoint→ Create →Add

Parameters :

Point Data	0/0/0

Similarly create key points at (152.4/0/0), (114.3/-609.6/0), (38.1/-609.6/0) and (76.2/-304.4/0)

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



2. Create curve

Command :CURVE,LINE

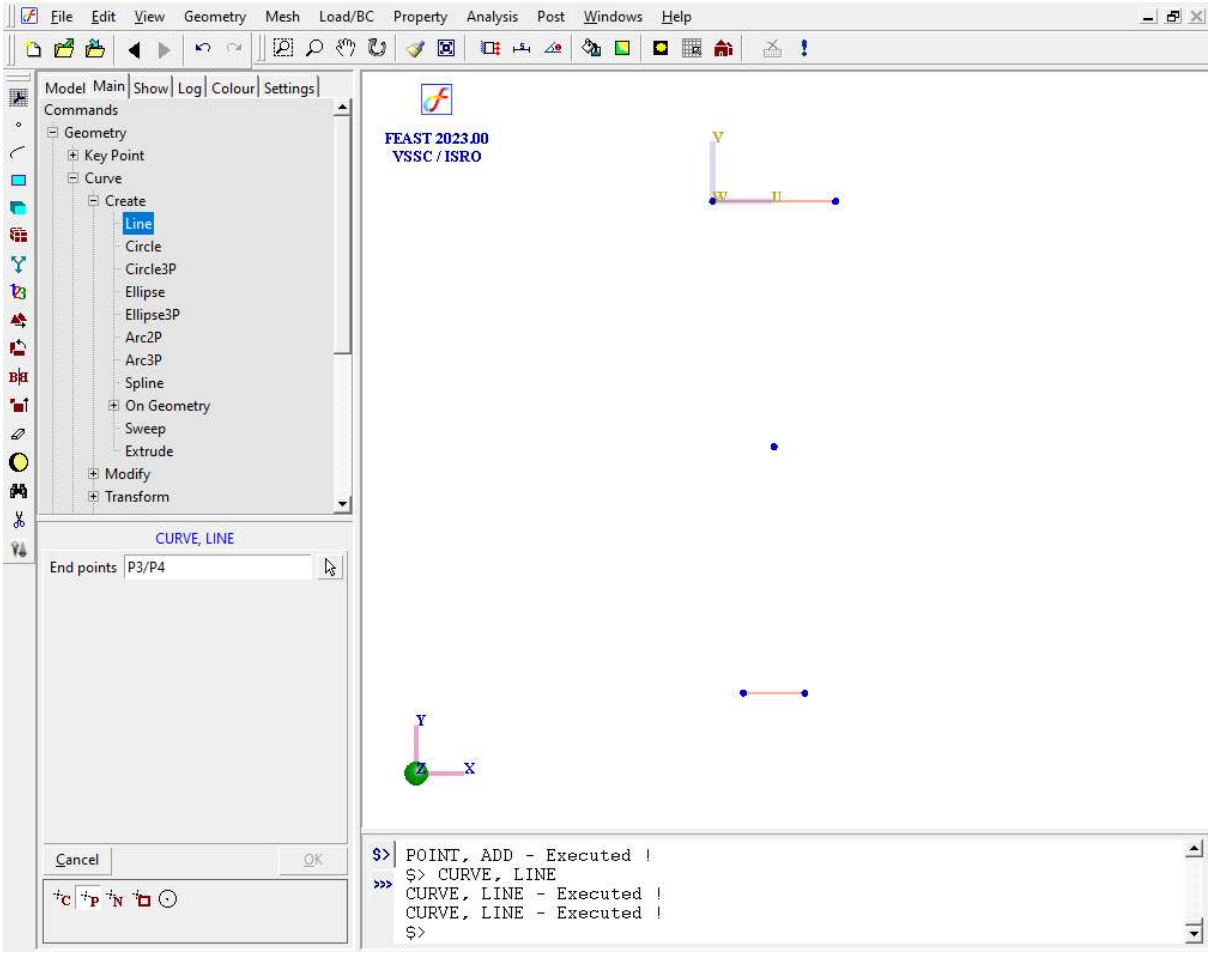
Menu : Geometry →Curve→ Create →Line

Parameters :

End points	P1/P2

Similarly create cure with points P3 and P4

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



3. Create surface

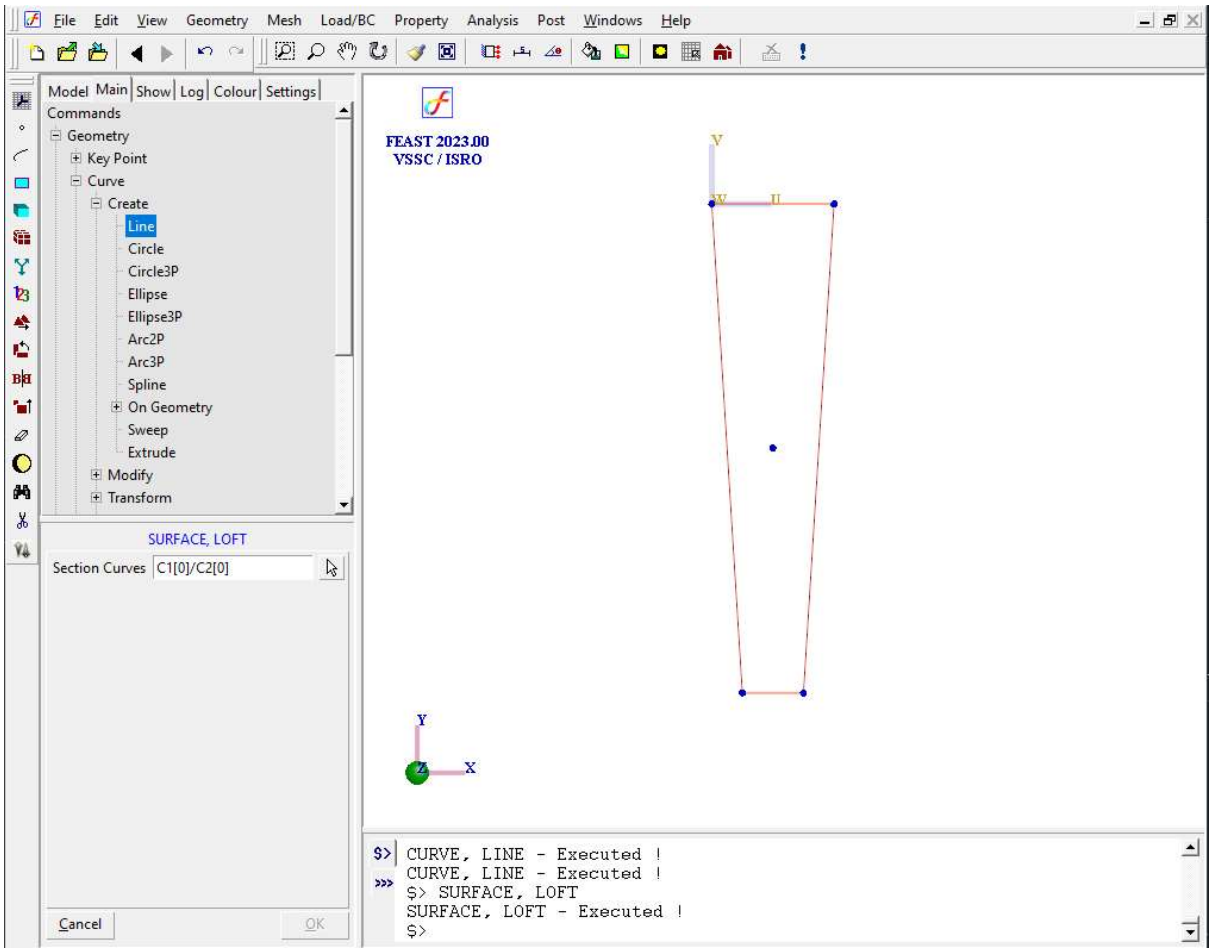
Command :SURFACE,LOFT

Menu : Geometry→Surface →Create →On Geometry→ Loft

Parameters :

Section Curves	C1/C2

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



4. Generate mesh

Command :MESH,QUAD

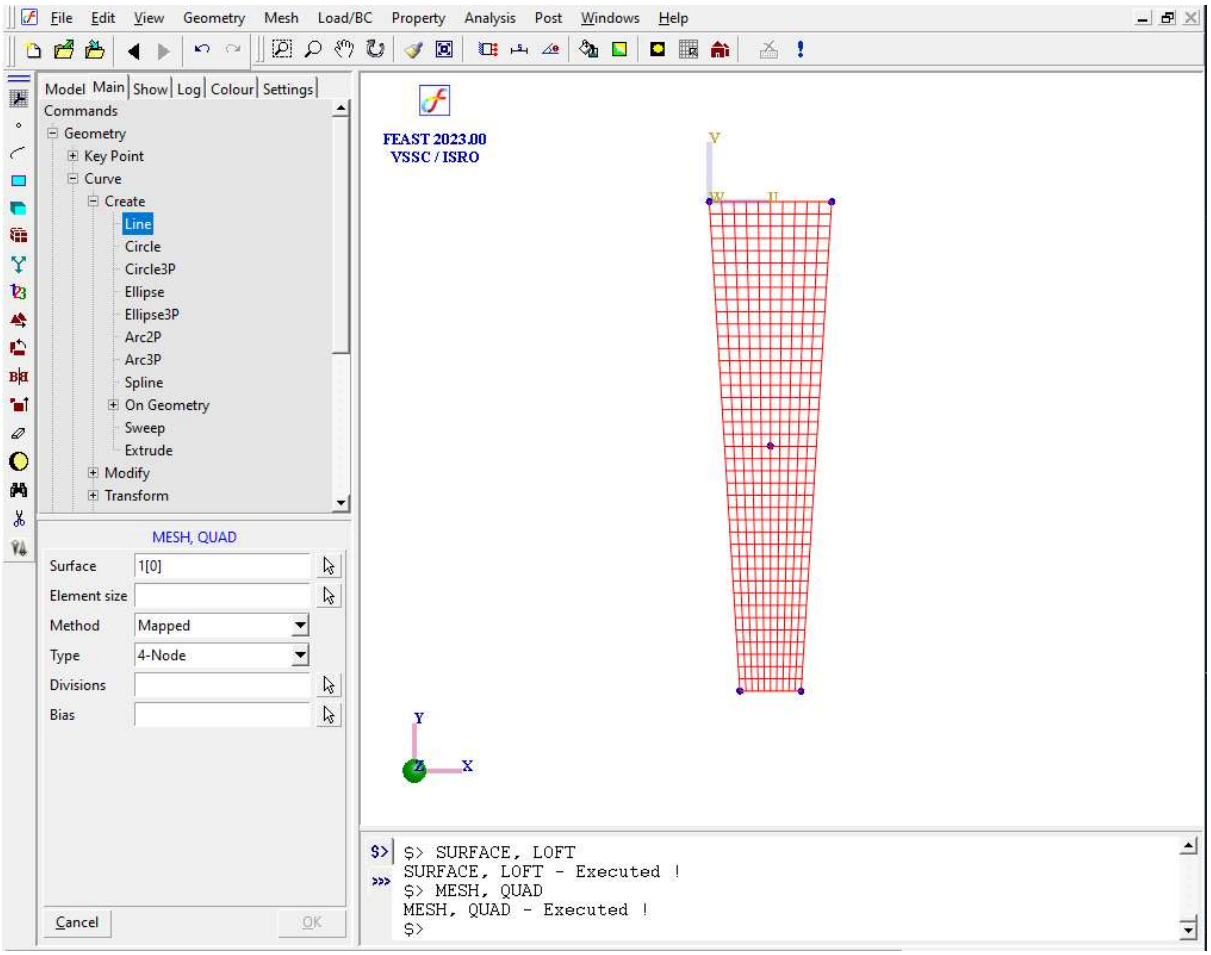
Menu : Mesh→MeshGen→QUAD

Parameters :

Surface	1 (Pick the surface from the screen)
Element Size	Click on two points on the surface edge to give
Method	Mapped
Type	4-Node
Divisions	Adjust the number of divisions on each edge by clicking on the edge
Bias	

Note : **Make sure that a node is created at the point P5**

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



5. Erase curve

Command : CURVE,ERASE

Menu : Geometry → Curve → Miscellaneous → Erase

Parameters :

List of curves	(Type in the curve ID or pick the curve after clicking the arrow in the surface ID box)

Similarly erase the surface using the command (SURFACE,ERASE)

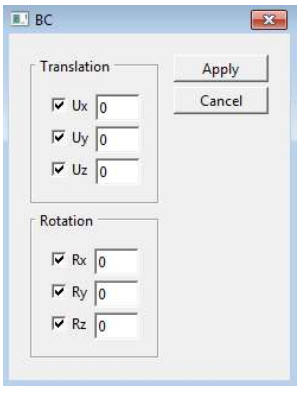
6. Apply boundary condition

Command : DISPBC,ADD

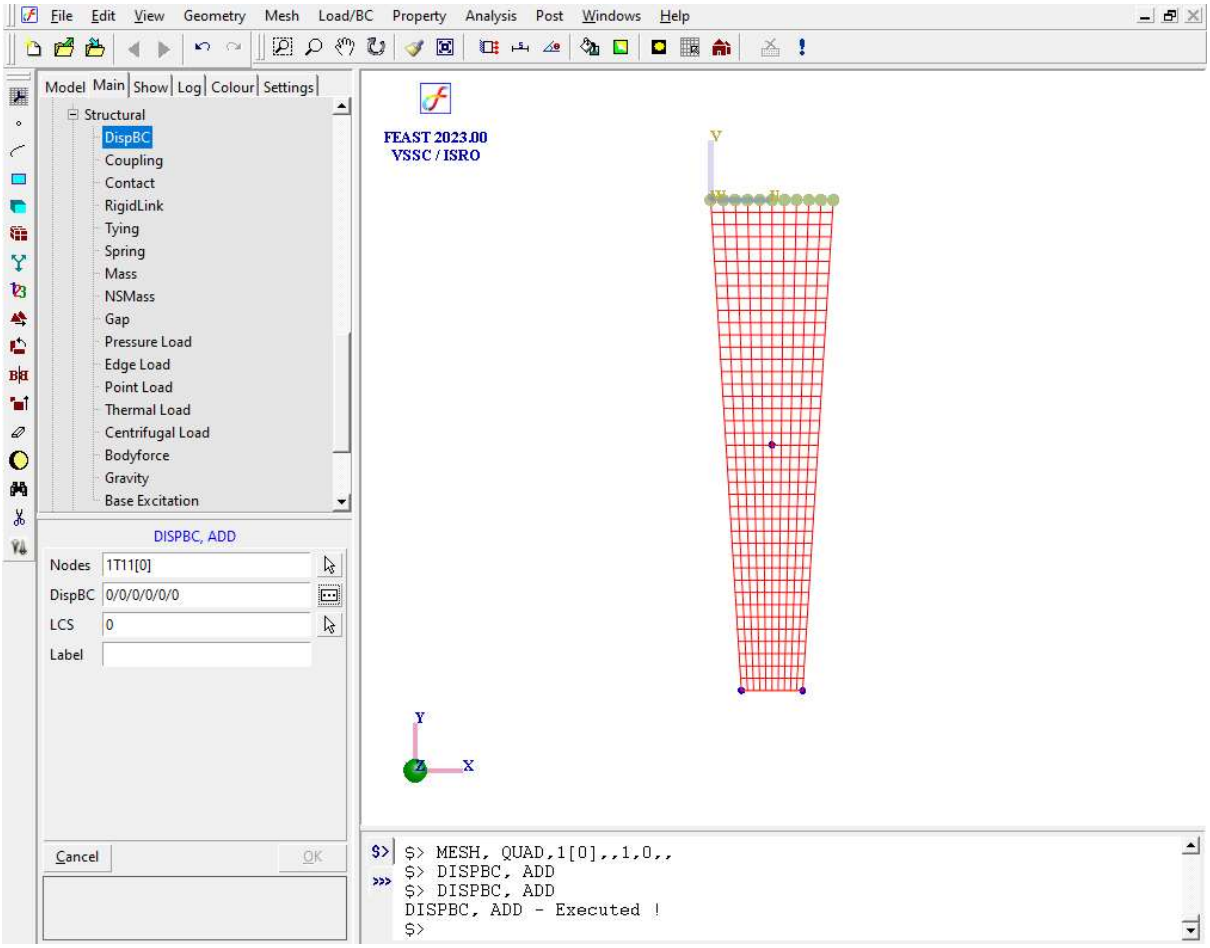
Menu : Load/BC →Structural→DispBC

Parameters:

Nodes	(Select all nodes at Y = 0)
DispBC	0/0/0/0/0/0



LCS	
Label	



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

7. Specifymaterial property

Command: MATERIAL, ISOTROPIC

Menu : Property → Material →Structural→Isotropic

Parameters :

Elements	(Select all the elements)
Young's Modulus	206843
Nu	0.3
Density	7.85E-09
Alpha	
Label	

8. Specify thickness

Command: THICKNESS, ADD

Menu : Property → Physical →Thickness

Parameters :

Elements	(Select all the elements)
Thickness	25.4
Label	

9. Specify load

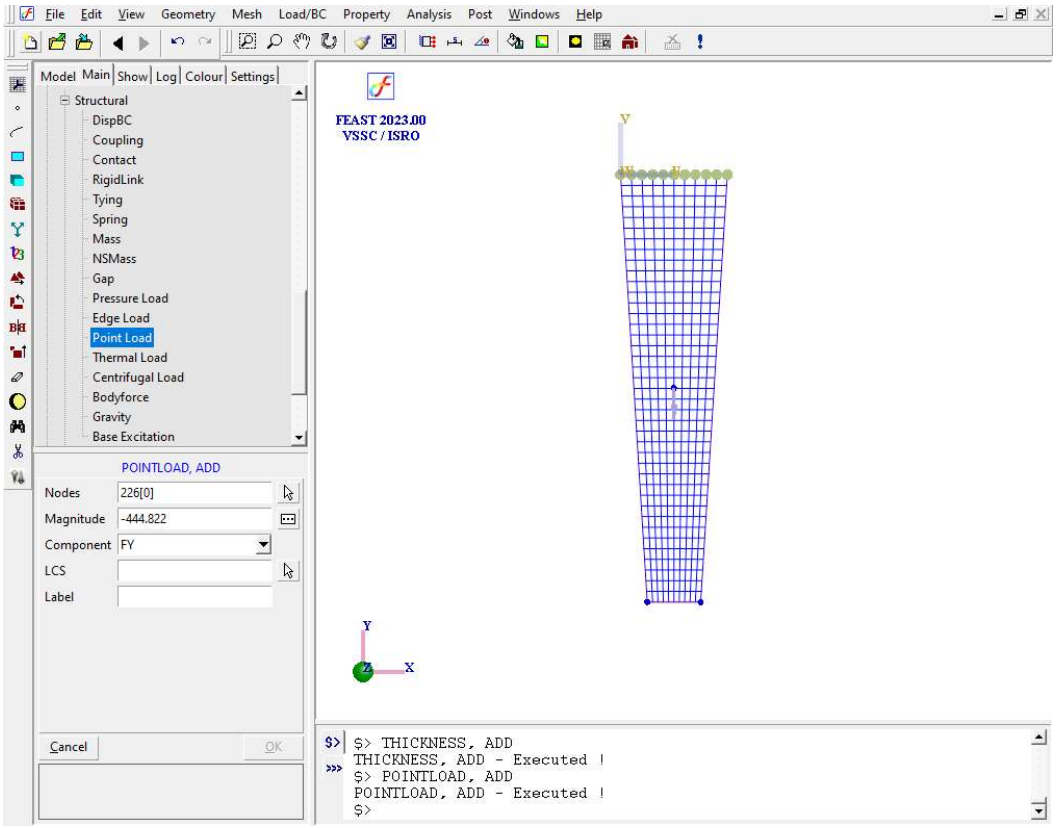
Command:POINTLOAD,ADD

Menu : Load/BC→Structural→Point Load

Parameters :

Nodes	(Pick the node at point P5)
Magnitude	-444.822
Component	Fy
LCS	0
Label	

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



10. Specify self weight

In order to specify the body force an acceleration of '1g' is applied to the model.

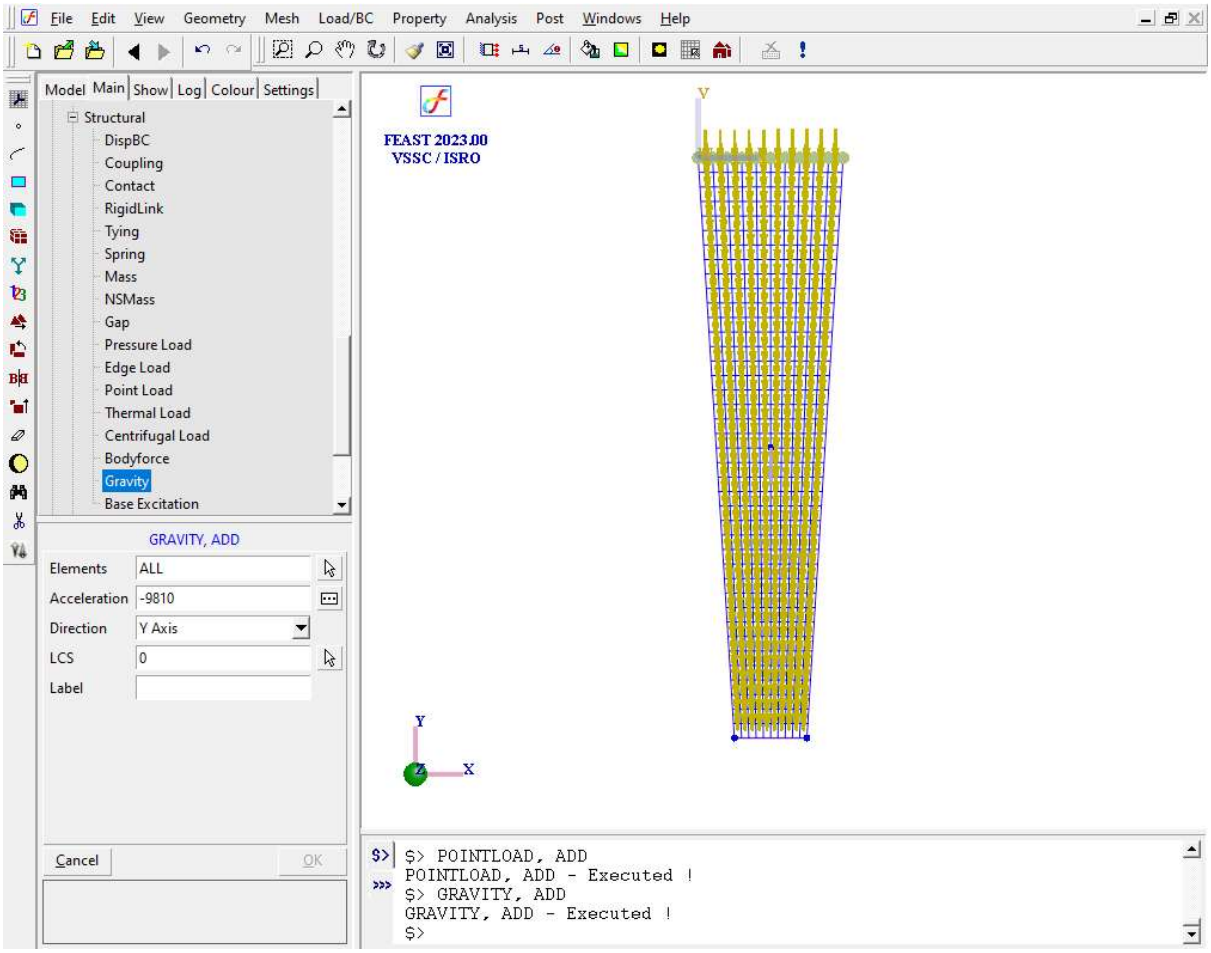
Command :GRAVITY,ADD

Menu : Load/BC →Structural→Gravity

Parameter :

Elements	(Select all the elements)
Acceleration	-9810
Direction	Y Axis
LCS ID	0
Label	

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



11. Set analysis type

Command : ANTYPE,ADD

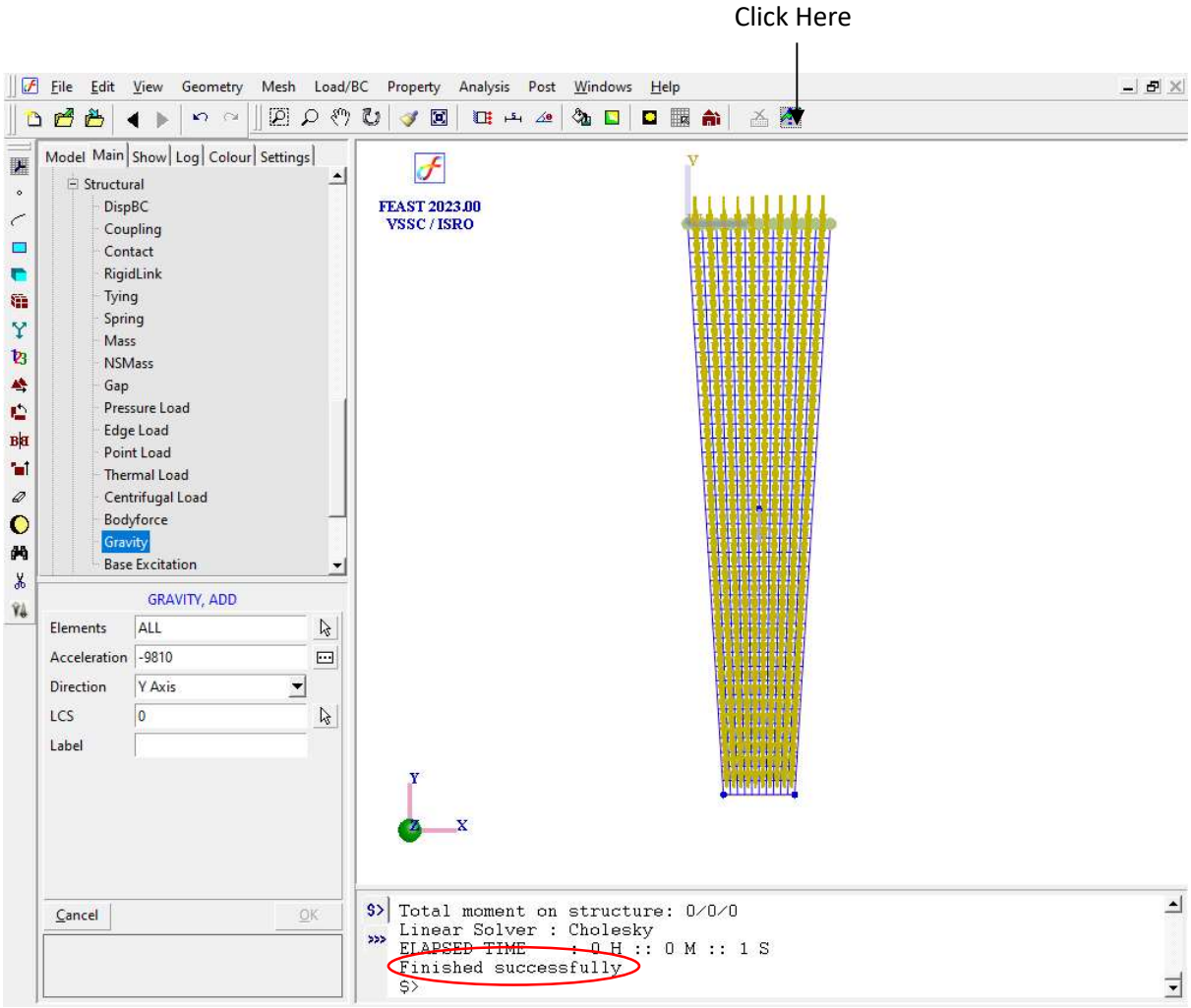
Menu : Analysis →Analysis Type

Parameter :

Analysis Types	Static

12. Submit the job in to FEAST

Click *Run Solver* button



After the solution gets completed, *"Finished successfully"* message appears in the message box.

13. Perform Post Processing

i) Displacement

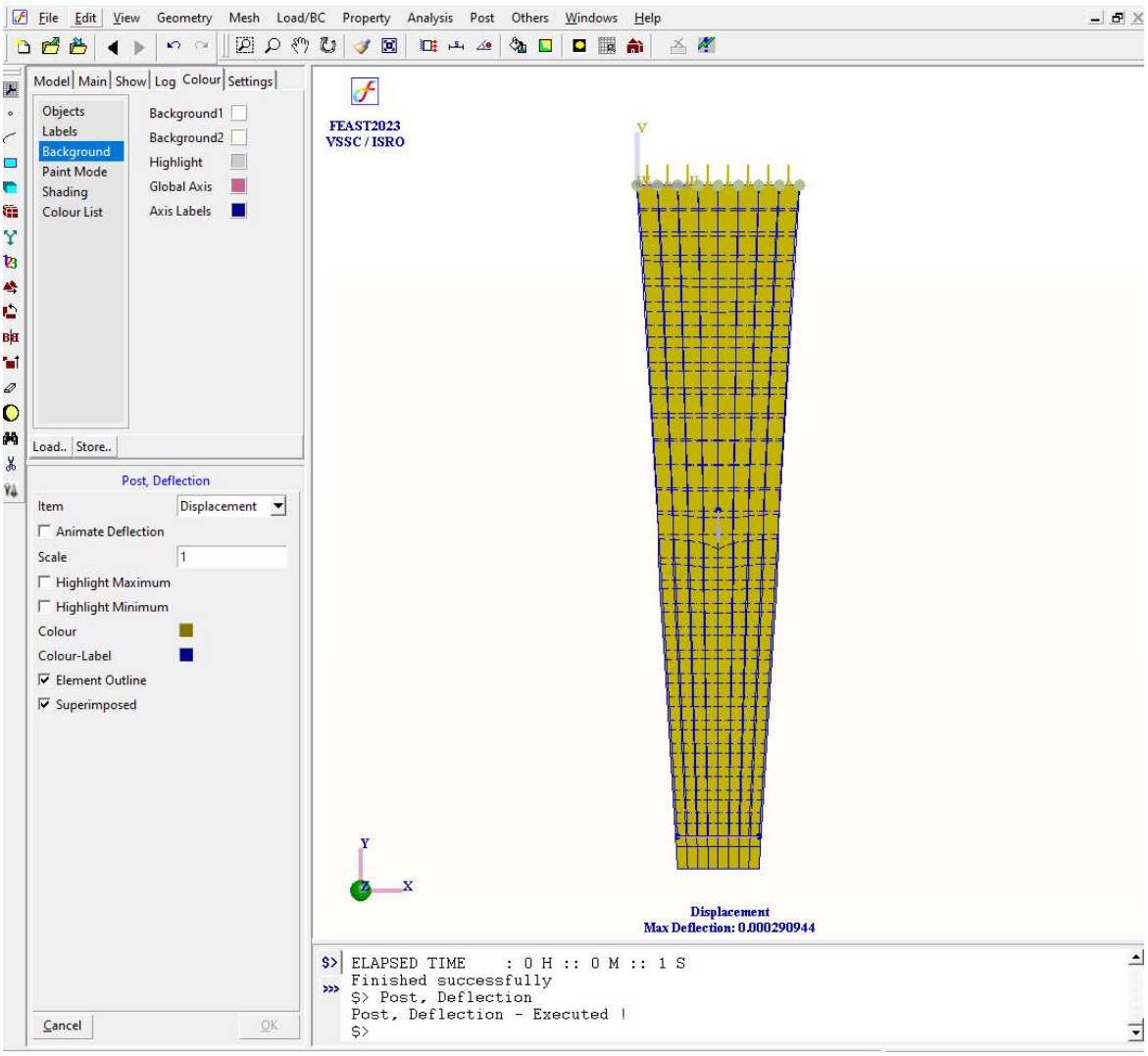
Command:POST,DEFLECTION

Menu : Post →Deflection

Parameters:

Item	Displacement

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



ii) Reaction force.

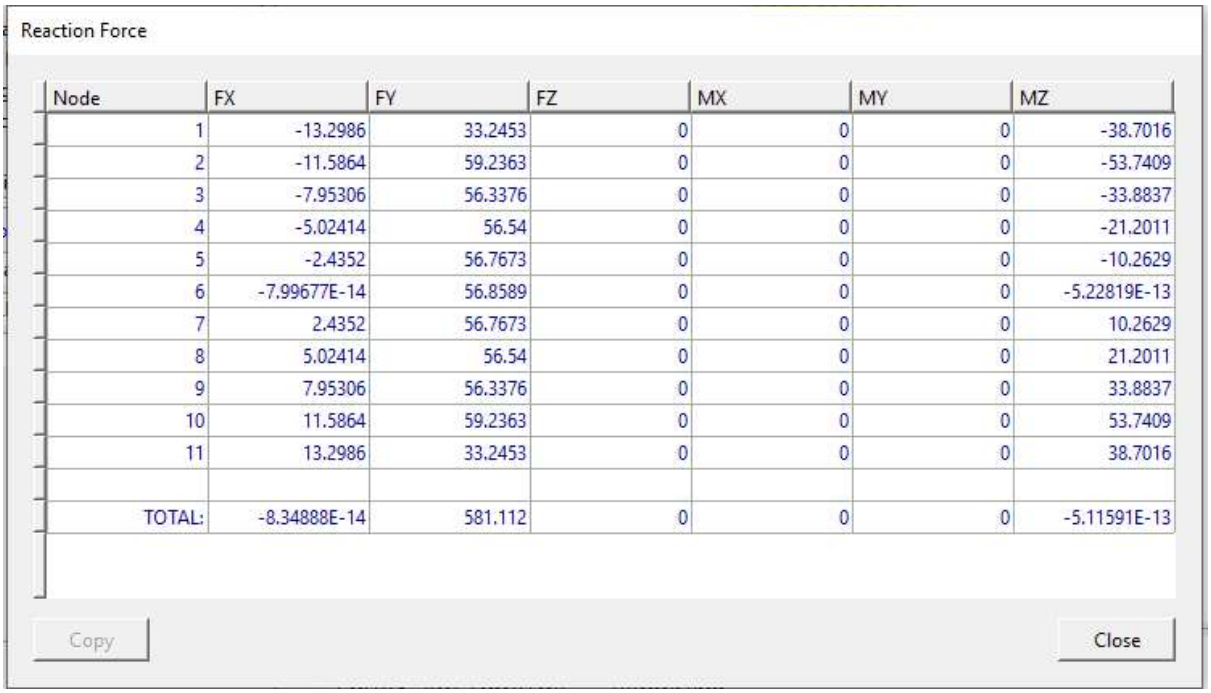
Command: POST,TABLEVIEW

Menu : Post → View Table

Parameters:

Item	Reaction force
Nodes	ALL
LCS	
Components	

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



Reaction Force

Node	FX	FY	FZ	MX	MY	MZ
1	-13.2986	33.2453	0	0	0	-38.7016
2	-11.5864	59.2363	0	0	0	-53.7409
3	-7.95306	56.3376	0	0	0	-33.8837
4	-5.02414	56.54	0	0	0	-21.2011
5	-2.4352	56.7673	0	0	0	-10.2629
6	-7.99677E-14	56.8589	0	0	0	-5.22819E-13
7	2.4352	56.7673	0	0	0	10.2629
8	5.02414	56.54	0	0	0	21.2011
9	7.95306	56.3376	0	0	0	33.8837
10	11.5864	59.2363	0	0	0	53.7409
11	13.2986	33.2453	0	0	0	38.7016
TOTAL:	-8.34888E-14	581.112	0	0	0	-5.11591E-13

Copy Close

iii) Stress contour

Command : POST, CONTOUR

Menu : Post →Contour

Parameters:

Item	Stress
Surface	Top
Component:stress	vonMises
LCS	
Restrict To	
Contour Type	Band
No. of Contours	9
Decimal Places	2

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