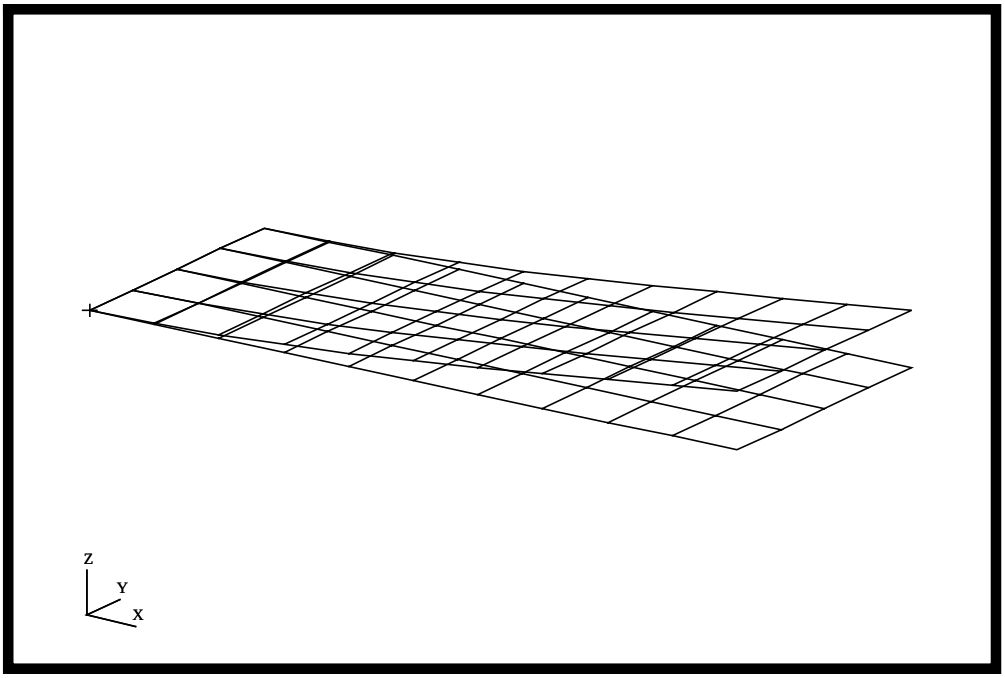
WORKSHOP PROBLEM 8

Enforced Motion with Direct Frequency Response



Objectives

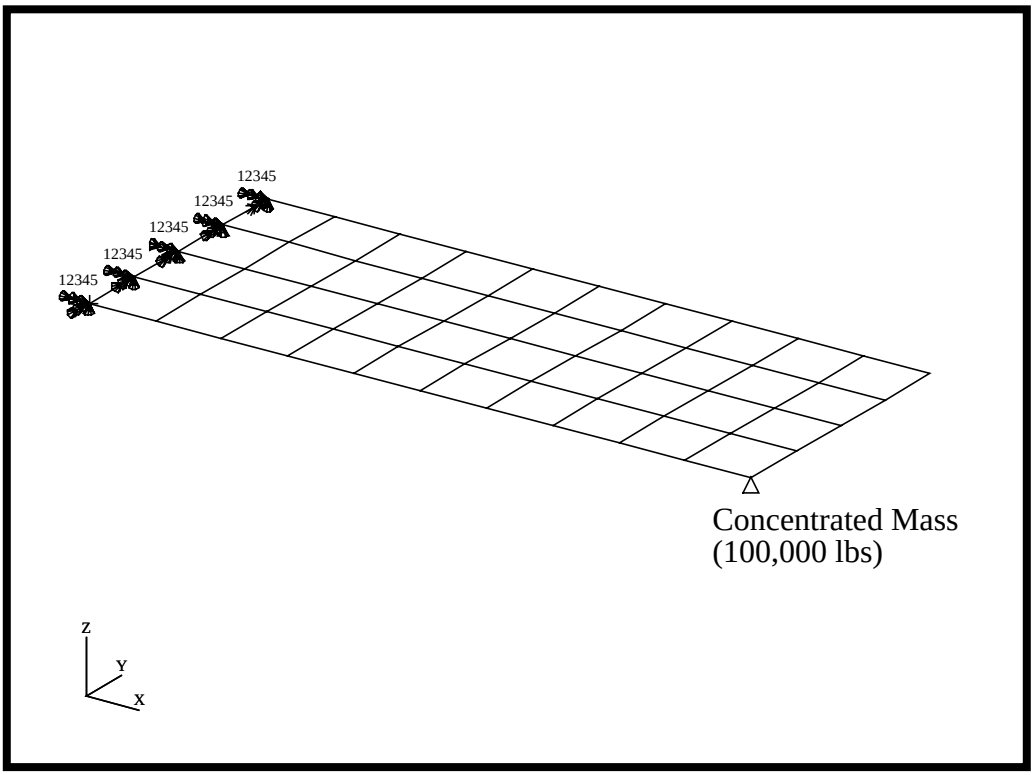
- Define frequency-varying tip displacement.
- Use the large mass method.
- Produce a MSC/NASTRAN input file from a dynamic math model created in Workshop 1.
- Submit the file for analysis in MSC/NASTRAN.
- Compute nodal displacements for desired time domain.

Model Description:

Using the direct method, determine the frequency response of the flat rectangular plate, created in Workshop 1, under a 0.1 displacement at a corner of the tip. Use a frequency step of 20 Hz in the range of 20 to 1000 Hz. Use a structural damping of g = 0.06.

Below is a finite element representation of the flate plate. It also contains the loads and boundary constraints.

Figure 8.1-Loads and Boundary Conditions



Suggested Exercise Steps

- Reference previously created dynamic math model, **plate.bdf**, by using the INCLUDE statement.
- Create the large mass at a corner of the tip (CMASS2).
- Define the frequency-varying tip displacement (RLOAD2, TABLED4, DAREA).
- Define a set of frequencies to be used in the solution (FREQ1).
- Prepare the model for a direct frequency analysis (SOL 108).
- Sprecify the structural damping.
  - PARAM, G, 0.06
- Request response in terms of nodal displacement and grid points 11, 33, and 55.
- Generate an input file, and submit it to the MSC/NASTRAN solver for direct transient analysis.
- Review the results, specifically the grid displacements.

```
ID SEMINAR,PROB8
```

```
CEND
```

```
BEGIN BULK
```

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

ENDDATA

Exercise Procedure:

1. Users who are not utilizing MSC/PATRAN for generating an input file should go to Step 9, otherwise, proceed to step 2.

2. Create a new database and named **prob8.db**.

   File/New Database

   New Database Name **prob8**

   OK

   In the *New Model Preference* form set the following:

   Tolerance ◆ **Default**

   Analysis code: **MSC/NASTRAN**

   OK

3. Create the model by importing an existing MSC/NASTRAN input file, **(plate.bdf)**.

   ◆ **Analysis**

   Action: **Read Input File**

   Object: **Model Data**

   Method: **Translate**

   Select Input File

   Select Input File **plate.bdf**

   OK

   Apply

   OK

4. Activate the entity labels by selecting the Show Labels icon on the tool-bar.

    **Show Labels**

5. Create the frequency dependent load case.

◆ **Load Cases**

Action:	**Create**
Load Case Name:	**frequency response**
Load Case Type:	**time_dependent**
Assign/Prioritize loads/BCs *(Highlight the following:)*	**Displ_spc1.1**

Apply

6. Place a large mass at a corner of the tip (**Node 11**). However, a point element must be created first.

◆ **Finite Element**

Action:	**Create**
Object:	**Element**
Method:	**Edit**
Shape:	**Point**
Node 1 =	**Node 11**

Apply

7. Then define the scalar mass.

◆ **Properties**

Action:	**Create**
Dimension:	**0D**
Type:	**Mass**
Property Set Name:	**scalar_mass**
Option(s):	**Grounded**

Input Properties ...

Mass:	**1.0E+5**
Dof at Node 1 (Value Type)	**UZ**

OK

Select Members: **Elm 41**
(Click on point element in select menu. Then select Elm 41.)

O **Point Element**

Add

Apply

8. Start the analysis.

◆ **Analysis**

Action: **Analyze**

Object: **Entire Model**

Method: **Analysis Deck**

Jobname: **prob8**

Solution Type...

Solution Type: ◆ **FREQUENCY RESPONSE**

Solution Parameters ...

Formulation: **Direct**

Mass Calculation **Coupled**

Wt.-Mass Conversion **.00259**

Structure Damping Coeff: **0.06**

OK

OK

Direct Text Input ...

◆ **Bulk Data Section**

Bulk Data Section:
(Each line in the box is a separate line to input!)

```
RLOAD2,500,600, , ,310
TABLED4,310,0.,1.,0.,10000.,
+,0.,0.,-39.4784,ENDT
DAREA,600,11,3,25.8799
```

◆ **Case Control Section**

Case Control Section: **DLOAD=500**

OK

Subcase Create...

Available Subcases **frequency_response**

Subcase Parameters...

Starting Frequency **20**

Ending Frequency **1000**

# of Freq. Increments **49**

OK

Output Requests...

under ***Output Request*** highlight:

SPCFORCES(SORT1,Real)=All FEM

Delete

OK

Apply

Cancel

Subcase Select ...

Subcases Selected: click on **Default**

Subcases for Solution Sequence: 108 click on **frequency_response**

OK

Apply

An MSC/NASTRAN input file called **prob8.bdf** will be generated. This process of translating your model into an input file is called the Forward Translation. The Forward Translation is complete when the Heartbeat turns green. MSC/PATRAN Users should proceed to step 10.

Generating an input file for MSC/NASTRAN Users:

MSC/NASTRAN users can generate an input file using the data previously stated. The result should be similar to the output below.

9. MSC/NASTRAN input file: **prob8.dat**

```
ID SEMINAR, PROB8
SOL 108
TIME 30
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= DIRECT METHOD
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SDISP(PHASE, SORT2)= ALL
set 222 = 11
OLOAD= 222
SUBCASE 1
DLOAD= 500
FREQUENCY= 100
$
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
YBLOG= NO
XTITLE= FREQUENCY (HZ)
YTTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER, MAGNITUDE
YBTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER, PHASE
XYPLOT DISP RESPONSE / 11 (T3RM, T3IP)
YTTITLE= DISPLACEMENT RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= DISPLACEMENT RESPONSE AT TIP CENTER, PHASE
XYPLOT DISP RESPONSE / 33 (T3RM, T3IP)
YTTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER, PHASE
XYPLOT DISP RESPONSE / 55 (T3RM, T3IP)
$
BEGIN BULK
$
```

```
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY UNIT DISPLACEMENT AT TIP POINT
$
CMASS2, 5000, 1.0E+5, 11, 3
$
RLOAD2, 500, 600, , ,310
$
TABLED4, 310, 0., 1., 0., 10000.,
 ,0., 0., -39.4784, ENDT
$
DAREA, 600, 11, 3, 25.8799
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Submitting the input file for analysis:

10. Submit the input file to MSC/NASTRAN for analysis.

    10a. To submit the MSC/PATRAN **.bdf** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob8.bdf scr=yes**. Monitor the run using the UNIX **ps** command.

    10b. To submit the MSC/NASTRAN **.dat** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob8 scr=yes**. Monitor the run using the UNIX **ps** command.

11. When the run is completed, use **plotps** utility to create a postscript file, **prob8.ps**, from the binary plot file **prob8.plt**. The displacement response plots for Grids 11, 33 and 55 are shown in figures 8.2 to 8.7**.**

12. Edit the **prob8.f06** file and search for the word **FATAL**. If no matches exist, search for the word **WARNING**. Determine whether existing WARNING messages indicate modeling errors.

13. While still editing **prob8.f06**, search for the word:

X Y - O U T P U T S U M M A R Y (spaces are necessary).

Displacement at Grid 11

Frequency (X) Displacement (Y)

140 = _____

380 = _____

Displacement at Grid 33

Frequency (X) Displacement (Y)

140 = _____

600 = _____

Displacement at Grid 55

Frequency (X) Displacement (Y)

140 = _____

1000 = _____

Comparison of Results

Compare the results obtained in the **.f06** file with the results on the following page:

X Y - O U T P U T S U M M A R Y (R E S P O N S E)

SUBCASE ID	CURVE TYPE	FRAME NO.	CURVE ID.	XMIN-FRAME/ ALL DATA	XMAX-FRAME/ ALL DATA	YMIN-FRAME/ ALL DATA	X FOR YMIN	YMAX-FRAME/ ALL DATA	X FOR YMAX
1	DISP	1	11(5,--)	2.000000E+01	1.000000E+03	9.992202E-02	3.600000E+02	9.992512E-02	2.000000E+0
				2.000000E+01	1.000000E+03	9.992202E-02	3.600000E+02	9.992512E-02	2.000000E+01
1	DISP	1	11(--, 11)	2.000000E+01	1.000000E+03	7.680080E-07	1.000000E+03	3.828149E-04	3.800000E+02
				2.000000E+01	1.000000E+03	7.680080E-07	1.000000E+03	3.828149E-04	3.800000E+02
1	DISP	2	33(5,--)	2.000000E+01	1.000000E+03	2.312926E-03	6.000000E+02	8.446401E-01	3.800000E+02
				2.000000E+01	1.000000E+03	2.312926E-03	6.000000E+02	8.446401E-01	3.800000E+02
1	DISP	2	33(--, 11)	2.000000E+01	1.000000E+03	3.348117E-01	9.799999E+02	3.599947E+02	2.000000E+01
				2.000000E+01	1.000000E+03	3.348117E-01	9.799999E+02	3.599947E+02	2.000000E+01
1	DISP	3	55(5,--)	2.000000E+01	1.000000E+03	2.434351E-02	1.000000E+03	1.624350E+00	3.800000E+02
				2.000000E+01	1.000000E+03	2.434351E-02	1.000000E+03	1.624350E+00	3.800000E+02
1	DISP	3	55(--, 11)	2.000000E+01	1.000000E+03	3.690138E+00	1.000000E+03	3.599892E+02	2.000000E+01
				2.000000E+01	1.000000E+03	3.690138E+00	1.000000E+03	3.599892E+02	2.000000E+01

14. MSC/NASTRAN Users have finished this exercise. MSC/PATRAN Users should proceed to the next step.

15. Proceed with the Reverse Translation process, that is importing the **prob8.op2** results file into MSC/PATRAN. To do this, return to the Analysis form and proceed as follows:

◆ **Analysis**

Action: **Read Output2**

Object: **Result Entities**

Method: **Translate**

Select Results File...

Select Results File **prob8.op2**

OK

Apply

16. Plot the results in XY plots.

The first plot is to make the Displacement versus Frequency plot at Node 11.

◆ **Results**

Form Type: **Advanced**

Select Result Cases
(Highlight all cases.)

Get Results

Select Result **1.1-Displacements, Translational**

Plot Type: **XY Plot**

Plot Type Options...

Result XY Plot Types **Results Versus Global Variables**

Global Var...

Global Variable: **1-Frequency**

Apply

Result (Y)...

Results: **1.1-Displacements, Translational**

Vector Component ❒ **X** ❒ **Y** ■ **Z**

Numerical Form for Complex Results ■ **Mag.**

OK

Node IDs **Node 33**

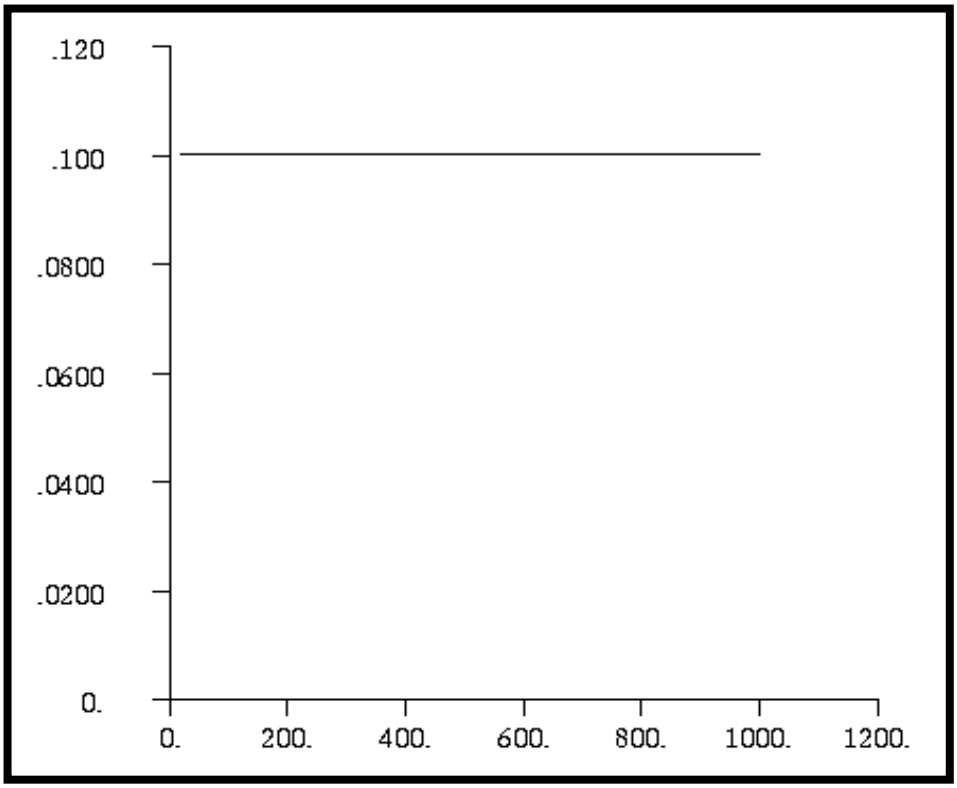
Apply...

New Title or Title Filter **Displacement vs Frequency at Node 11**

Rename

Apply

Figure 8.2-Displacement Response at Node 11.



The next step is to make the plot of Phase versus Frequency. Return to the *Results Display* form. If the *Curves for XY Plot* form and the *Result XY Plot Options* form are still open, close them by pushing the **Cancel** button.

Plot Type Options...

Result (Y)...

Results: **1.1-Displacements, Translational**

Vector Component ❒ **X** ❒ **Y** ■ **Z**

Numerical Form for Complex Results ■ **Phase**

OK

Node IDs **Node 11**

Apply...

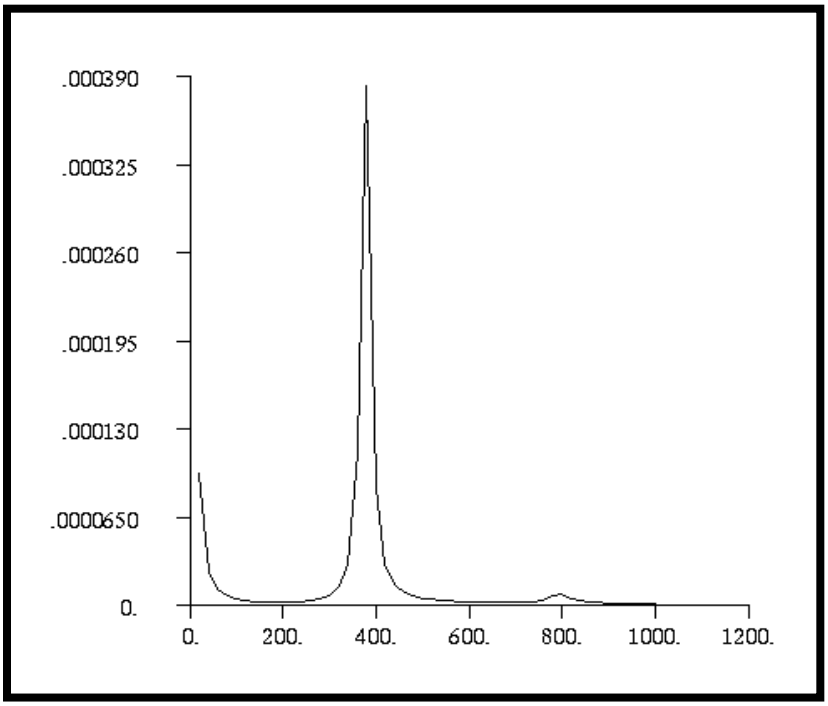
Result XY Window Name: **XYWindow2**

New Title or Title Filter **Phase vs Frequency at Node 11**

Rename

Apply

Figure 8.3-Phase Angle at Node 11



Repeat the above steps of plotting the XY plots of Grids 11 for Node 33 and 55. Once again, push **Cancel** to remove any miscellaneous forms until the *Results Display* form.

Plot Type Options...

Result (Y)...

Numerical Form for Complex Results ■ **Mag.**

OK

Node IDs **Node 33**

Apply...

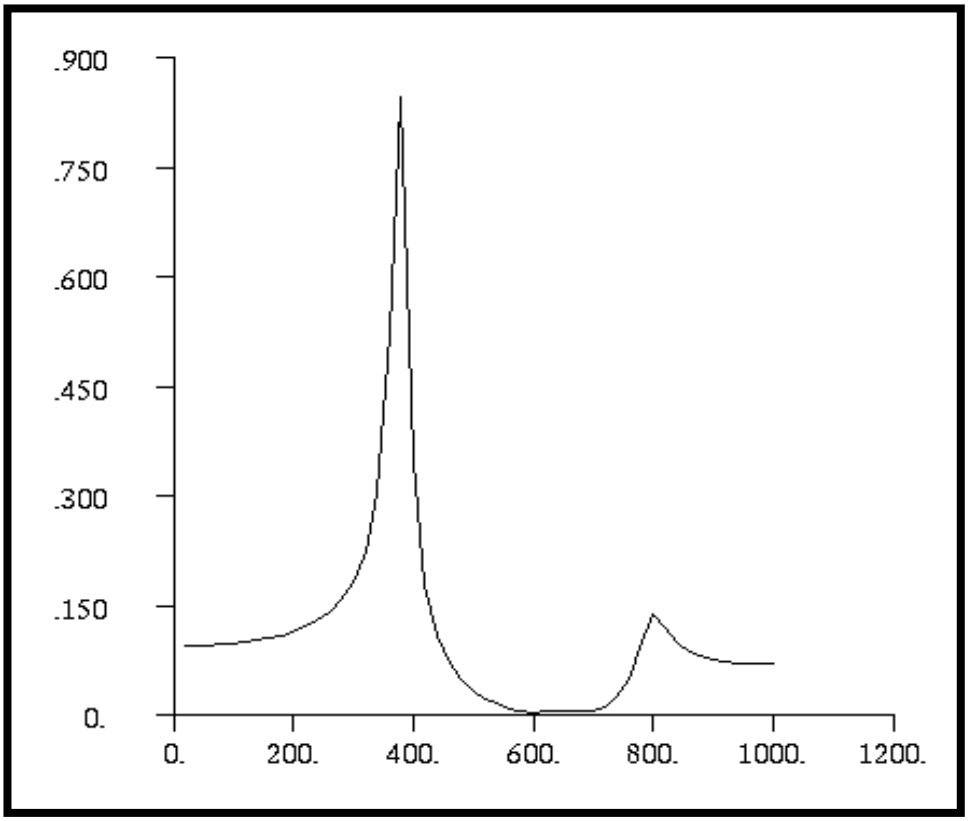
Result XY Window Name: **XYWindow3**

New Title or Title Filter **Displacement vs Frequency at Node 33**

Rename

Apply

Figure 8.4-Displacement Response at Node 33



Plot Type Options...

Result (Y)...

Numerical Form for Complex Results ■ **Phase**

OK

Node IDs **Node 33**

Apply...

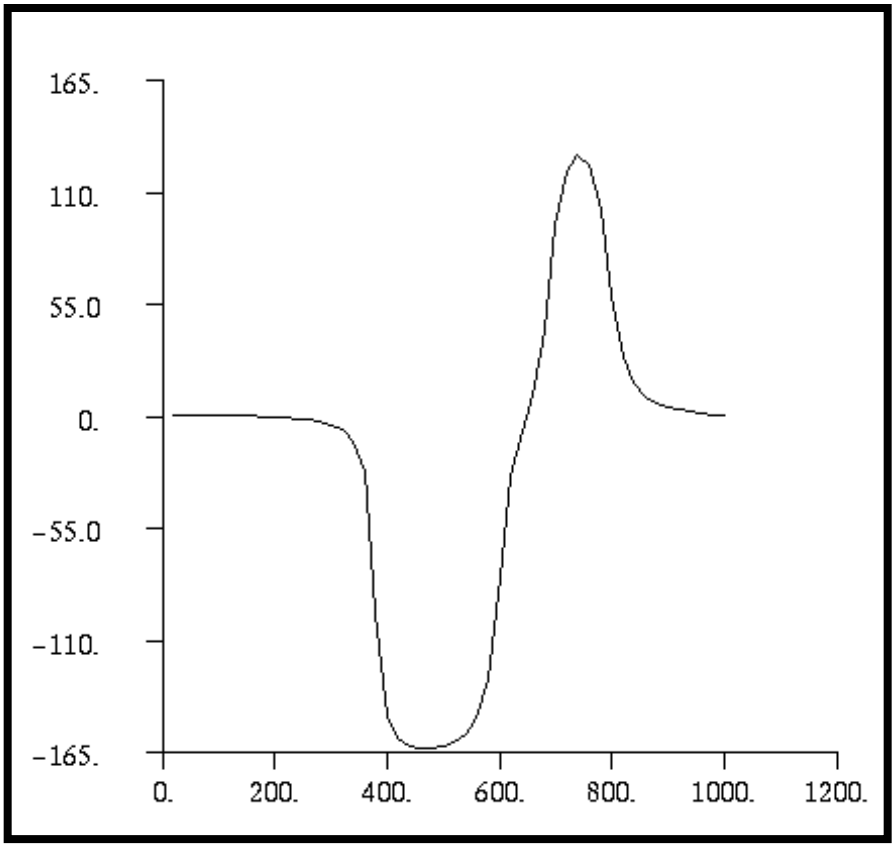
Result XY Window Name: **XYWindow4**

New Title or Title Filter **Phase vs Frequency at Node 33**

Rename

Apply

Figure 8.5-Phase Angle at Node 33



Plot Type Options...

Result (Y)...

Numerical Form for Complex Results ■ **Mag.**

OK

Node IDs **Node 55**

Apply...

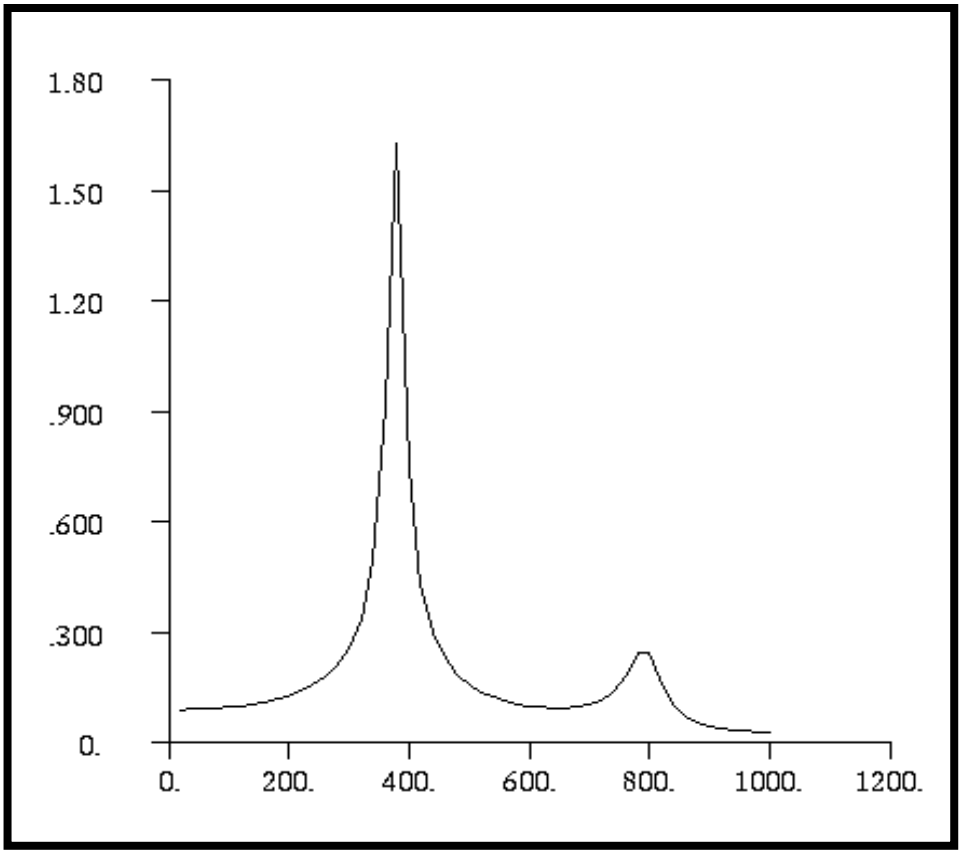
Result XY Window Name: **XYWindow5**

New Title or Title Filter **Displacement vs Frequency at Node 55**

Rename

Apply

Figure 8.6-Displacement Response at Node 55



Plot Type Options...

Result (Y)...

Numerical Form for Complex Results ■ **Phase**

OK

Node IDs **Node 55**

Apply...

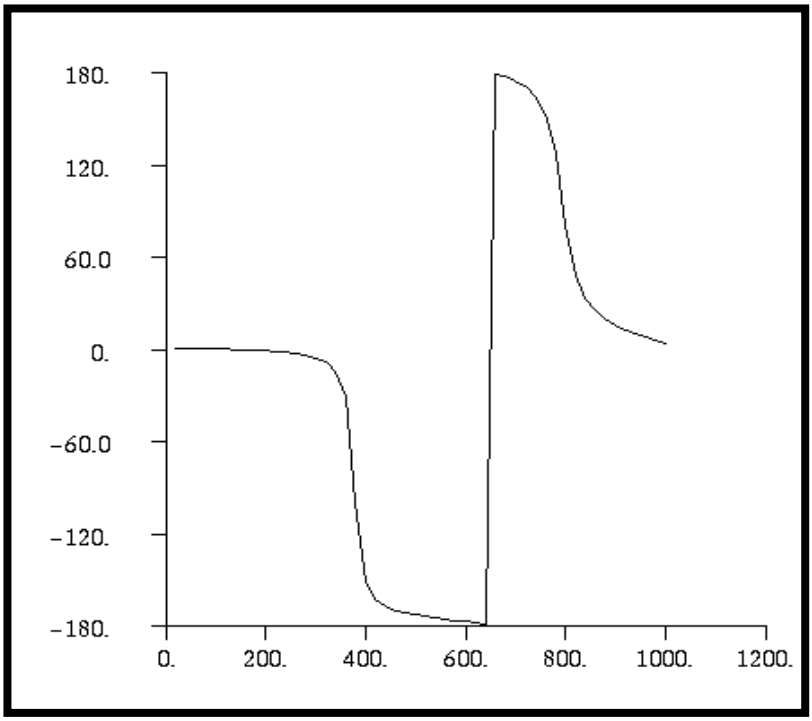
Result XY Window Name: **XYWindow6**

New Title or Title Filter **Phase vs Frequency at Node 55**

Rename

Apply

Fig 8.7-Phase Angle at Node 55



Quit MSC/PATRAN when you have completed this exercise.