



FREE VIBRATION ANALYSIS OF A COMPOSITE RECTANGULAR PLATE

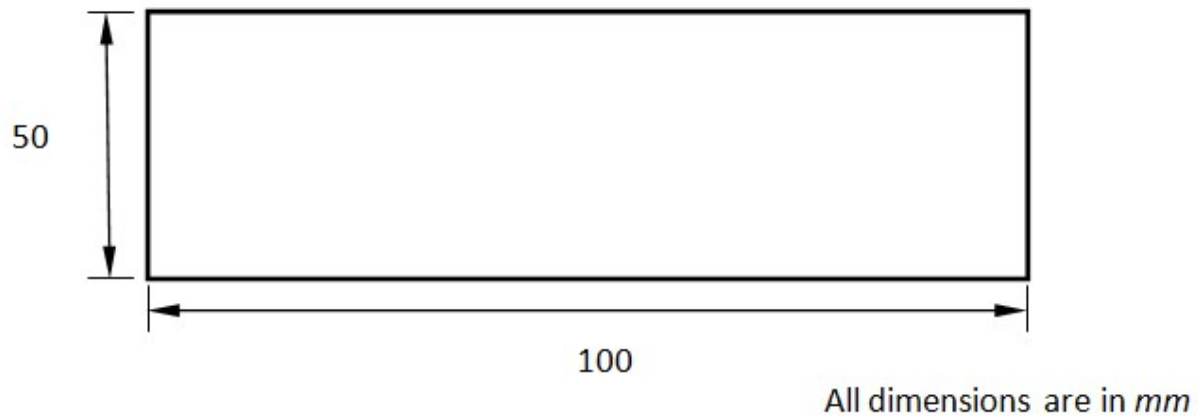


Figure 1

Objective: Compute the first 20 eigen values of a three layer composite plate shown in Figure 1 of lamina thickness 1/2/1, lamina angle $0^\circ/90^\circ/0^\circ$ for the given material property.

Material property

$E_{11}=7E+4$, $E_{22}=E_{33}=5E+3$, $\nu_{12}=\nu_{23}=0.2$, $\nu_{13}=0.3$, $G_{12}=2E+3$, $G_{13}=G_{23}=1E+3$



PROCEDURE

1. Create keypoints

Command :POINT,ADD

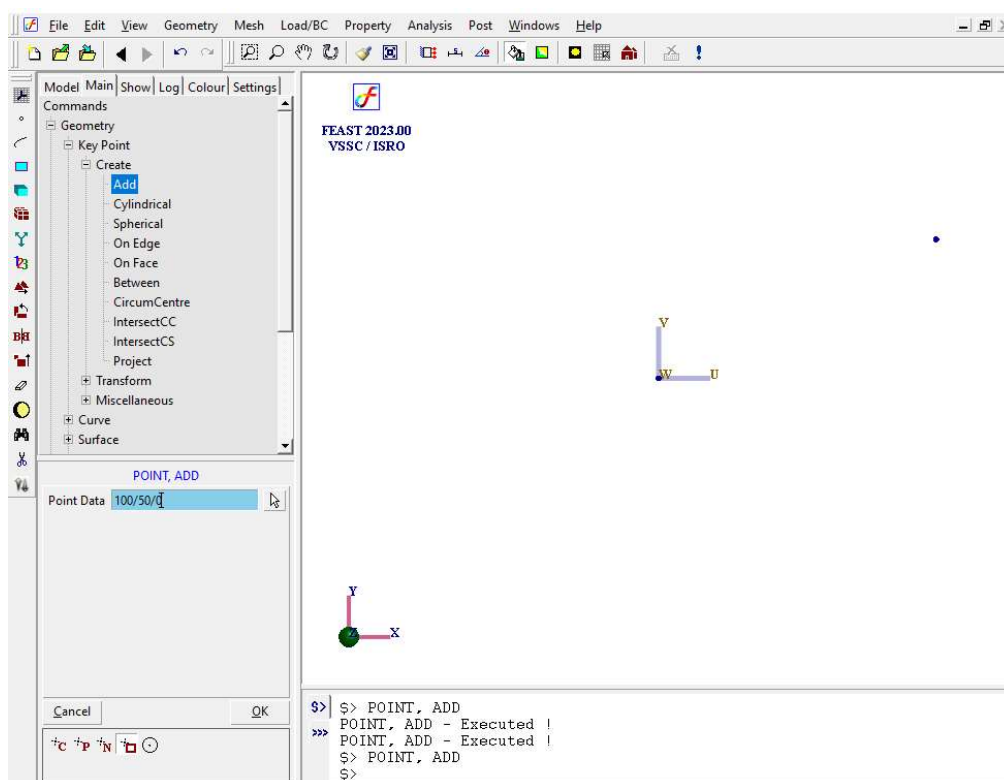
Menu : Geometry →Keypoint→ Create →Add

Parameters :

Point Data	0/0/0
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Similarly create key points at (100/50/0)

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





2. Create surface

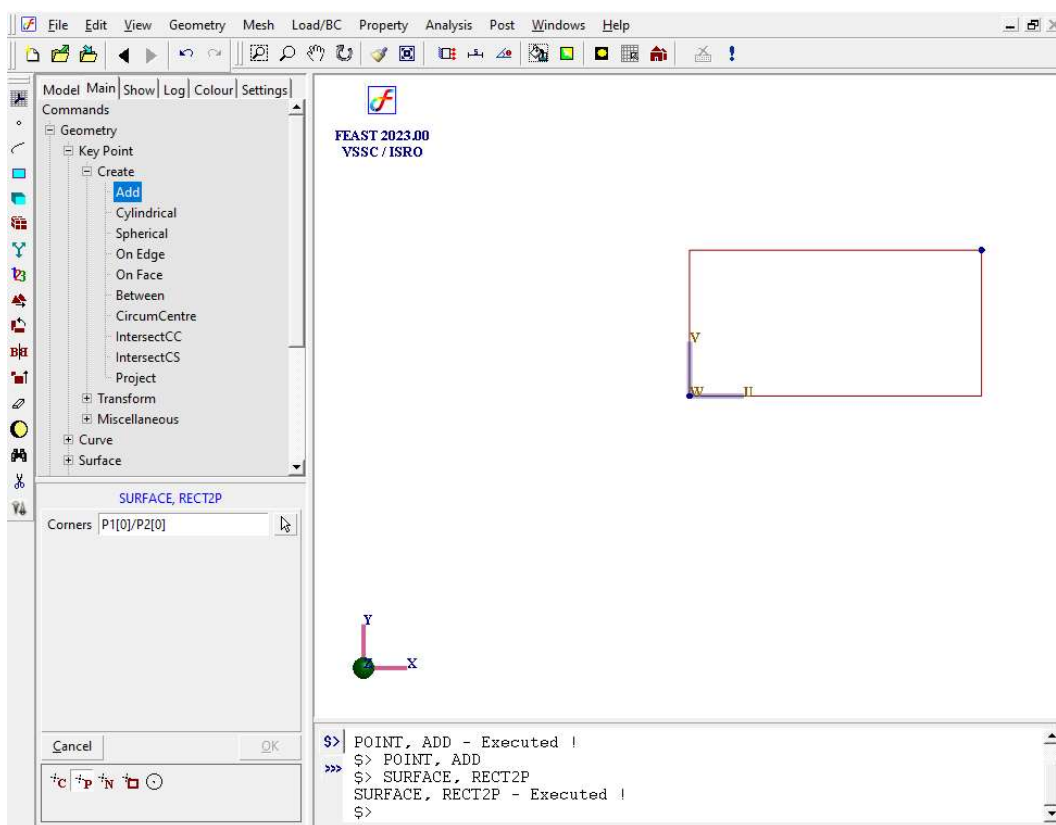
Command :SURFACE, RECT2P

Menu : Geometry → Surface → Create → Rect2P

Parameters:

Corners	Select the points P1 and P2 using the filter options above parameter box. 
Output ID	

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





3. Generate mesh

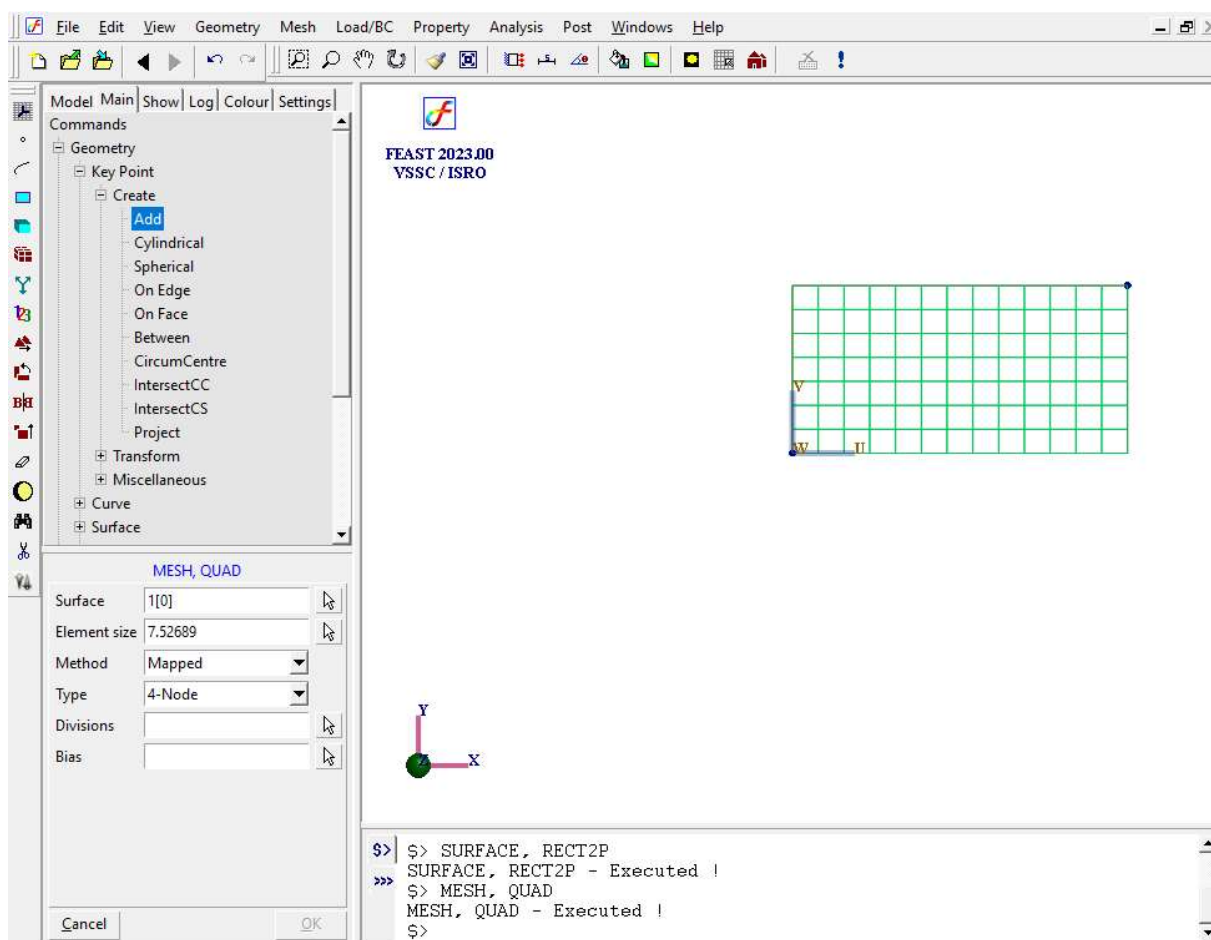
Command: MESH, QUAD

Menu : Mesh→MeshGen→QUAD

Parameters:

Surface	Select the surface created
Element Size	7.52689
Method	Mapped
Type	4-Node
Divisions	Right/left click on surface edge to alter the subdivisions
Bias	

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





4. Assignmaterialproperty

Command:MATERIAL,ORTHOTROPIC

Menu : Property→Material→Structural→Orthotropic

Parameters:

Elements	
Longitudinal modulus	70000
Transverse modulus	5000
Normal Modulus	5000
NuL-T	0.2
NuL-N	0.3
NuT-N	0.2
Density	2.8E-09
Alpha L	0
Alpha T	0
Alpha N	0
Shear Modulus L-T	2000
Shear Modulus L-N	1000
Shear Modulus T-N	1000
Tensile Strength L	0
Compressive Strength L	0
Tensile Strength T	0
Compressive Strength T	0
In plane Shear Strength	0
Tsai-Wu Coefficient	0
Label	

Note:

**Do not specify any Element IDs here.

5. Specifythicknessfor layers

Command:THICKNESS, ADD

Menu : Property →Physical →Thickness



Parameters:

Elements	
Thickness	1 
Label	Layer 1 & 3

Note:

**Here also do not specify the element ID's.

Create another set of thickness data with thickness value 2mm for second layer.

6. Specify material angle

Command: MATANGLE, ADD

Menu : Property → Physical → Material Angles

Parameters:

Angle	0
Reference	Element edge
LCS	
Label	Angle1

Note:

**Create another set of material angle with value 90 for second layer.

Verify whether two set of material angle values were defined in 'Edit' option.

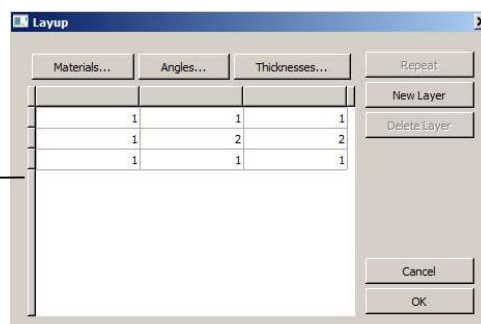
7. Create layup details

Command : MATERIAL, LAYERED

Menu : Property → Material → Structural → Layered

Parameters :

Elements	Select all the elements for which the layup data are specified
Layup Data	1/1/1/1/2/2/1/1/1 
Label	



Now the composite layer definition is done.



8. Set Analysis Type

Command :ANTYPE, ADD

Menu : Analysis→Analysis Type

Parameters :

Analysis Types	Free Vibration
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9. Set free vibration general data

Command:FREEVIBGEN, ADD

Menu : Analysis →Free Vibration→ General

Parameters:

Mode Extraction	Number of modes
Number of modes	20
Mass Option	Lumped
Effective Mass	No

10. Save the project model

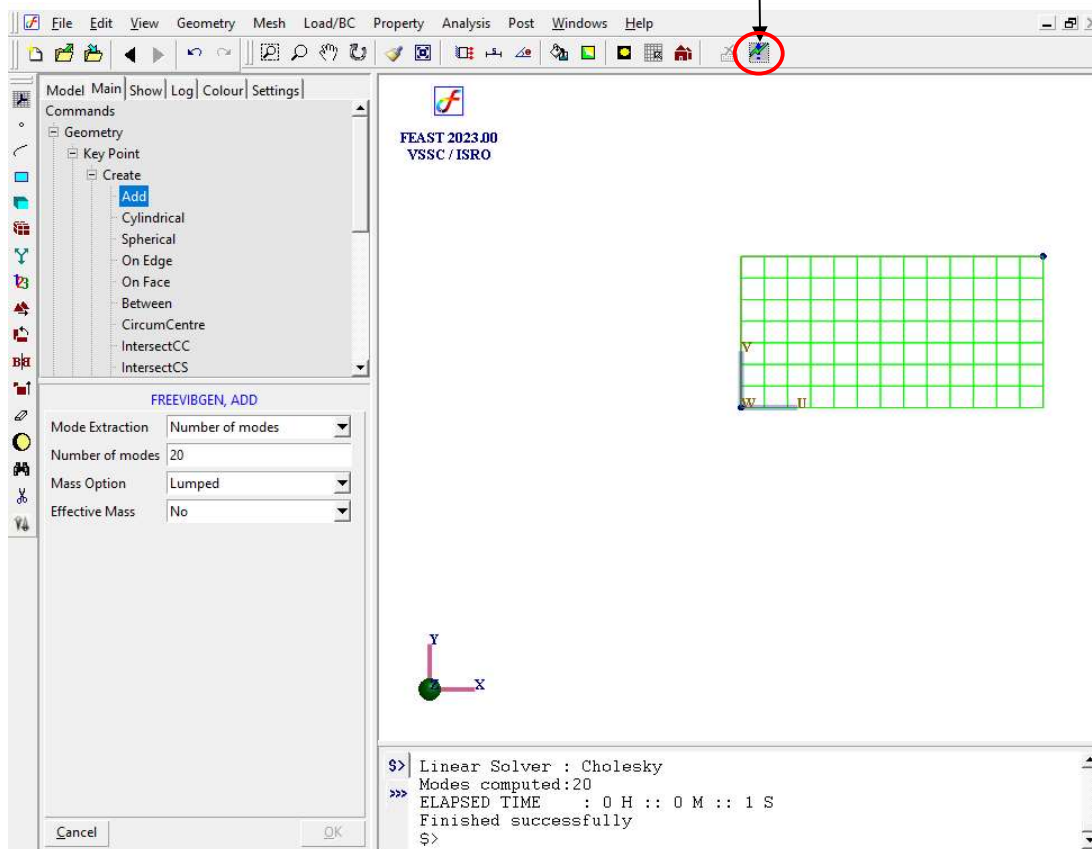
Menu:File →Save

11. Activate FEAST solver

Click *Run Solver* button



Click here



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

12. Perform Post Processing

i) View result. Frequency

Command:POST, TABLEVIEW

Menu : Post→ View Table

Parameters:

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

Frequency

Mode	Frequency(Hz)
1	0
2	0
3	0
4	0
5	4.82168e-05
6	0.000142483
7	644.488
8	1564.01
9	1857.39
10	2867.19
11	3009.39
12	3095.58
13	3286.79
14	3542.3

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