

Modal frequency response analysis of a cantilever plate subject to harmonic pressure load using FEAST^{SMT}

Objective

- To model an isotropic rectangular plate with dimensions as in fig 1.
- To define a harmonic pressure load of 0.1kPa normal to the plate
- To study the frequency response of the plate using FEAST^{SMT}

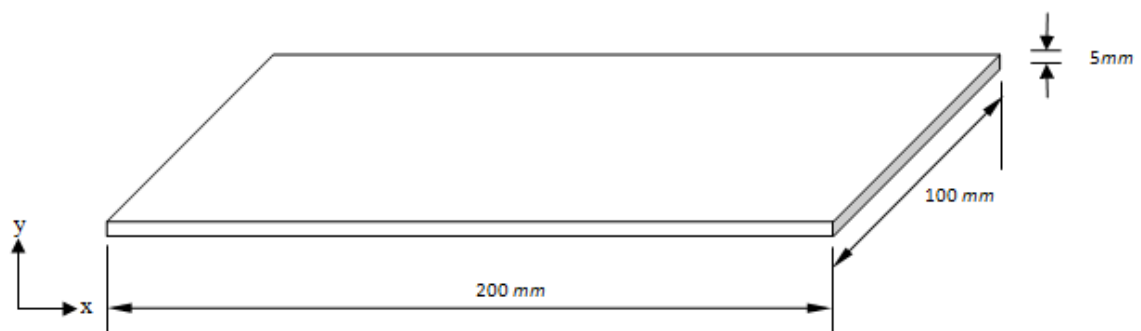


Fig 1. Isotropic rectangular plate

Problem definition

Plate dimensions are shown in the figure.

Analysis Type: Frequency response

Modulus of elasticity, E = 70000MPa

Poisson's Ratio, ν = 0.3

Specific gravity = 2.8

Loads and boundary conditions:

- Pressure load .1kPa is applied normal to the plate.
- Left edge of the plate is assumed to be fixed.

Procedure

1. Creation of geometry

- Create 4 points at (0,0,0) (200,0,0) (0,100,0) and (200,100,0)

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	1

- Create quadrilateral surface on four points

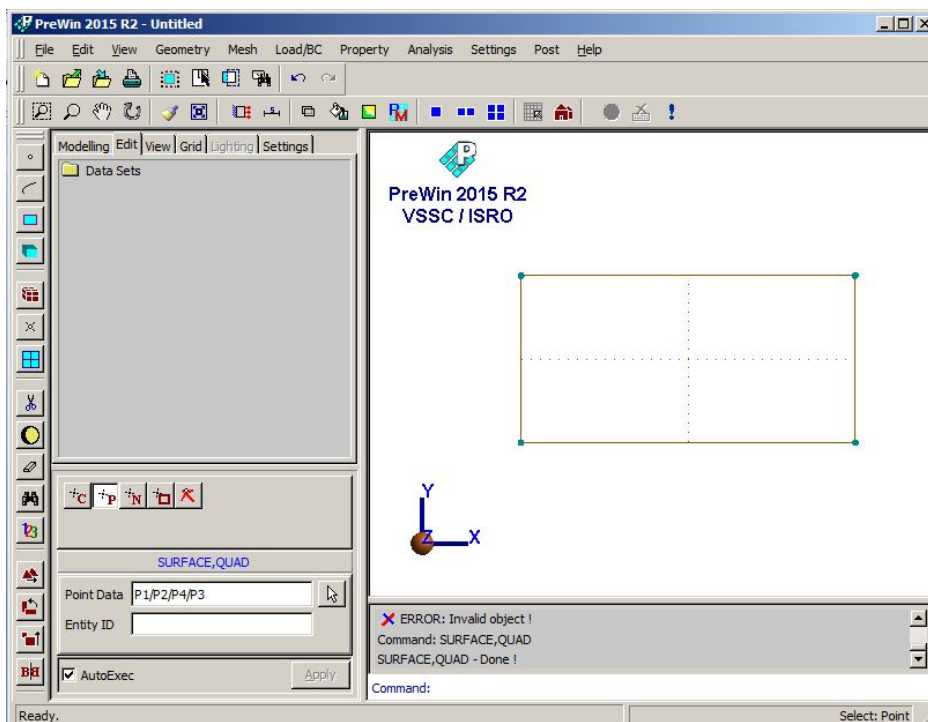
Command : SURFACE, QUAD

Menu : Geometry → Surface → Create → Quad Surface

Parameters : (To be filled by the users)

Point Data	Use mouse to pick the points
Entity ID	1

At the end of this operation, the screen looks like this.



2. Meshing using quadrilateral elements

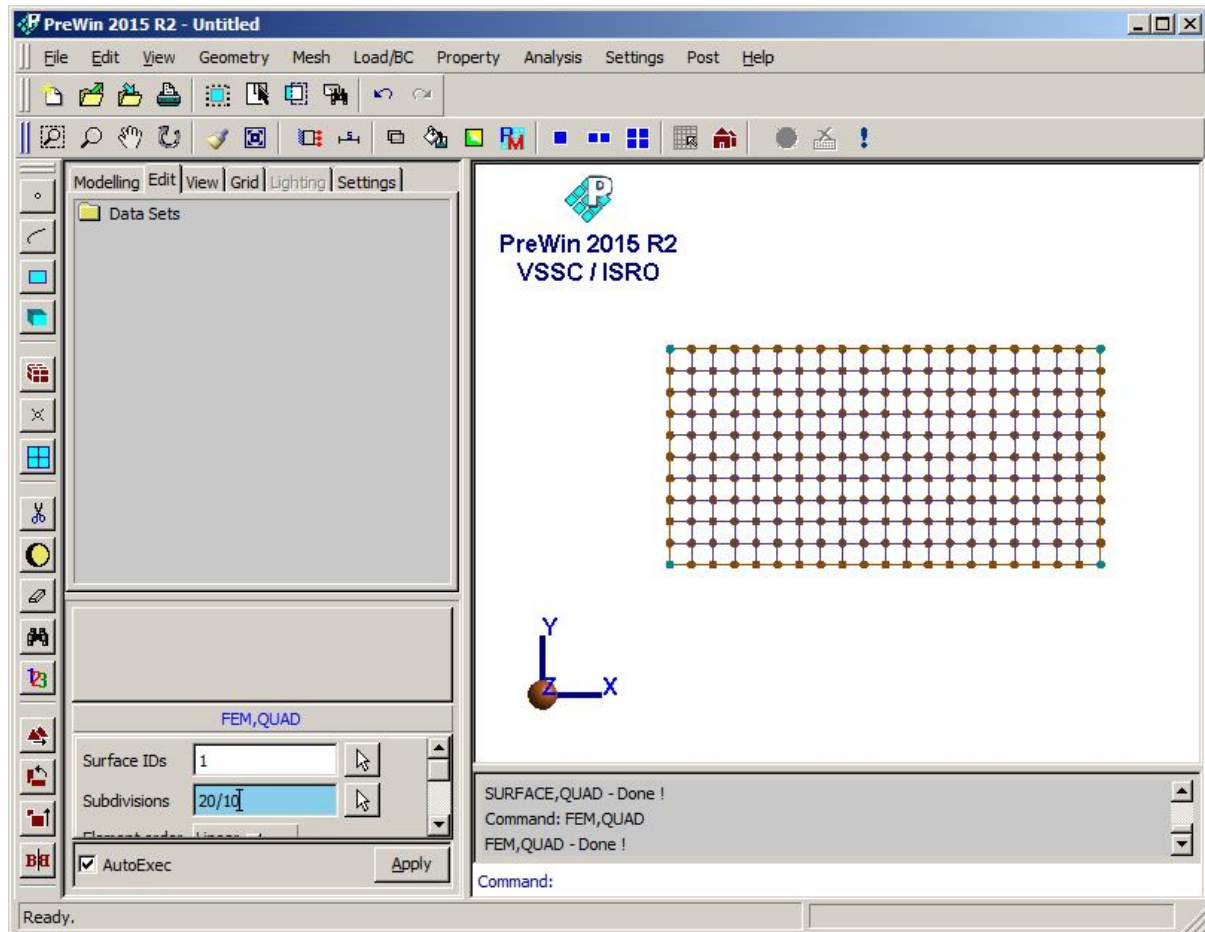
Command : FEM, QUAD

Menu : Mesh → FE Mesh → Generate QUAD

Parameters :

Surface IDs	1
Subdivisions	20/10
Element order	Linear
Bias Factors	1/1
Element IDs	
Node IDs	

At the end of this operation, the screen looks like this.

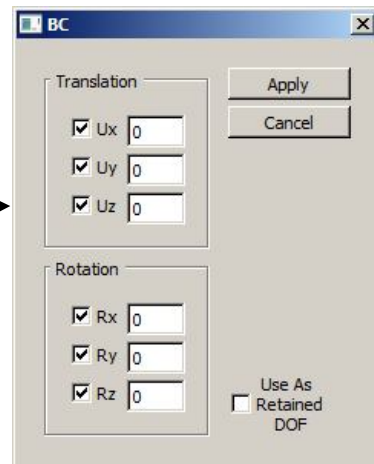


3. Specify displacement boundary conditions

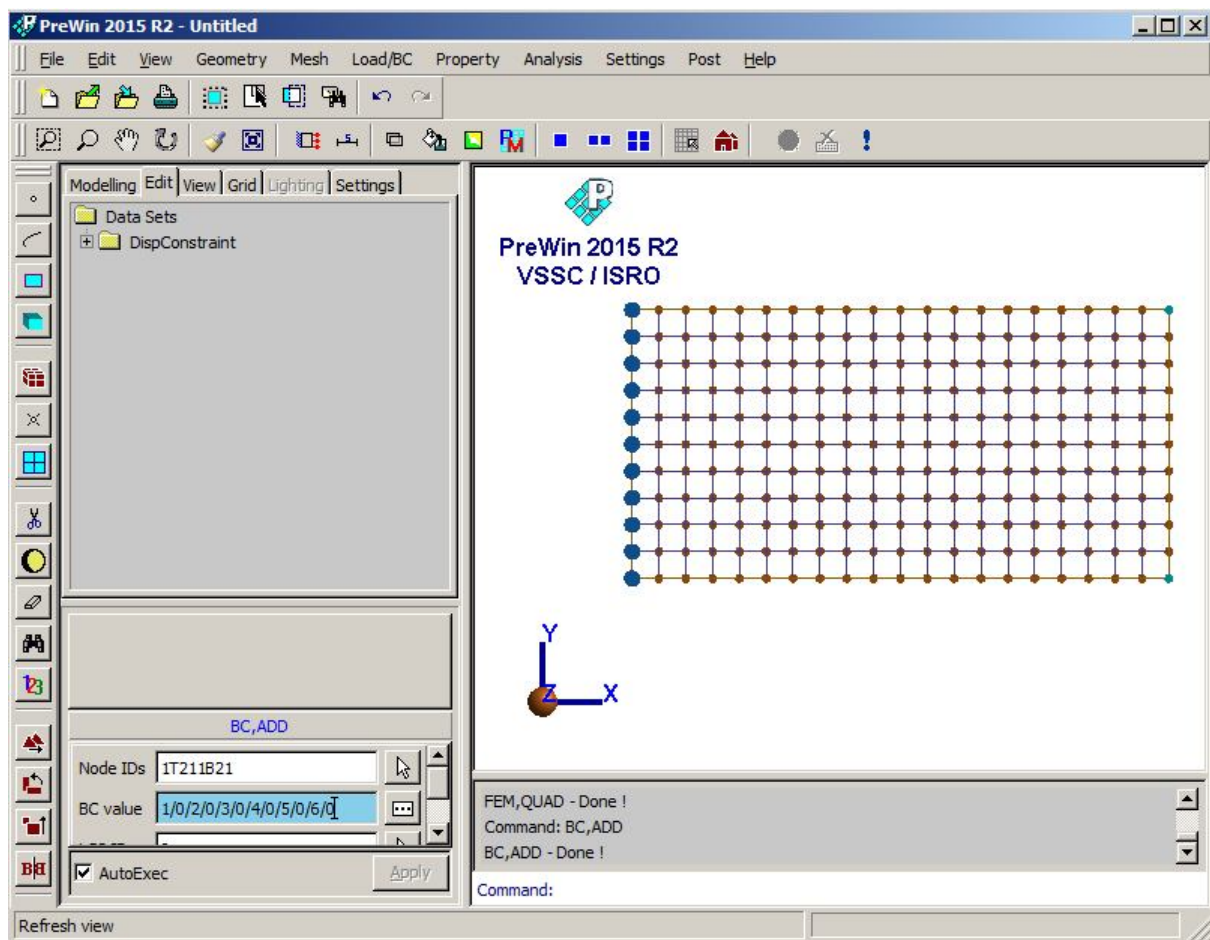
Command : BC, ADD

Menu : Load/BC → Displacement BC → Add

Node ID	Select the nodes on the left side boundary edges
BC Value	1/0/2/0/3/0/4/0/5/0/6/0
LCS ID	0
Set ID	1



At the end of this operation, the screen looks like this.



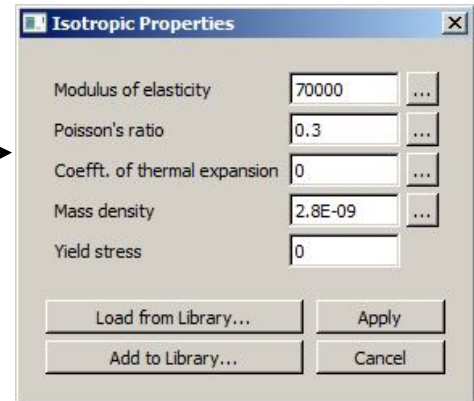
4. Specify material properties

Command : MATERIAL, ISO

Menu : Property → Material → Isotropic → Add

Parameters

Element IDs	all
Material Data	70000/0.3/0/2.8E-09/0
Material ID	1



5. Specify shell thickness

Command : THICKNESS, ADD

Menu : Property → Physical → Thickness → Add

Parameters

Element IDs	1T200
Thickness	5
Set ID	1

6. Specify pressure load

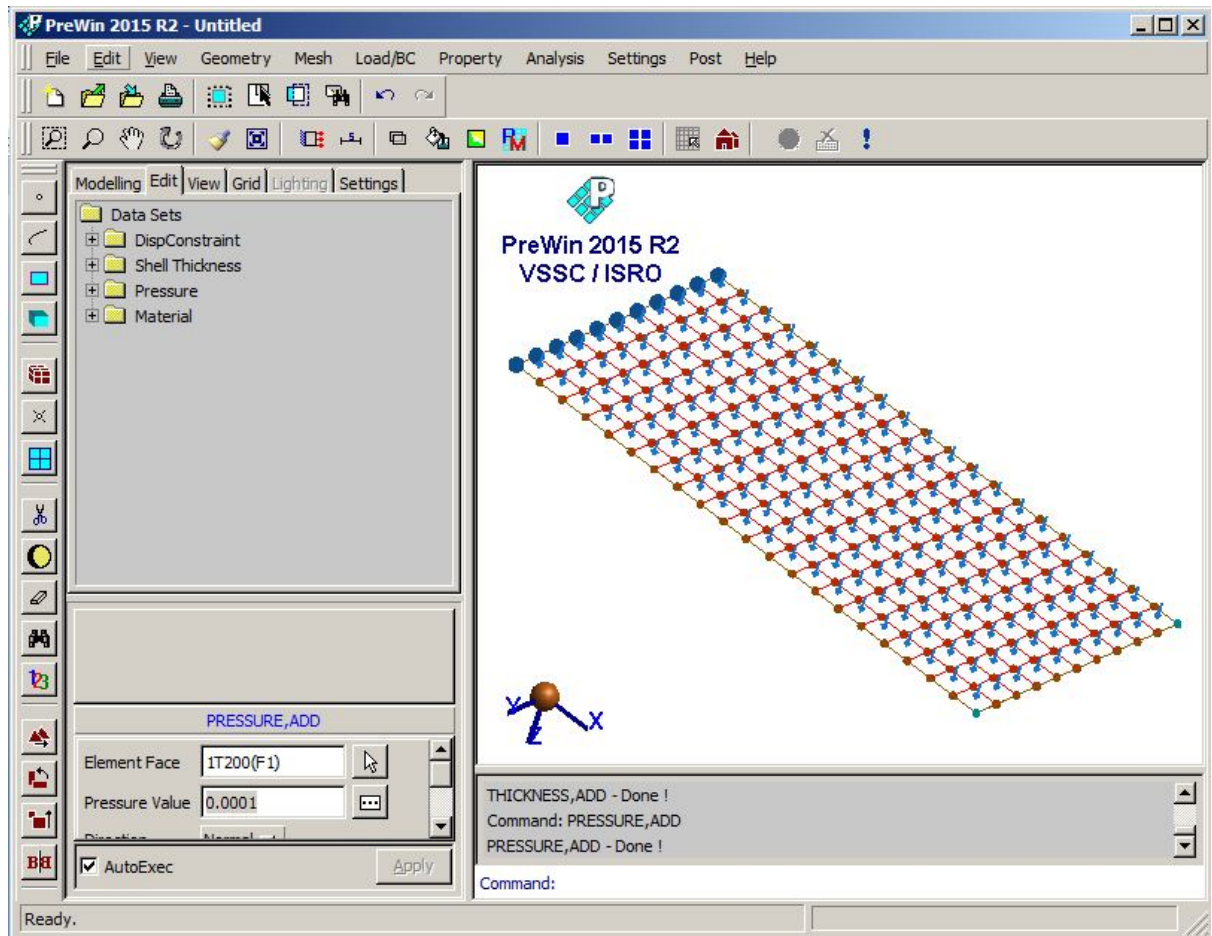
Command : PRESSURE, ADD

Menu : Load/BC → Pressure → Add

Parameters

Element face	all
Pressure value	.0001
Direction	Normal
LCS ID	0
Set ID	1

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



7. Specify analysis type

Commands : ANTYPE, SET
 Menu : Analysis → Analysis Type
 Parameters : (To be filled by the user)

Analysis Type	Frequency Response
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8. Specify analysis options

Commands : ANOPTION, SET
 Menu : Analysis → Analysis Options
 Parameters : (To be filled by the user)

Linear Solver	Multi Frontal
Eigen Solver	Lanczos

9. Specify frequency response general properties

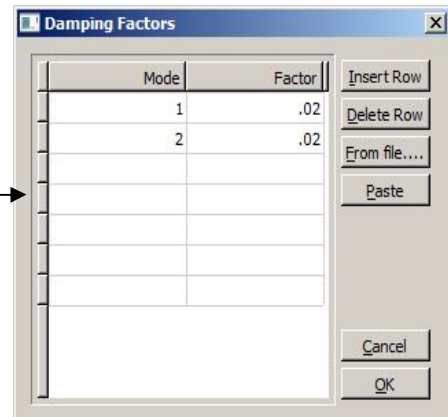
Commands : FREQGEN, ADD
Menu : Analysis →Frequency Response →General →Add
Parameters : (To be filled by the user)

No of eigen values	10
Start Frequency	1
End Frequency	1000
Finer Increment	1
Coarser Increment	10
Mass Computation	Consistent

10. Specify damping factor

Commands : EXPFRDAMP, ADD
Menu : Analysis →Frequency Response →Damping →Add
Parameters : (To be filled by the user)

Damping factors 

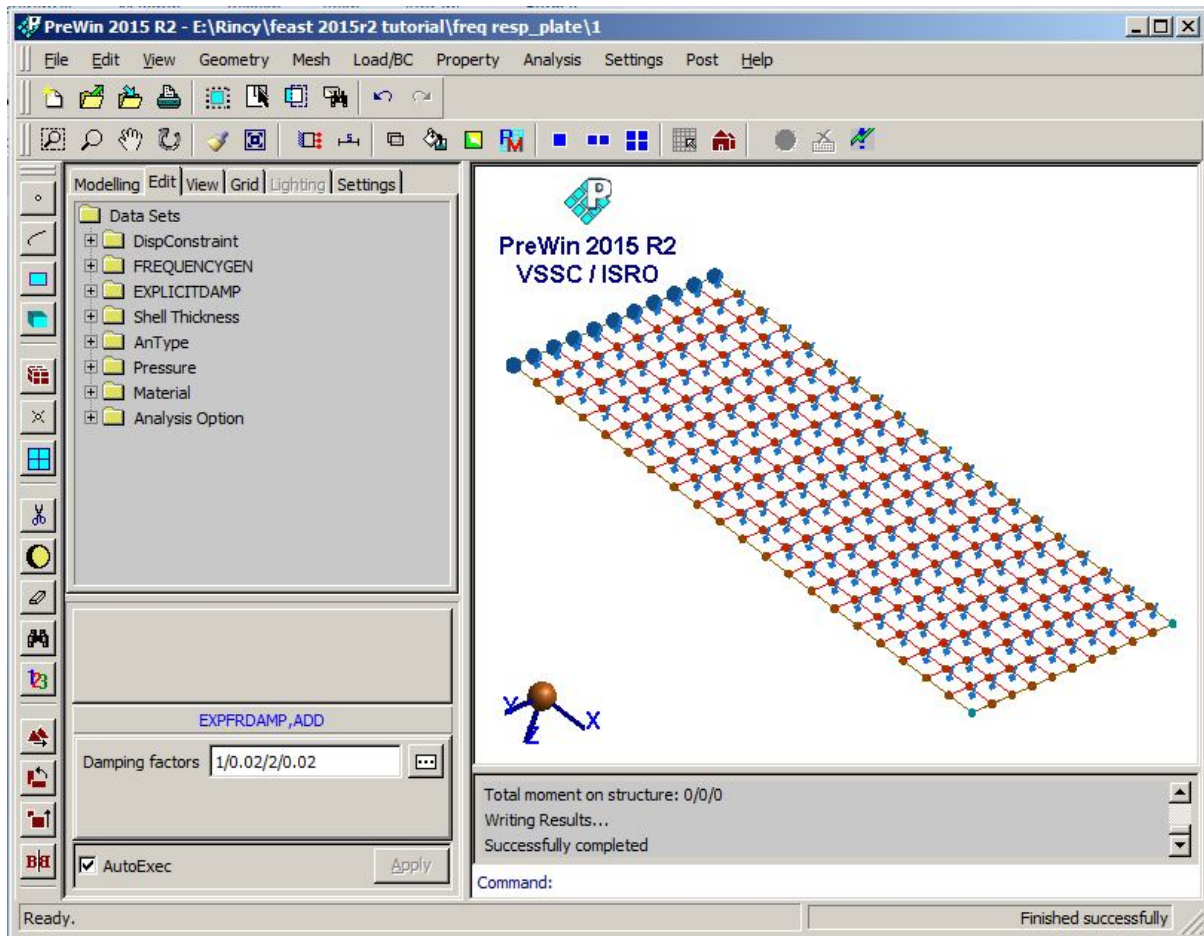


11. Save the data file

Menu : File → Save

12. Submit the job into FEAST

Menu : Analysis → Run Solver



After the solution is completed the message "successfully completed" appears in the message box.

13. Post processing

a) XY –Plot Displacement

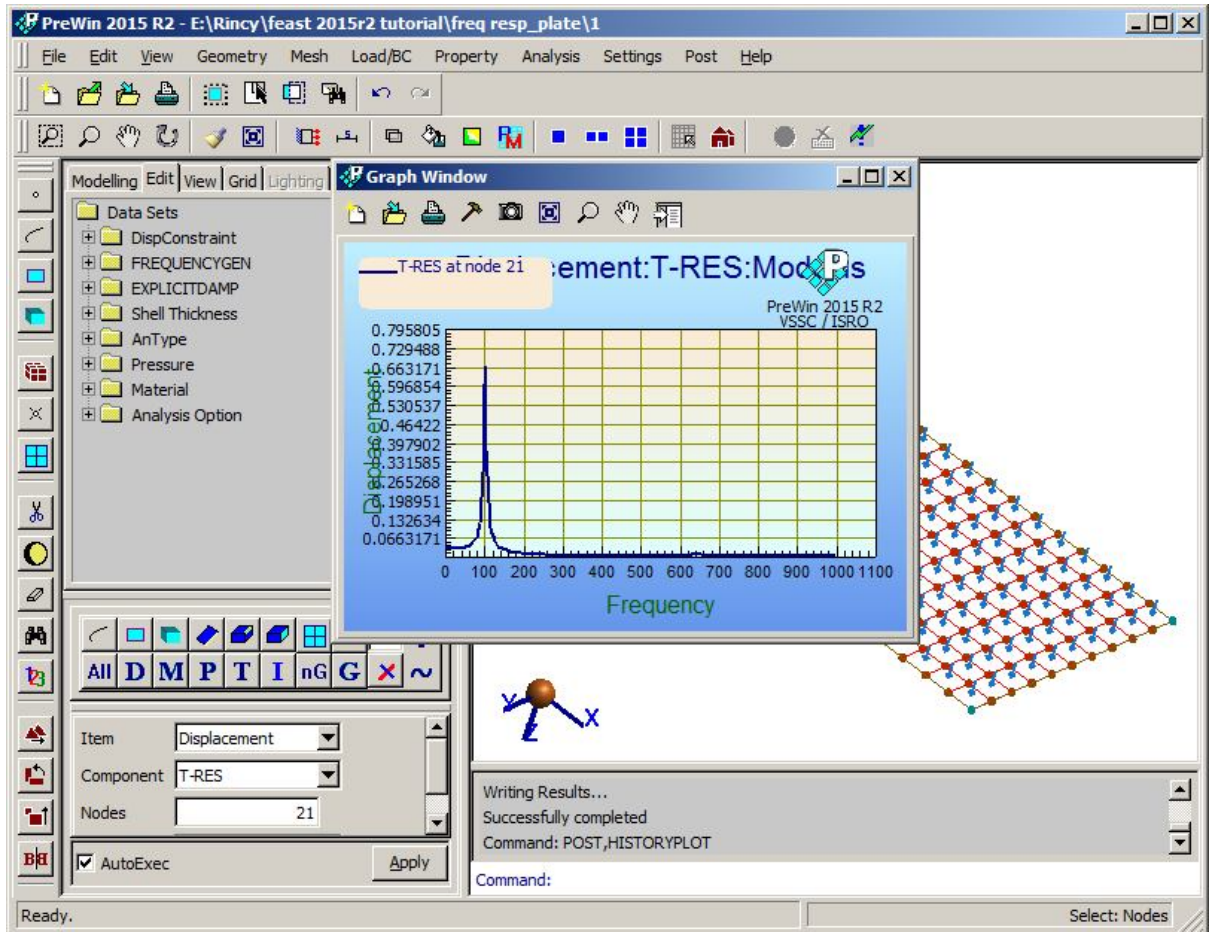
Command : POST, DISTDISP

Menu : Post → XY Plot

Parameters :

Item	Displacement
Component	T-RES
Nodes	21
Complex As	Real

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



Velocities and accelerations at desired nodes and degrees of freedom can be plotted using similar procedure.

b) View Results

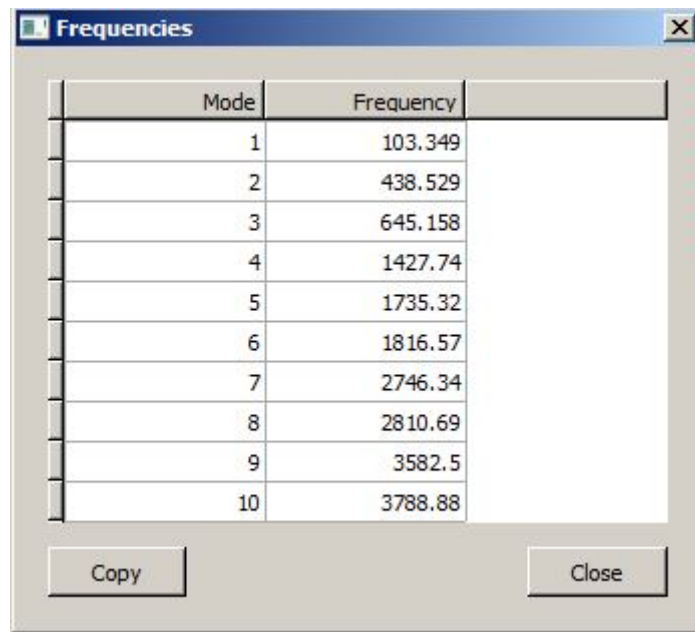
Command : POST, VIEWRESULTS

Menu : Post → View results

Parameters :

Item	Frequencies
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At the end of this operation, an output window like this is obtained



Mode	Frequency
1	103.349
2	438.529
3	645.158
4	1427.74
5	1735.32
6	1816.57
7	2746.34
8	2810.69
9	3582.5
10	3788.88

c) Output file can be seen in *.OUT