Dynamic Analysis Using MSC Nastran

NAS102A Workbook

June 2013

MSC Software®

Simulating Reality, Delivering Certainty™

NA*V2013*Z*Z*Z*SM-NAS102A-WBK

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CONTENTS

Workshop

WORKSHOP 1
MODAL ANALYSIS OF A FLAT PLATE

- **Workshop Objectives**
  - Use the Lanczos method to find the first ten natural frequencies and mode shapes of a flat rectangular plate.

- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp1.dat

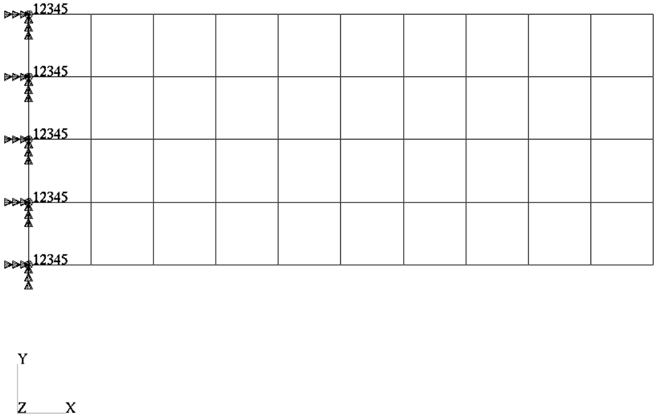
- **Problem Description:**
  - The next page contains information on the flat plate, including the finite element representation, boundary condition, and structural parameters necessary to construct the input file.

Structural Information

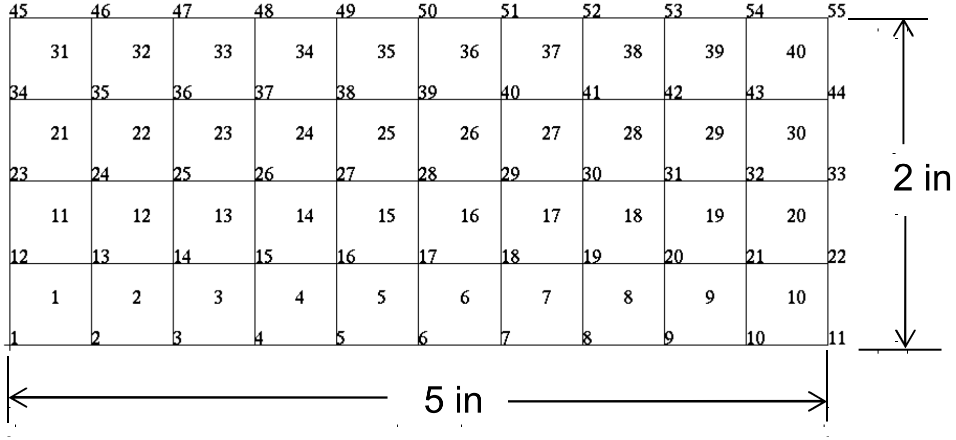
Table 3A.

Length (a)	5 in
Height (b)	2 in
Thickness	0.100 in
Weight Density	0.282 lbs/in3
Mass/Weight Factor	2.59E-3 sec2/in
Elastic Modulus	30.0E6 lbs/in2
Poisson’s Ratio	0.3

Boundary Condition



Grid Coordinates and Elements



- **Suggested Steps**
  1. Open and review the plate.bdf include file.
  2. Modify the starting input file, wkshp1.dat, to add the Lanczos method.
  3. Save and run the new input file.
  4. Review the MSC Nastran results using the solution file soln1.f06.

Step 1. Open and Review the Plate.bdf File

```
$
$   plate.bdf
$
$   geometric input file for plate model
$
PSHELL   1       1       .1      1               1
CQUAD4   1       1       1       2       13      12
CQUAD4   2       1       2       3       14      13
CQUAD4   3       1       3       4       15      14
CQUAD4   4       1       4       5       16      15
CQUAD4   5       1       5       6       17      16
CQUAD4   6       1       6       7       18      17
CQUAD4   7       1       7       8       19      18
CQUAD4   8       1       8       9       20      19
CQUAD4   9       1       9       10      21      20
CQUAD4   10      1       10      11      22      21
CQUAD4   11      1       12      13      24      23
CQUAD4   12      1       13      14      25      24
CQUAD4   13      1       14      15      26      25
CQUAD4   14      1       15      16      27      26
CQUAD4   15      1       16      17      28      27
CQUAD4   16      1       17      18      29      28
CQUAD4   17      1       18      19      30      29
CQUAD4   18      1       19      20      31      30
CQUAD4   19      1       20      21      32      31
CQUAD4   20      1       21      22      33      32
```

```
CQUAD4   21      1       23      24      35      34
CQUAD4   22      1       24      25      36      35
CQUAD4   23      1       25      26      37      36
CQUAD4   24      1       26      27      38      37
CQUAD4   25      1       27      28      39      38
CQUAD4   26      1       28      29      40      39
CQUAD4   27      1       29      30      41      40
CQUAD4   28      1       30      31      42      41
CQUAD4   29      1       31      32      43      42
CQUAD4   30      1       32      33      44      43
CQUAD4   31      1       34      35      46      45
CQUAD4   32      1       35      36      47      46
CQUAD4   33      1       36      37      48      47
CQUAD4   34      1       37      38      49      48
CQUAD4   35      1       38      39      50      49
CQUAD4   36      1       39      40      51      50
CQUAD4   37      1       40      41      52      51
CQUAD4   38      1       41      42      53      52
CQUAD4   39      1       42      43      54      53
CQUAD4   40      1       43      44      55      54
$
MAT1     1       3.+7            .3      .282
$
```

Weight Density
see PARAM,WTMASS

Step 1. Open and Review the Plate.bdf File (Cont.)

```
$
GRID    1               0.      0.      0.
GRID    2               .5      0.      0.
GRID    3               1.      0.      0.
GRID    4               1.5     0.      0.
GRID    5               2.      0.      0.
GRID    6               2.5     0.      0.
GRID    7               3.      0.      0.
GRID    8               3.5     0.      0.
GRID    9               4.      0.      0.
GRID    10              4.5     0.      0.
GRID    11              5.      0.      0.
GRID    12              0.      .5      0.
GRID    13              .5      .5      0.
GRID    14              1.      .5      0.
GRID    15              1.5     .5      0.
GRID    16              2.      .5      0.
GRID    17              2.5     .5      0.
GRID    18              3.      .5      0.
GRID    19              3.5     .5      0.
GRID    20              4.      .5      0.
GRID    21              4.5     .5      0.
GRID    22              5.      .5      0.
GRID    23              0.      1.      0.
GRID    24              .5      1.      0.
GRID    25              1.      1.      0.
GRID    26              1.5     1.      0.
GRID    27              2.      1.      0.
GRID    28              2.5     1.      0.
GRID    29              3.      1.      0.
GRID    30              3.5     1.      0.
```

```
GRID    31              4.      1.      0.
GRID    32              4.5     1.      0.
GRID    33              5.      1.      0.
GRID    34              0.      1.5     0.
GRID    35              .5      1.5     0.
GRID    36              1.      1.5     0.
GRID    37              1.5     1.5     0.
GRID    38              2.      1.5     0.
GRID    39              2.5     1.5     0.
GRID    40              3.      1.5     0.
GRID    41              3.5     1.5     0.
GRID    42              4.      1.5     0.
GRID    43              4.5     1.5     0.
GRID    44              5.      1.5     0.
GRID    45              0.      2.      0.
GRID    46              .5      2.      0.
GRID    47              1.      2.      0.
GRID    48              1.5     2.      0.
GRID    49              2.      2.      0.
GRID    50              2.5     2.      0.
GRID    51              3.      2.      0.
GRID    52              3.5     2.      0.
GRID    53              4.      2.      0.
GRID    54              4.5     2.      0.
GRID    55              5.      2.      0.
$
SPC1    1       12345   1       12      23      34      45
```

Step 2. Modify the wkshp1.dat File

Start with the partial input file wkshp1.dat and change the file name to **soln1.dat,** then modify as follows:

Executive Control Section

a. Add the solution sequence, **SOL 103**.

Case Control Section

b. Add eigenvalue **METHOD** callout.

c. Add eigenvector printout.

Bulk Data Section

d. Add weight/mass conversion factor.

e. Add eigenvalue method with **10** roots.

Start with partial input file, wkshp1.dat

```
$
$   wkshp1.dat
$
$   exec control add:  solution sequence
$   case control add:  eigenvalue method callout
$                      eigenvector printout
$
$   bulk data add:     weight/mass conversion factor
$                      eigenvalue method
$
CEND
TITLE = NORMAL MODES EXAMPLE
ECHO = UNSORTED
SUBCASE 1
   SUBTITLE= USING LANCZOS
   SPC = 1
BEGIN BULK
PARAM,POST, 0
PARAM   COUPMASS 1
$
include 'plate.bdf'
$
ENDDATA
```

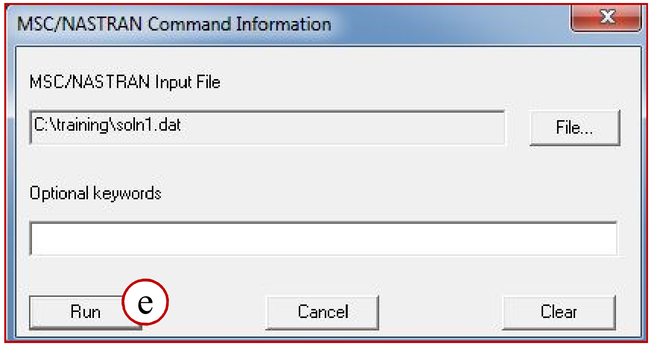
Modified input file, save as soln1.dat

```
  $
  $   soln1.dat
  $
  SOL 103 ⓐ
  CEND
  TITLE = NORMAL MODES EXAMPLE
  ECHO = UNSORTED
  SUBCASE 1
     SUBTITLE= USING LANCZOS
 ⓑ  METHOD = 1
     SPC = 1
 ⓒ  VECTOR=ALL
  BEGIN BULK
  PARAM,POST,0
  PARAM   COUPMASS 1
ⓓ PARAM    WTMASS   .00259
ⓔ EIGRL    1                       10       0
  $
  include 'plate.bdf'
  $
  ENDDATA
```

Step 3. Save and Run the Input File

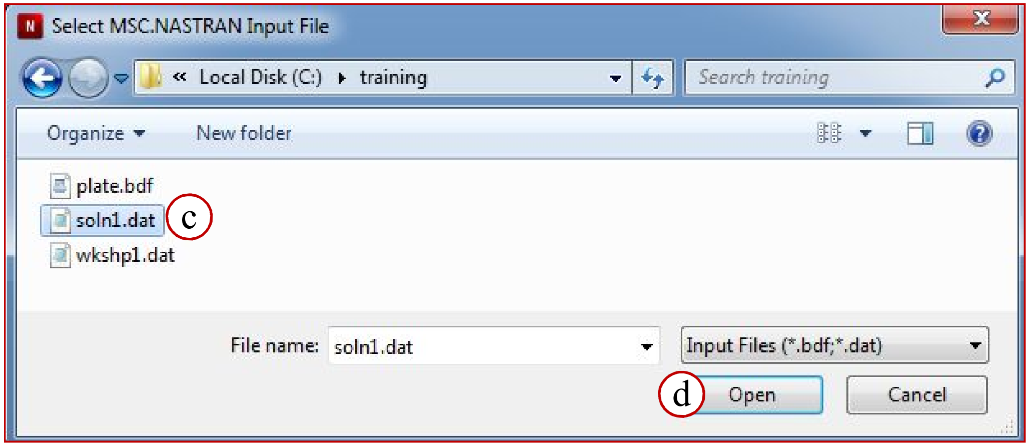
Save and run the modified file in Nastran.

a. Save the modified file as **soln1.dat**.
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln1.dat**.
d. Click **Open**.
e. Click **Run**.


MSC/NASTRAN Command Information

MSC/NASTRAN Input File: C:\training\soln1.dat

Optional keywords:


Select MSC.NASTRAN Input File

« Local Disk (C:) ▸ training

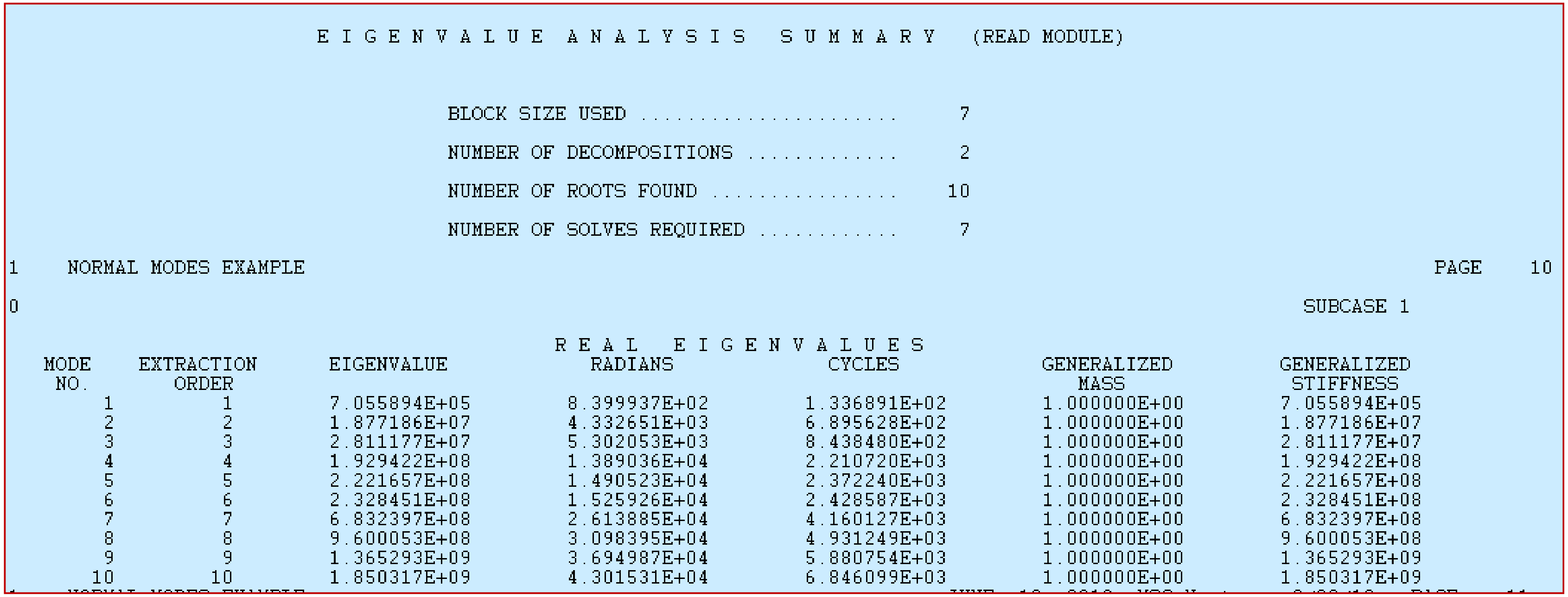
plate.bdf
soln1.dat
wkshp1.dat

File name: soln1.dat

Input Files (*.bdf;*.dat)

Step 4. Review the Results

1st 10 Natural Frequencies (eigenvalues) of the Plate

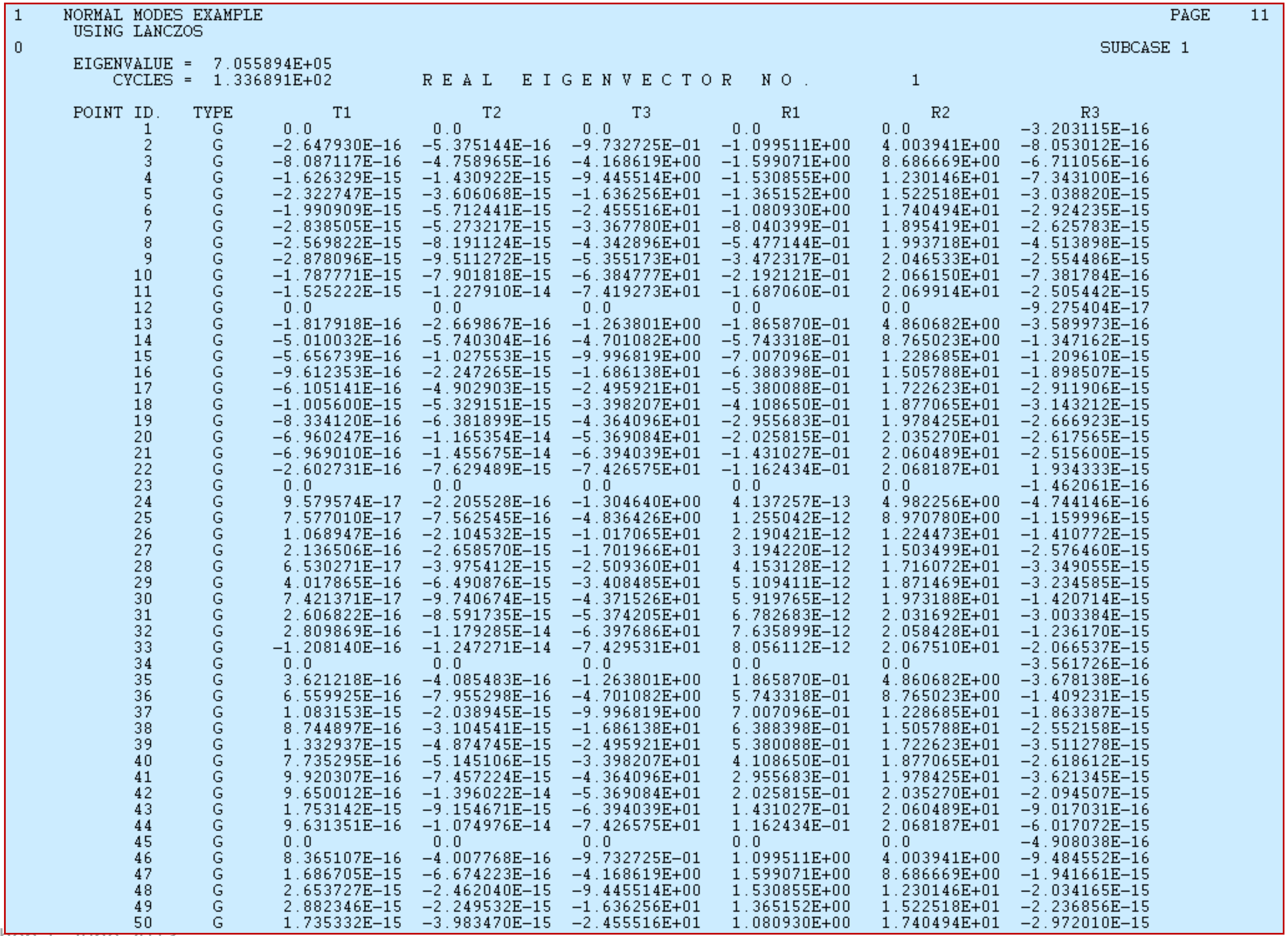


```
                         E I G E N V A L U E   A N A L Y S I S   S U M M A R Y   (READ MODULE)


                                    BLOCK SIZE USED ......................      7

                                    NUMBER OF DECOMPOSITIONS .............      2

                                    NUMBER OF ROOTS FOUND ................     10

                                    NUMBER OF SOLVES REQUIRED ............      7
1    NORMAL MODES EXAMPLE                                                                                   PAGE    10

0                                                                                                  SUBCASE 1

                                                 R E A L   E I G E N V A L U E S
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        7.055894E+05        8.399937E+02        1.336891E+02        1.000000E+00        7.055894E+05
        2         2        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
        3         3        2.811177E+07        5.302053E+03        8.438480E+02        1.000000E+00        2.811177E+07
        4         4        1.929422E+08        1.389036E+04        2.210720E+03        1.000000E+00        1.929422E+08
        5         5        2.221657E+08        1.490523E+04        2.372240E+03        1.000000E+00        2.221657E+08
        6         6        2.328451E+08        1.525926E+04        2.428587E+03        1.000000E+00        2.328451E+08
        7         7        6.832397E+08        2.613885E+04        4.160127E+03        1.000000E+00        6.832397E+08
        8         8        9.600053E+08        3.098395E+04        4.931249E+03        1.000000E+00        9.600053E+08
        9         9        1.365293E+09        3.694987E+04        5.880754E+03        1.000000E+00        1.365293E+09
       10        10        1.850317E+09        4.301531E+04        6.846099E+03        1.000000E+00        1.850317E+09
```

Step 4. Review the Results (Cont.)

1st Mode shape (eigenvector) of the Plate

(see the soln1.f06 file for all 10 eigenvectors)



```
1    NORMAL MODES EXAMPLE                                                                                     PAGE    11
      USING LANCZOS
0                                                                                                         SUBCASE 1
      EIGENVALUE =  7.055894E+05
          CYCLES =  1.336891E+02         R E A L   E I G E N V E C T O R   N O .          1

      POINT ID.   TYPE          T1             T2             T3             R1             R2             R3
             1      G      0.0            0.0            0.0            0.0            0.0           -3.203115E-16
             2      G     -2.647930E-16  -5.375144E-16  -9.732725E-01  -1.099511E+00   4.003941E+00  -8.053012E-16
             3      G     -8.087117E-16  -4.758965E-16  -4.168619E+00  -1.599071E+00   8.686669E+00  -6.711056E-16
             4      G     -1.626329E-15  -1.430922E-15  -9.445514E+00  -1.530855E+00   1.230146E+01  -7.343100E-16
             5      G     -2.322747E-15  -3.606068E-15  -1.636256E+01  -1.365152E+00   1.522518E+01  -3.038820E-15
             6      G     -1.990909E-15  -5.712441E-15  -2.455516E+01  -1.080930E+00   1.740494E+01  -2.924235E-15
             7      G     -2.838505E-15  -5.273217E-15  -3.367780E+01  -8.040399E-01   1.895419E+01  -2.625783E-15
             8      G     -2.569822E-15  -8.191124E-15  -4.342896E+01  -5.477144E-01   1.993718E+01  -4.513898E-15
             9      G     -2.878096E-15  -9.511272E-15  -5.355173E+01  -3.472317E-01   2.046533E+01  -2.554486E-15
            10      G     -1.787771E-15  -7.901818E-15  -6.384777E+01  -2.192121E-01   2.066150E+01  -7.381784E-16
            11      G     -1.525222E-15  -1.227910E-14  -7.419273E+01  -1.687060E-01   2.069914E+01  -2.505442E-15
            12      G      0.0            0.0            0.0            0.0            0.0           -9.275404E-17
            13      G     -1.817918E-16  -2.669867E-16  -1.263801E+00  -1.865870E-01   4.860682E+00  -3.589973E-16
            14      G     -5.010032E-16  -5.740304E-16  -4.701082E+00  -5.743318E-01   8.765023E+00  -1.347162E-15
            15      G     -5.656739E-16  -1.027553E-15  -9.996819E+00  -7.007096E-01   1.228685E+01  -1.209610E-15
            16      G     -9.612353E-16  -2.247265E-15  -1.686138E+01  -6.388398E-01   1.505788E+01  -1.898507E-15
            17      G     -6.105141E-16  -4.902903E-15  -2.495921E+01  -5.380088E-01   1.722623E+01  -2.911906E-15
            18      G     -1.005600E-15  -5.329151E-15  -3.398207E+01  -4.108650E-01   1.877065E+01  -3.143212E-15
            19      G     -8.334120E-16  -6.381899E-15  -4.364096E+01  -2.955683E-01   1.978425E+01  -2.666923E-15
            20      G     -6.960247E-16  -1.165354E-14  -5.369084E+01  -2.025815E-01   2.035270E+01  -2.617565E-15
            21      G     -6.969010E-16  -1.455675E-14  -6.394039E+01  -1.431027E-01   2.060489E+01  -2.515600E-15
            22      G     -2.602731E-16  -7.629489E-15  -7.426575E+01  -1.162434E-01   2.068187E+01   1.934333E-15
            23      G      0.0            0.0            0.0            0.0            0.0           -1.462061E-16
            24      G      9.579574E-17  -2.205528E-16  -1.304640E+00   4.137257E-13   4.982256E+00  -4.744146E-16
            25      G      7.577010E-17  -7.562545E-16  -4.836426E+00   1.255042E-12   8.970780E+00  -1.159996E-15
            26      G      1.068947E-16  -2.104532E-15  -1.017065E+01   2.190421E-12   1.224473E+01  -1.410772E-15
            27      G      2.136506E-16  -2.658570E-15  -1.701966E+01   3.194220E-12   1.503499E+01  -2.576460E-15
            28      G      6.530271E-17  -3.975412E-15  -2.509360E+01   4.153128E-12   1.716072E+01  -3.349055E-15
            29      G      4.017865E-16  -6.490876E-15  -3.408485E+01   5.109411E-12   1.871469E+01  -3.234585E-15
            30      G      7.421371E-17  -9.740674E-15  -4.371526E+01   5.919765E-12   1.973188E+01  -1.420714E-15
            31      G      2.606822E-16  -8.591735E-15  -5.374205E+01   6.782683E-12   2.031692E+01  -3.003384E-15
            32      G      2.809869E-16  -1.179285E-14  -6.397686E+01   7.635899E-12   2.058428E+01  -1.236170E-15
            33      G     -1.208140E-16  -1.247271E-14  -7.429531E+01   8.056112E-12   2.067510E+01  -2.066537E-15
            34      G      0.0            0.0            0.0            0.0            0.0           -3.561726E-16
            35      G      3.621218E-16  -4.085483E-16  -1.263801E+00   1.865870E-01   4.860682E+00  -3.678138E-16
            36      G      6.559925E-16  -7.955298E-16  -4.701082E+00   5.743318E-01   8.765023E+00  -1.409231E-15
            37      G      1.083153E-15  -2.038945E-15  -9.996819E+00   7.007096E-01   1.228685E+01  -1.863387E-15
            38      G      8.744897E-16  -3.104541E-15  -1.686138E+01   6.388398E-01   1.505788E+01  -2.552158E-15
            39      G      1.332937E-15  -4.874745E-15  -2.495921E+01   5.380088E-01   1.722623E+01  -3.511278E-15
            40      G      7.735295E-16  -5.145106E-15  -3.398207E+01   4.108650E-01   1.877065E+01  -2.618612E-15
            41      G      9.920307E-16  -7.457224E-15  -4.364096E+01   2.955683E-01   1.978425E+01  -3.621345E-15
            42      G      9.650012E-16  -1.396022E-14  -5.369084E+01   2.025815E-01   2.035270E+01  -2.094507E-15
            43      G      1.753142E-15  -9.154671E-15  -6.394039E+01   1.431027E-01   2.060489E+01  -9.017031E-16
            44      G      9.631351E-16  -1.074976E-14  -7.426575E+01   1.162434E-01   2.068187E+01  -6.017072E-15
            45      G      0.0            0.0            0.0            0.0            0.0           -4.908038E-16
            46      G      8.365107E-16  -4.007768E-16  -9.732725E-01   1.099511E+00   4.003941E+00  -9.484552E-16
            47      G      1.686705E-15  -6.674223E-16  -4.168619E+00   1.599071E+00   8.686669E+00  -1.941661E-15
            48      G      2.653727E-15  -2.462040E-15  -9.445514E+00   1.530855E+00   1.230146E+01  -2.034165E-15
            49      G      2.882346E-15  -2.249532E-15  -1.636256E+01   1.365152E+00   1.522518E+01  -2.236856E-15
            50      G      1.735332E-15  -3.983470E-15  -2.455516E+01   1.080930E+00   1.740494E+01  -2.972010E-15
```

WORKSHOP 2
NORMAL MODES WITH PRELOAD

- **Workshop Objectives**
  - For a simply supported beam with no pre-load, use SOL 103 to find the first bending frequency.
  - Add a preload to the beam, then use SOL 103 to once again find the first bending frequency.

- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - wkshp2.dat

- **Problem Description**
  - The next page contains information on the beam, including the cross-section of the beam with its dimensions, the loads and boundary conditions, and the structural parameters necessary to construct the input file.

Loads and Boundary Conditions

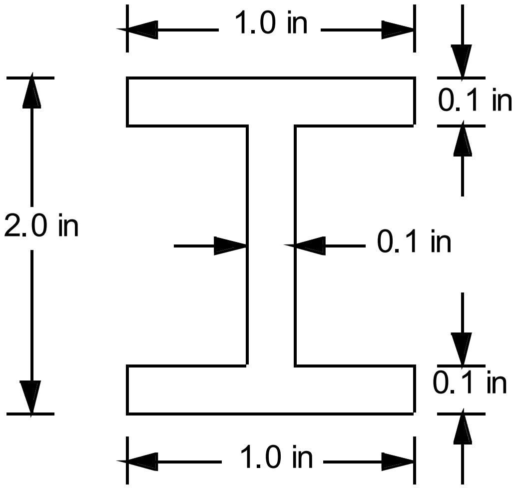
Added pre-load
500 lbs in x-direction

End of beam,
Grid point 11

Structural Information

Length:	**100 in**
Height:	**2 in**
Width:	**1 in**
Thickness:	**0.100 in**
Area:	**0.38 in^2**
I_1:	**0.229 in^4**
I_2:	**0.017 in^4**

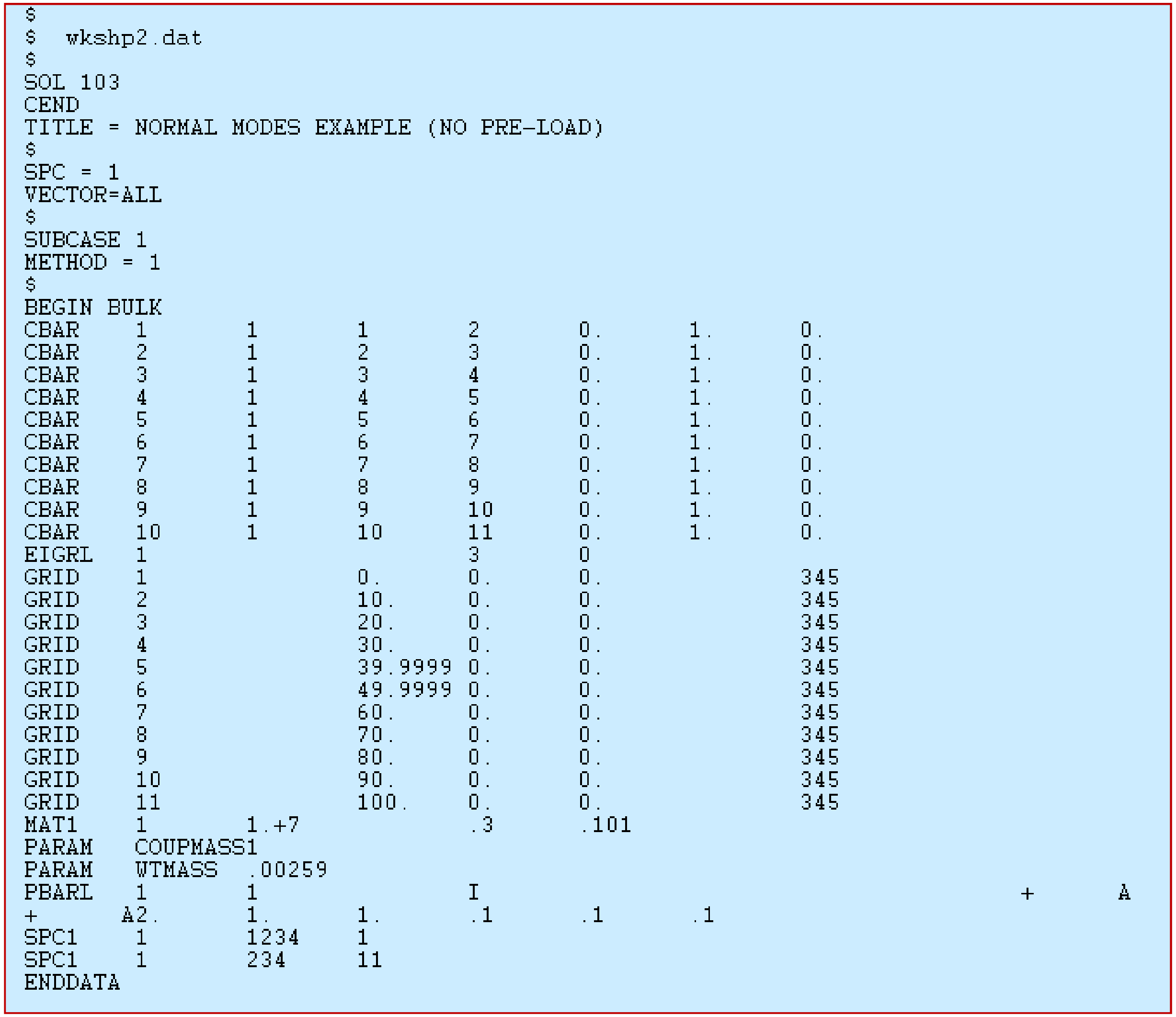
Cross-section of beam



- **Suggested Steps**
  1. Open and Review the starting input file, wkshp2.dat.
  2. Run the input file in MSC Nastran.
  3. Review the MSC Nastran results for beam with no pre-load.
  4. Modify the wkshp2.dat file to add the pre-load and re-run the file in MSC Nastran.
  5. Review the MSC Nastran results using the soln2.f06 file for beam with pre-load of 500 lbs.

Step 1. Open and Review the wkshp2.dat File

The file wkshp2.dat is the baseline model without a pre-load

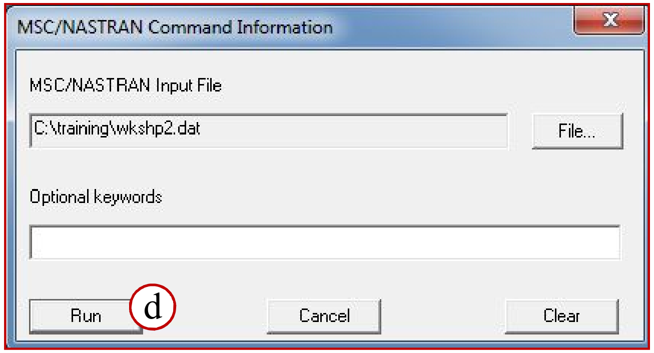


```
$
$  wkshp2.dat
$
SOL 103
CEND
TITLE = NORMAL MODES EXAMPLE (NO PRE-LOAD)
$
SPC = 1
VECTOR=ALL
$
SUBCASE 1
METHOD = 1
$
BEGIN BULK
CBAR    1       1       1       2       0.      1.      0.
CBAR    2       1       2       3       0.      1.      0.
CBAR    3       1       3       4       0.      1.      0.
CBAR    4       1       4       5       0.      1.      0.
CBAR    5       1       5       6       0.      1.      0.
CBAR    6       1       6       7       0.      1.      0.
CBAR    7       1       7       8       0.      1.      0.
CBAR    8       1       8       9       0.      1.      0.
CBAR    9       1       9       10      0.      1.      0.
CBAR    10      1       10      11      0.      1.      0.
EIGRL   1                       3       0
GRID    1               0.      0.      0.              345
GRID    2               10.     0.      0.              345
GRID    3               20.     0.      0.              345
GRID    4               30.     0.      0.              345
GRID    5               39.9999 0.      0.              345
GRID    6               49.9999 0.      0.              345
GRID    7               60.     0.      0.              345
GRID    8               70.     0.      0.              345
GRID    9               80.     0.      0.              345
GRID    10              90.     0.      0.              345
GRID    11              100.    0.      0.              345
MAT1    1       1.+7            .3      .101
PARAM   COUPMASS1
PARAM   WTMASS  .00259
PBARL   1       1               I                                       +      A
+      A2.      1.      1.      .1      .1      .1
SPC1    1       1234    1
SPC1    1       234     11
ENDDATA
```

Step 2. Run the File wkshp2.dat in MSC Nastran

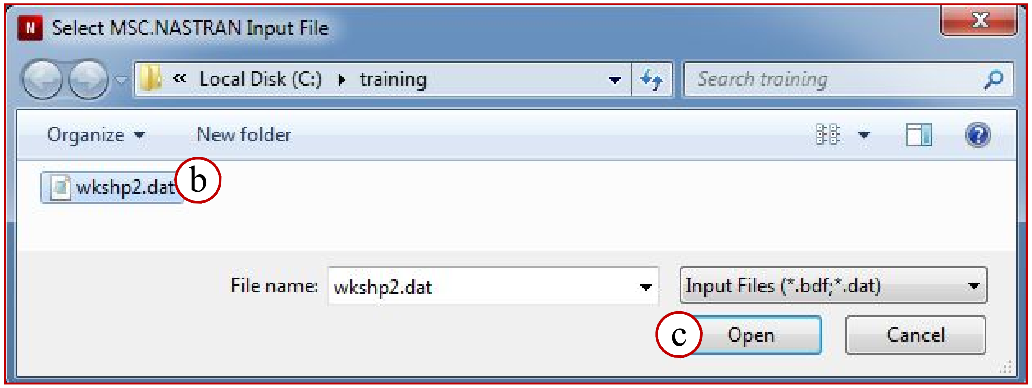
Run the wkshp2.dat file in MSC Nastran.

a. Double click the **MSC Nastran** desktop icon to open Nastran.
b. Navigate to the correct directory and select the file **wkshp2.dat**.
c. Click **Open**.
d. Click **Run**.



MSC/NASTRAN Input File: C:\training\wkshp2.dat

Optional keywords:



« Local Disk (C:) ▸ training

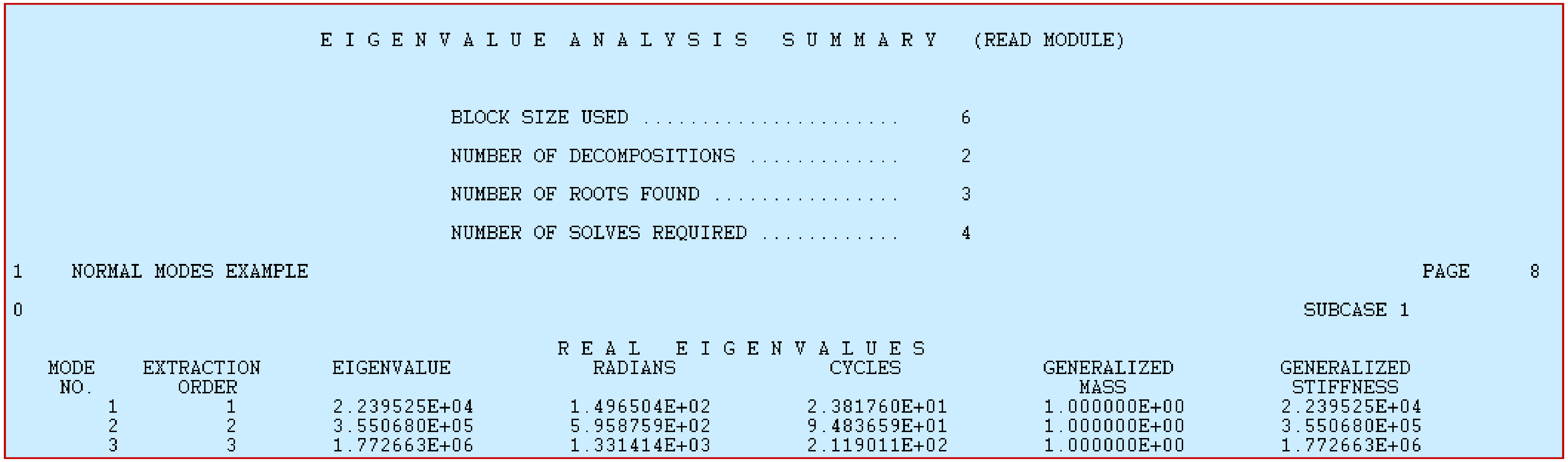
wkshp2.dat

File name: wkshp2.dat

Input Files (*.bdf;*.dat)

Step 3. Review Results for wkshp2.dat Input File

Eigenvalue Results for Beam with No Pre-Load

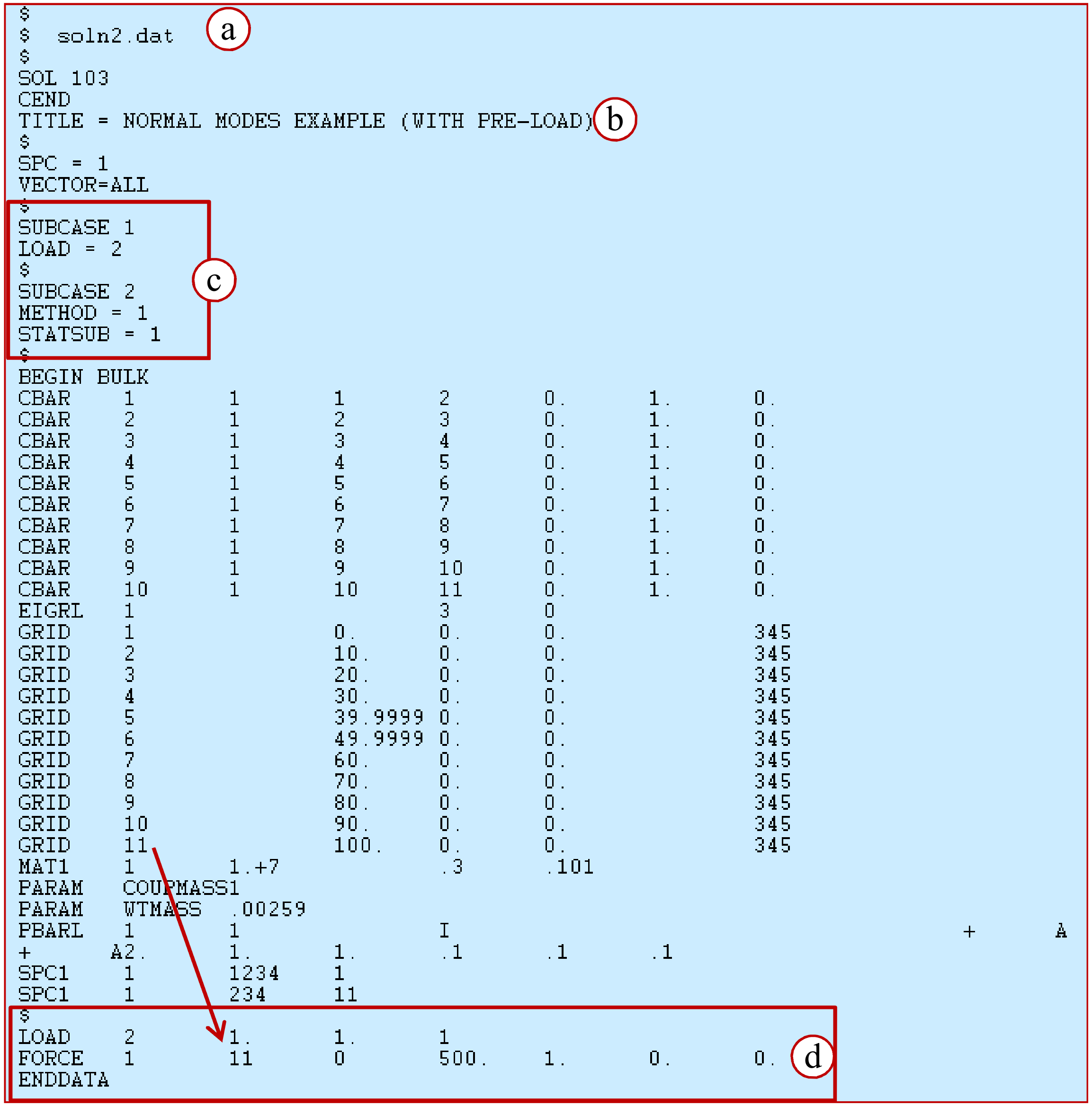


```
                              E I G E N V A L U E   A N A L Y S I S   S U M M A R Y   (READ MODULE)

                                         BLOCK SIZE USED ......................      6

                                         NUMBER OF DECOMPOSITIONS .............      2

                                         NUMBER OF ROOTS FOUND ................      3

                                         NUMBER OF SOLVES REQUIRED ............      4
1    NORMAL MODES EXAMPLE                                                                                 PAGE     8

0                                                                                                   SUBCASE 1

                                                       R E A L   E I G E N V A L U E S
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        2.239525E+04        1.496504E+02        2.381760E+01        1.000000E+00        2.239525E+04
        2         2        3.550680E+05        5.958759E+02        9.483659E+01        1.000000E+00        3.550680E+05
        3         3        1.772663E+06        1.331414E+03        2.119011E+02        1.000000E+00        1.772663E+06
```

Step 4. Modify the wkshp2.dat File to Add Preload

Use wkshp2.dat as a starting point and modify the file to add the pre-load of 500 lbs at the end of the beam.

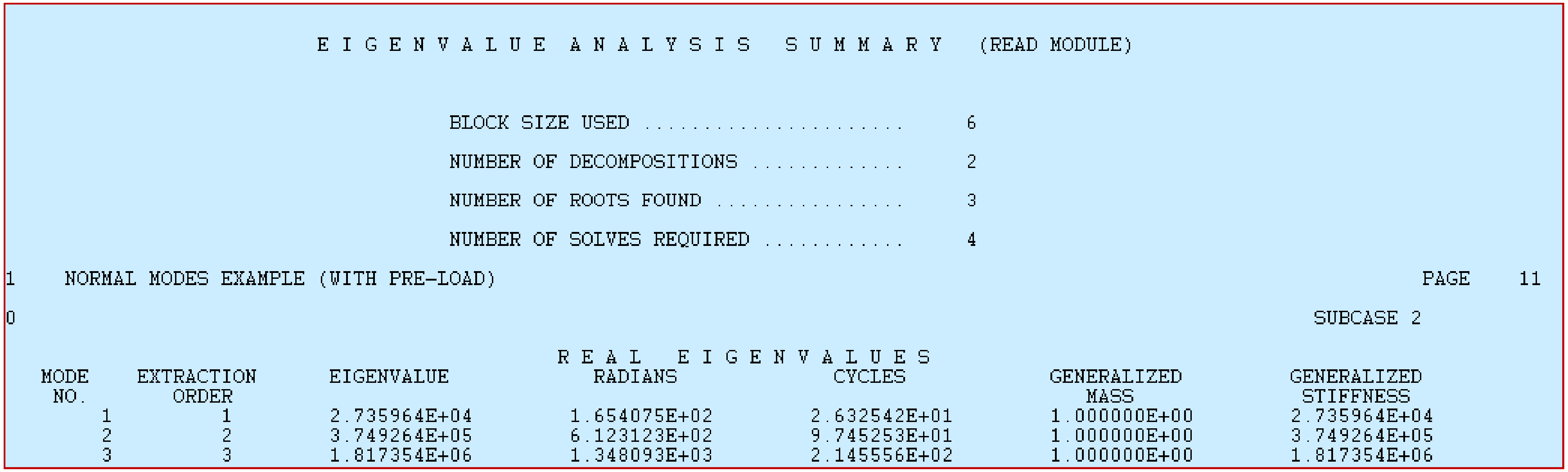
a. Change the name of file to **soln2.dat**.
b. Change the portion of the TITLE that is in parenthesis to **(WITH PRE-LOAD)**
c. In Case Control, add the two necessary subcases when using a pre-load.
d. In Bulk Data, add the pre-load of **500 lbs** in the **x-direction** at the end of the beam, **GRID 11**.
e. Save the modified file as **soln2.dat**.
f. Run the new file, **soln2.dat**, in MSC Nastran, (to review this process, see step 2, page 7)



```
$
$  soln2.dat
$
SOL 103
CEND
TITLE = NORMAL MODES EXAMPLE (WITH PRE-LOAD)
$
SPC = 1
VECTOR=ALL
$
SUBCASE 1
LOAD = 2
$
SUBCASE 2
METHOD = 1
STATSUB = 1
$
BEGIN BULK
CBAR    1       1       1       2       0.      1.      0.
CBAR    2       1       2       3       0.      1.      0.
CBAR    3       1       3       4       0.      1.      0.
CBAR    4       1       4       5       0.      1.      0.
CBAR    5       1       5       6       0.      1.      0.
CBAR    6       1       6       7       0.      1.      0.
CBAR    7       1       7       8       0.      1.      0.
CBAR    8       1       8       9       0.      1.      0.
CBAR    9       1       9       10      0.      1.      0.
CBAR    10      1       10      11      0.      1.      0.
EIGRL   1                       3       0
GRID    1               0.      0.      0.              345
GRID    2               10.     0.      0.              345
GRID    3               20.     0.      0.              345
GRID    4               30.     0.      0.              345
GRID    5               39.9999 0.      0.              345
GRID    6               49.9999 0.      0.              345
GRID    7               60.     0.      0.              345
GRID    8               70.     0.      0.              345
GRID    9               80.     0.      0.              345
GRID    10              90.     0.      0.              345
GRID    11              100.    0.      0.              345
MAT1    1       1.+7            .3      .101
PARAM   COUPMASS1
PARAM   WTMASS  .00259
PBARL   1       1               I                                       +      A
+      A2.      1.      1.      .1      .1      .1
SPC1    1       1234    1
SPC1    1       234     11
$
LOAD    2       1.      1.      1
FORCE   1       11      0       500.    1.      0.      0.
ENDDATA
```

Step 5. Review Results for soln2.dat Input File

Eigenvalue Results for Beam with Pre-Load



```
                          E I G E N V A L U E   A N A L Y S I S   S U M M A R Y   (READ MODULE)



                                     BLOCK SIZE USED ......................      6

                                     NUMBER OF DECOMPOSITIONS .............      2

                                     NUMBER OF ROOTS FOUND ................      3

                                     NUMBER OF SOLVES REQUIRED ............      4

1    NORMAL MODES EXAMPLE (WITH PRE-LOAD)                                                                   PAGE    11

0                                                                                                   SUBCASE 2

                                              R E A L   E I G E N V A L U E S
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        2.735964E+04        1.654075E+02        2.632542E+01        1.000000E+00        2.735964E+04
        2         2        3.749264E+05        6.123123E+02        9.745253E+01        1.000000E+00        3.749264E+05
        3         3        1.817354E+06        1.348093E+03        2.145556E+02        1.000000E+00        1.817354E+06
```

WORKSHOP 3

NORMAL MODES ANALYSIS USING GUYAN REDUCTION

- **Workshop Objectives**
  - Use Guyan Reduction to reduce the model used in Workshop 1.
  - After the reduction is complete, using the Lanczos method, find the first five natural frequencies and mode shapes of the plate.

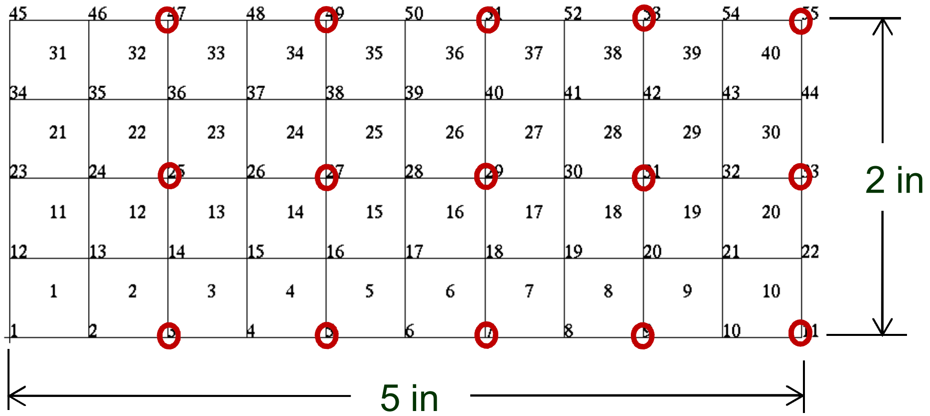
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp3.dat

- **Problem Description:**
  - The plate has the same structural data and boundary condition from workshop 1, shown on page 5 for your convenience.

- **Problem Description Continued.**
  - For the Guyan reduction, use the points indicated in figure below.

Guyan Reduction Points



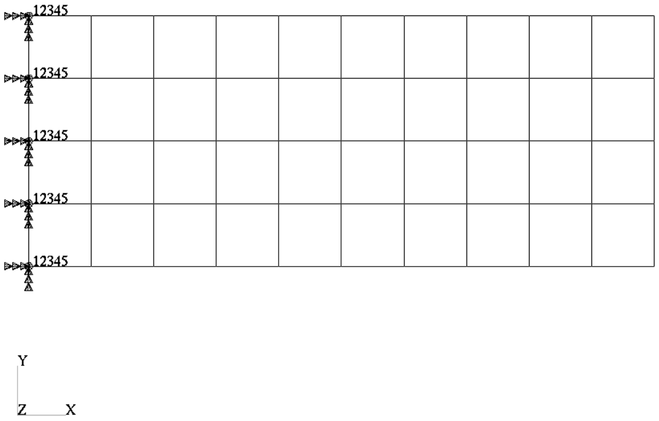
- **Problem Description Continued.**

Structural Information

Table 3A.

Length (a)	5 in
Height (b)	2 in
Thickness	0.100 in
Weight Density	0.282 lbs/in3
Mass/Weight Factor	2.59E-3 sec2/in
Elastic Modulus	30.0E6 lbs/in2
Poisson’s Ratio	0.3

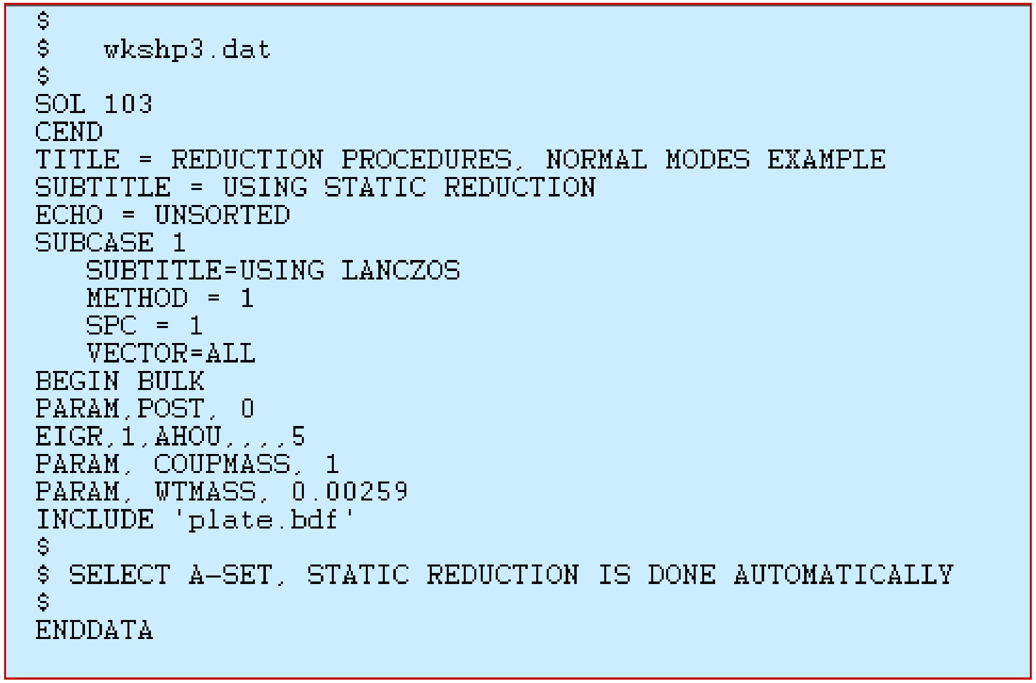
Boundary Condition



- **Suggested Steps**
  1. Open and review the wkshp3.dat file.
  2. Modify this input file to add Guyan Reduction.
  3. Run the new input file in MSC Nastran.
  4. Review the MSC Nastran results using the solution file soln3.f06.
  5. Compare results of this workshop with workshop 1.

Step 1. Open and Review the wkshp3.dat File

The workshp3.dat is the partial input file to be modified.

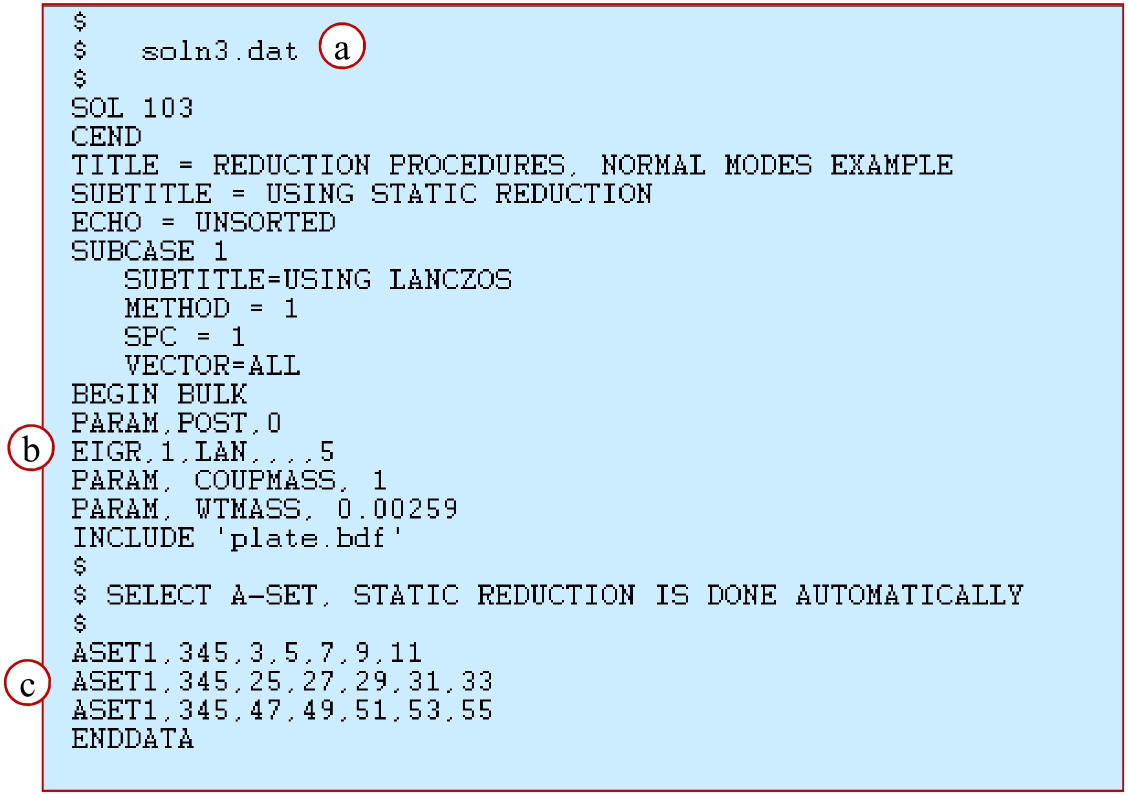


```
$
$   wkshp3.dat
$
SOL 103
CEND
TITLE = REDUCTION PROCEDURES, NORMAL MODES EXAMPLE
SUBTITLE = USING STATIC REDUCTION
ECHO = UNSORTED
SUBCASE 1
   SUBTITLE=USING LANCZOS
   METHOD = 1
   SPC = 1
   VECTOR=ALL
BEGIN BULK
PARAM,POST, 0
EIGR,1,AHOU,,,,5
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
INCLUDE 'plate.bdf'
$
$ SELECT A-SET, STATIC REDUCTION IS DONE AUTOMATICALLY
$
ENDDATA
```

Step 2. Modify Input File to Add Guyan Reduction

Start with the input file wkshp3.dat and add the request for Guyan reduction.

a. Change the file name to **soln3.dat**.
b. Change the **EIGR** entry to use the Lanczos method.
c. Add the **ASET1** entry using the points shown on page WS3-4.
d. Save the modified file as **soln3.dat**.

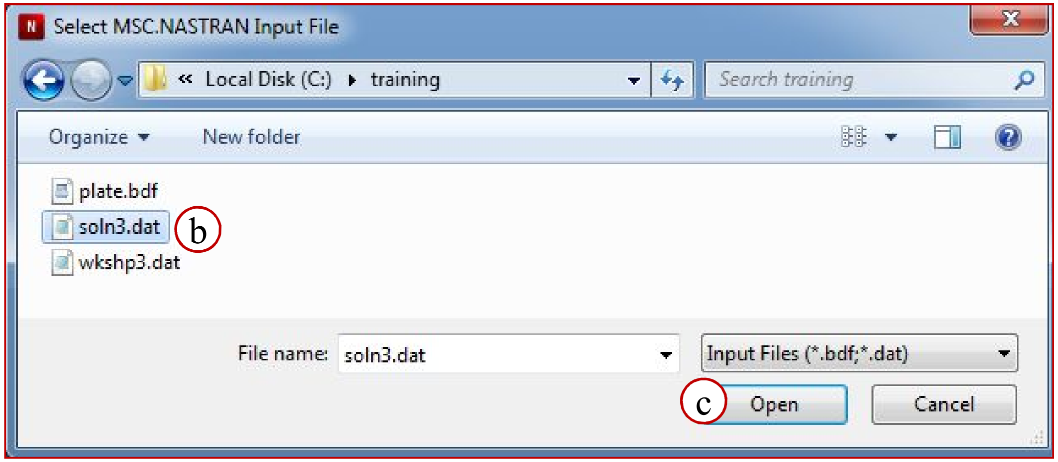


```
$
$   soln3.dat
$
SOL 103
CEND
TITLE = REDUCTION PROCEDURES, NORMAL MODES EXAMPLE
SUBTITLE = USING STATIC REDUCTION
ECHO = UNSORTED
SUBCASE 1
   SUBTITLE=USING LANCZOS
   METHOD = 1
   SPC = 1
   VECTOR=ALL
BEGIN BULK
PARAM,POST,0
EIGR,1,LAN,,,,5
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
INCLUDE 'plate.bdf'
$
$ SELECT A-SET, STATIC REDUCTION IS DONE AUTOMATICALLY
$
ASET1,345,3,5,7,9,11
ASET1,345,25,27,29,31,33
ASET1,345,47,49,51,53,55
ENDDATA
```

Step 3. Run the New Input File, soln3.dat

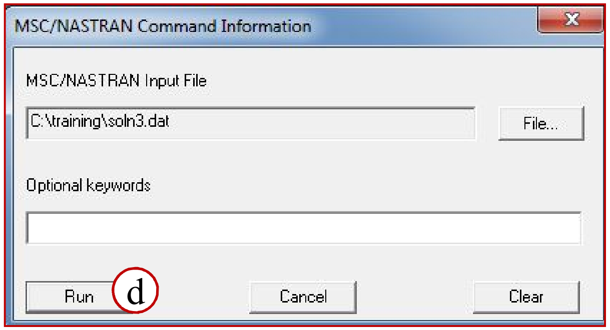
Run the soln3.dat file in MSC Nastran.

a. Double click the **MSC Nastran** desktop icon to open Nastran.
b. Navigate to the correct directory and select the file **soln3.dat**.
c. Click **Open**.
d. Click **Run**.



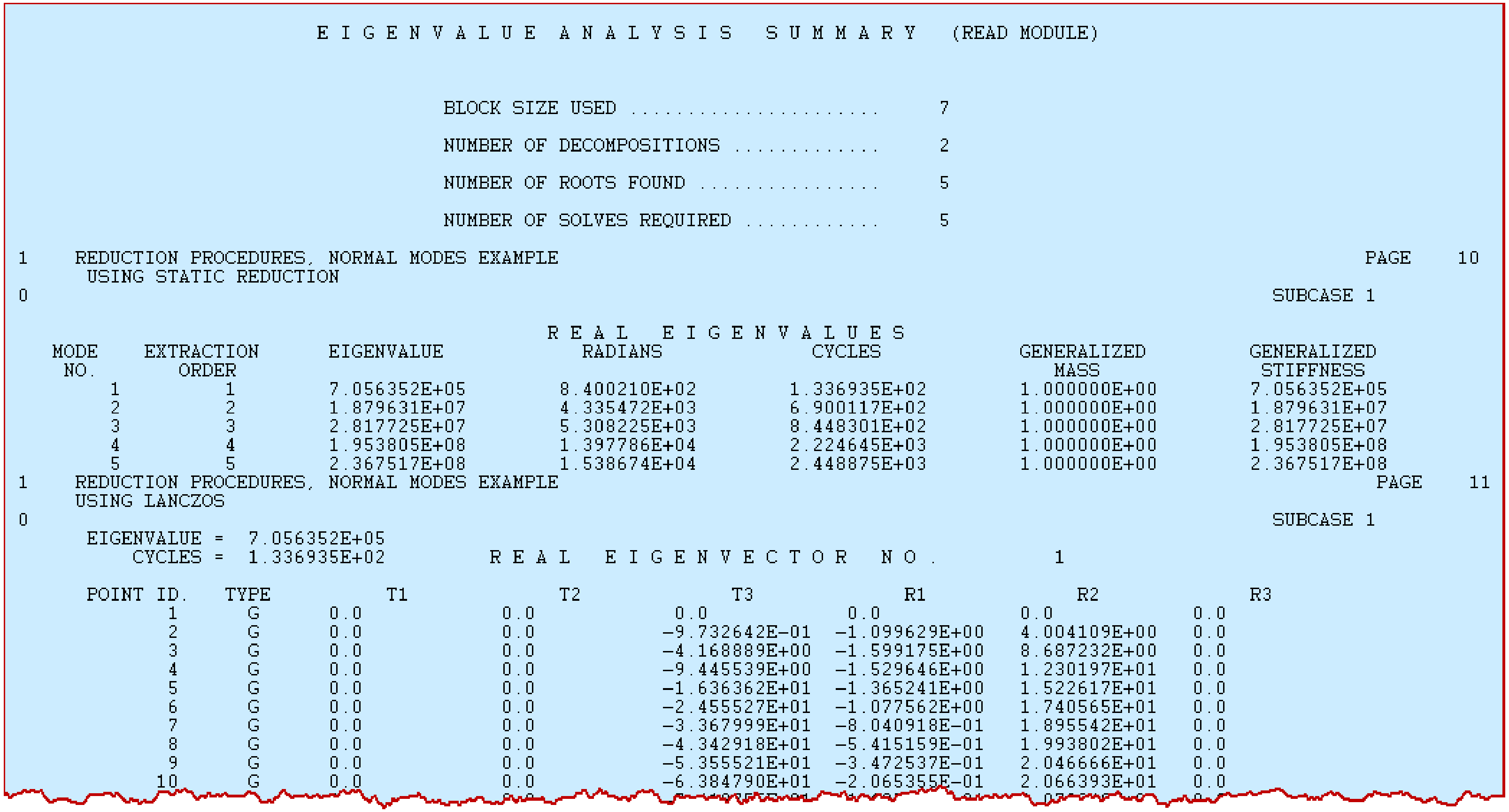
File name: soln3.dat

Input Files (*.bdf;*.dat)



MSC/NASTRAN Input File: C:\training\soln3.dat

Step 4. Review Results of Input File, soln3.dat



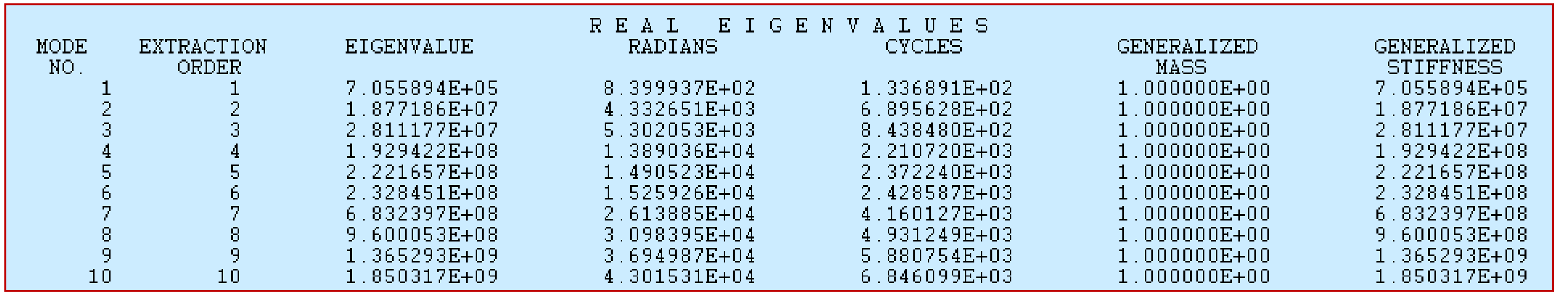
```
                          E I G E N V A L U E   A N A L Y S I S   S U M M A R Y   (READ MODULE)



                                     BLOCK SIZE USED ......................     7

                                     NUMBER OF DECOMPOSITIONS .............     2

                                     NUMBER OF ROOTS FOUND ................     5

                                     NUMBER OF SOLVES REQUIRED ............     5

1    REDUCTION PROCEDURES, NORMAL MODES EXAMPLE                                                                      PAGE    10
      USING STATIC REDUCTION
0                                                                                                            SUBCASE 1

                                              R E A L   E I G E N V A L U E S
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        7.056352E+05        8.400210E+02        1.336935E+02        1.000000E+00        7.056352E+05
        2         2        1.879631E+07        4.335472E+03        6.900117E+02        1.000000E+00        1.879631E+07
        3         3        2.817725E+07        5.308225E+03        8.448301E+02        1.000000E+00        2.817725E+07
        4         4        1.953805E+08        1.397786E+04        2.224645E+03        1.000000E+00        1.953805E+08
        5         5        2.367517E+08        1.538674E+04        2.448875E+03        1.000000E+00        2.367517E+08
1    REDUCTION PROCEDURES, NORMAL MODES EXAMPLE                                                                       PAGE     11
     USING LANCZOS
0                                                                                                            SUBCASE 1
      EIGENVALUE =  7.056352E+05
          CYCLES =  1.336935E+02         R E A L   E I G E N V E C T O R   N O .              1

      POINT ID.   TYPE          T1             T2             T3             R1             R2             R3
             1      G      0.0            0.0            0.0            0.0            0.0            0.0
             2      G      0.0            0.0           -9.732642E-01  -1.099629E+00   4.004109E+00   0.0
             3      G      0.0            0.0           -4.168889E+00  -1.599175E+00   8.687232E+00   0.0
             4      G      0.0            0.0           -9.445539E+00  -1.529646E+00   1.230197E+01   0.0
             5      G      0.0            0.0           -1.636362E+01  -1.365241E+00   1.522617E+01   0.0
             6      G      0.0            0.0           -2.455527E+01  -1.077562E+00   1.740565E+01   0.0
             7      G      0.0            0.0           -3.367999E+01  -8.040918E-01   1.895542E+01   0.0
             8      G      0.0            0.0           -4.342918E+01  -5.415159E-01   1.993802E+01   0.0
             9      G      0.0            0.0           -5.355521E+01  -3.472537E-01   2.046666E+01   0.0
            10      G      0.0            0.0           -6.384790E+01  -2.065355E-01   2.066393E+01   0.0
```

To see the entire list of results, use the soln3.f06 file

Step 5. Compare Results

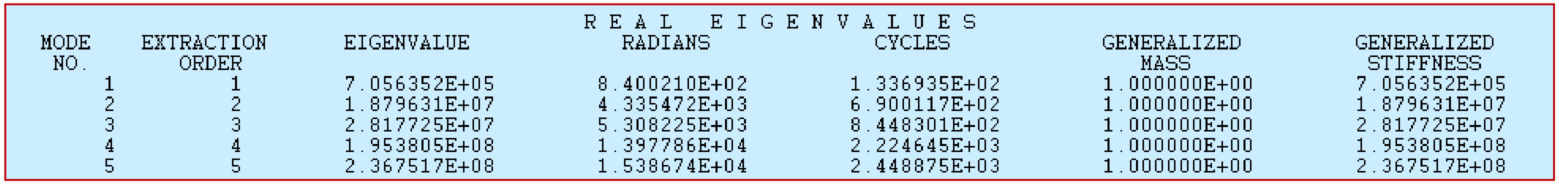
Compare the results after the Guyan Reduction with workshop 1.

Eigenvalue results from workshop 1



```
                                          R E A L   E I G E N V A L U E S
 MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
  NO.       ORDER                                                                        MASS              STIFFNESS
     1         1        7.055894E+05        8.399937E+02        1.336891E+02        1.000000E+00        7.055894E+05
     2         2        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
     3         3        2.811177E+07        5.302053E+03        8.438480E+02        1.000000E+00        2.811177E+07
     4         4        1.929422E+08        1.389036E+04        2.210720E+03        1.000000E+00        1.929422E+08
     5         5        2.221657E+08        1.490523E+04        2.372240E+03        1.000000E+00        2.221657E+08
     6         6        2.328451E+08        1.525926E+04        2.428587E+03        1.000000E+00        2.328451E+08
     7         7        6.832397E+08        2.613885E+04        4.160127E+03        1.000000E+00        6.832397E+08
     8         8        9.600053E+08        3.098395E+04        4.931249E+03        1.000000E+00        9.600053E+08
     9         9        1.365293E+09        3.694987E+04        5.880754E+03        1.000000E+00        1.365293E+09
    10        10        1.850317E+09        4.301531E+04        6.846099E+03        1.000000E+00        1.850317E+09
```

Eigenvalue results from workshop 3



```
                                          R E A L   E I G E N V A L U E S
 MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
  NO.       ORDER                                                                        MASS              STIFFNESS
     1         1        7.056352E+05        8.400210E+02        1.336935E+02        1.000000E+00        7.056352E+05
     2         2        1.879631E+07        4.335472E+03        6.900117E+02        1.000000E+00        1.879631E+07
     3         3        2.817725E+07        5.308225E+03        8.448301E+02        1.000000E+00        2.817725E+07
     4         4        1.953805E+08        1.397786E+04        2.224645E+03        1.000000E+00        1.953805E+08
     5         5        2.367517E+08        1.538674E+04        2.448875E+03        1.000000E+00        2.367517E+08
```

WORKSHOP 4
DIRECT TRANSIENT RESPONSE

- **Workshop Objectives**
  - Using the direct method, determine the transient response of the flat rectangular plate (from Workshop 1) subject to time-varying excitation as described below.

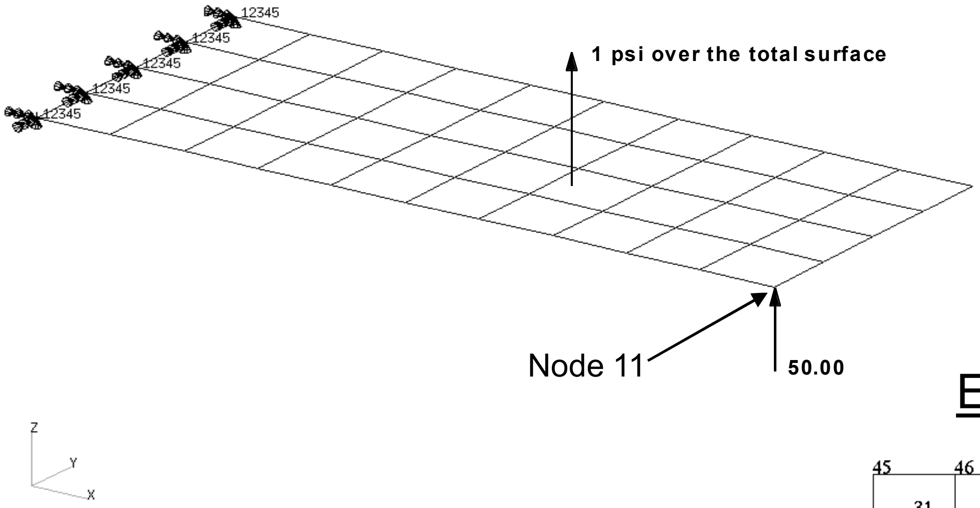
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp4.dat

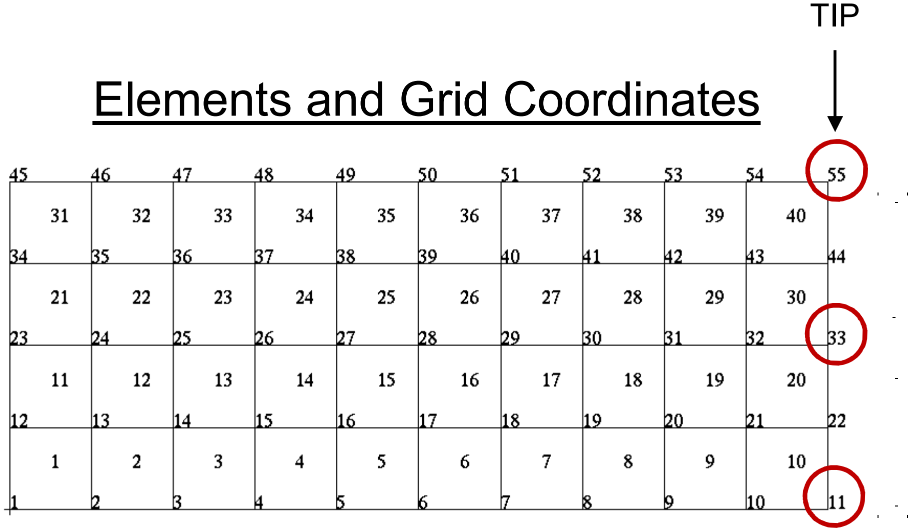
- **Problem Description**
  - The structure is excited by 1 psi pressure load over the total surface of the plate varying at 250 Hz. In addition, a 50 lb force is applied at a corner of the tip also varying at 250 Hz, but 180^o out-of-phase with the pressure load. Both time dependent dynamic loads are applied for the duration of 0.008 seconds only. Use structural damping of g=0.06 and convert this damping to equivalent viscous damping at 250 Hz. Carry the analysis for 0.04 seconds.

- **Problem Description Continued**
  - The diagrams below show the finite element representation of the flat plate and the loads and boundary condition.

Loads and Boundary Condition



Elements and Grid Coordinates



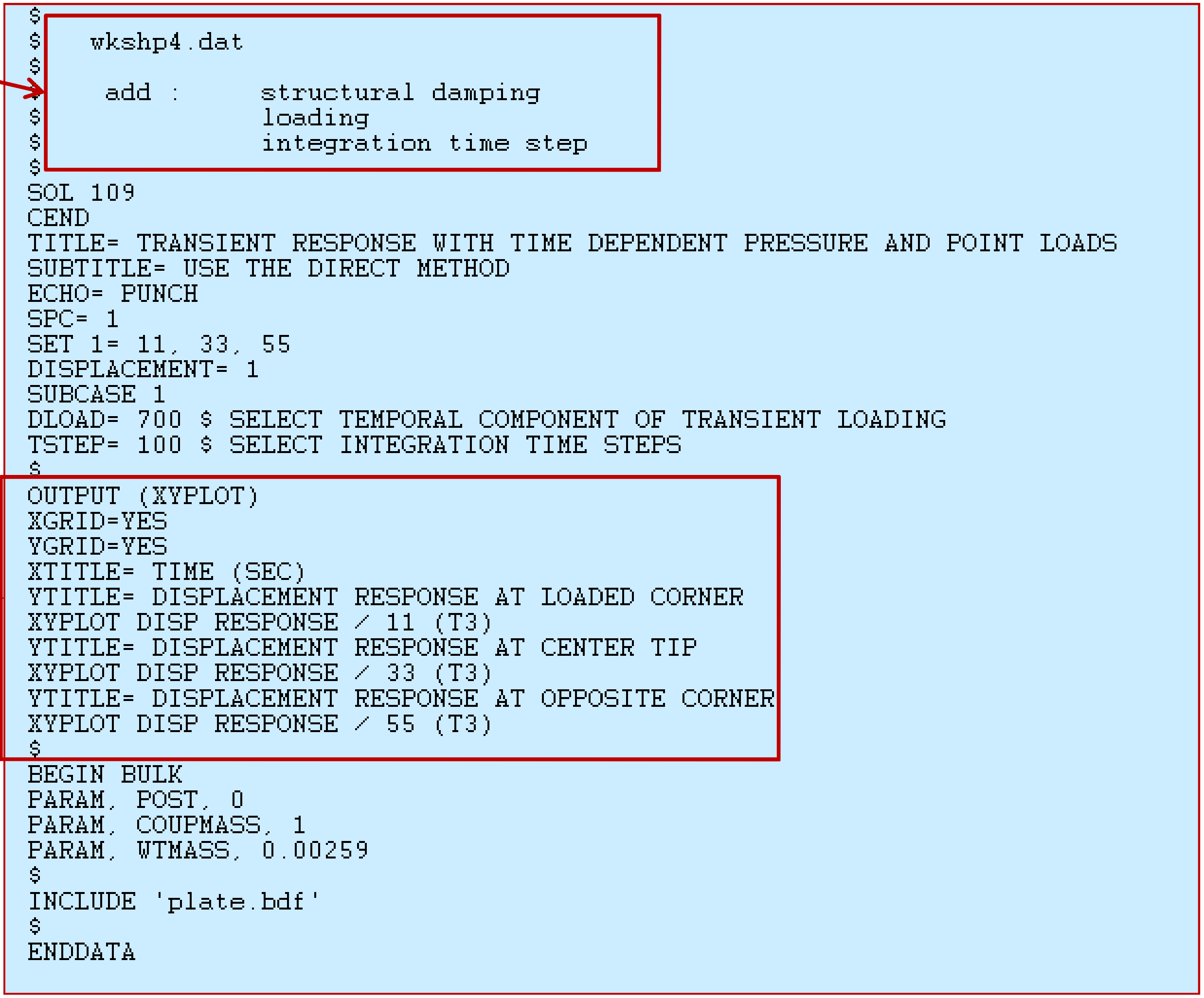
- **Suggested Steps**
  1. Open and review the input file wkshp4.dat.
  2. Add structural damping and convert to viscous damping.
  3. Add the time dependent pressure load.
  4. Add the time dependent point load.
  5. Add the combined loads
  6. Add the integration step.
  7. Save and run the new input file in MSC Nastran.
  8. Review the MSC Nastran results using the solution file soln4.f06
  9. Convert results to graph.
  10. View the graph results.

Step 1. Open and Review the Input File wkshp4.dat

The file wkshp4.dat is the starting input file to be modified.

To complete input file add these entries

Output displacement response graphs at grid points 11, 33,55



```
$
$    wkshp4.dat
$
$     add :      structural damping
$                loading
$                integration time step
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= 1
SUBCASE 1
DLOAD= 700 $ SELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ SELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

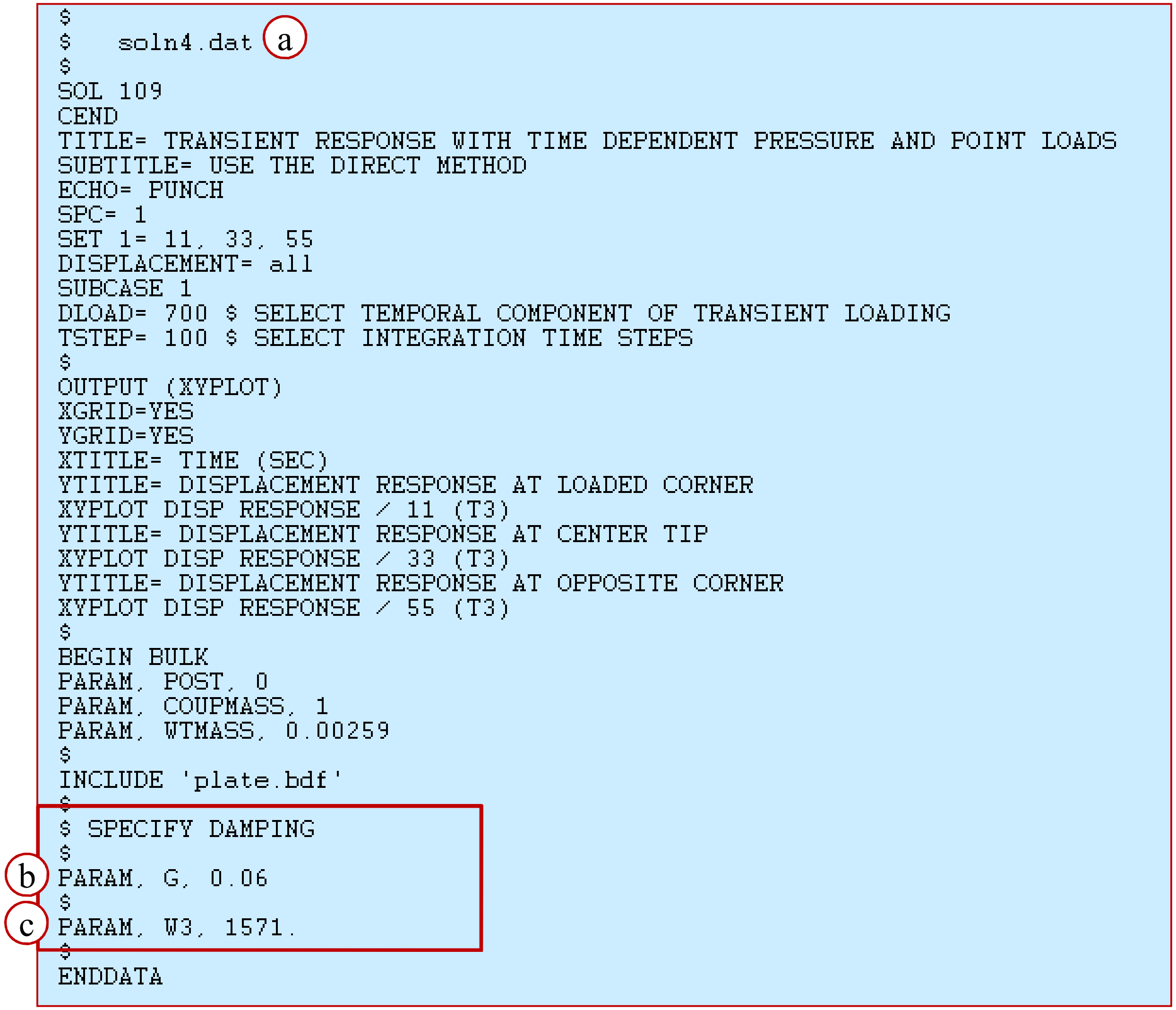
Step 2. Add Structural Damping and Convert to Viscous Damping

Add the appropriate parameters in the Bulk Data section for damping.

a. First rename the input file as **soln4.dat**.

b. For structural damping, use **PARAM G** with a value of **.06**.

c. To convert to viscous damping, use **PARAM W3**, for the value of this parameter, convert 250 Hz to radians/sec



```
$
$   soln4.dat
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= all
SUBCASE 1
DLOAD= 700 $ SELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ SELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY DAMPING
$
PARAM, G, 0.06
$
PARAM, W3, 1571.
$
ENDDATA
```

Step 3. Add Time Dependent Pressure Load

Add the time dependent pressure load of 1 psi over the entire plate varying at 250 HZ.

a. Use a **TLOAD2** entry in combination with a **PLOAD2** and the given information on page WS4-3 to obtain:
   - Time = **from 0 to .008 sec**
   - Frequency = **250 HZ**
   - Phase angle = **-90°**
b. For the **PLOAD** entry, apply the pressure of **1 psi** over all the elements of the plate. (**1 through 40**)

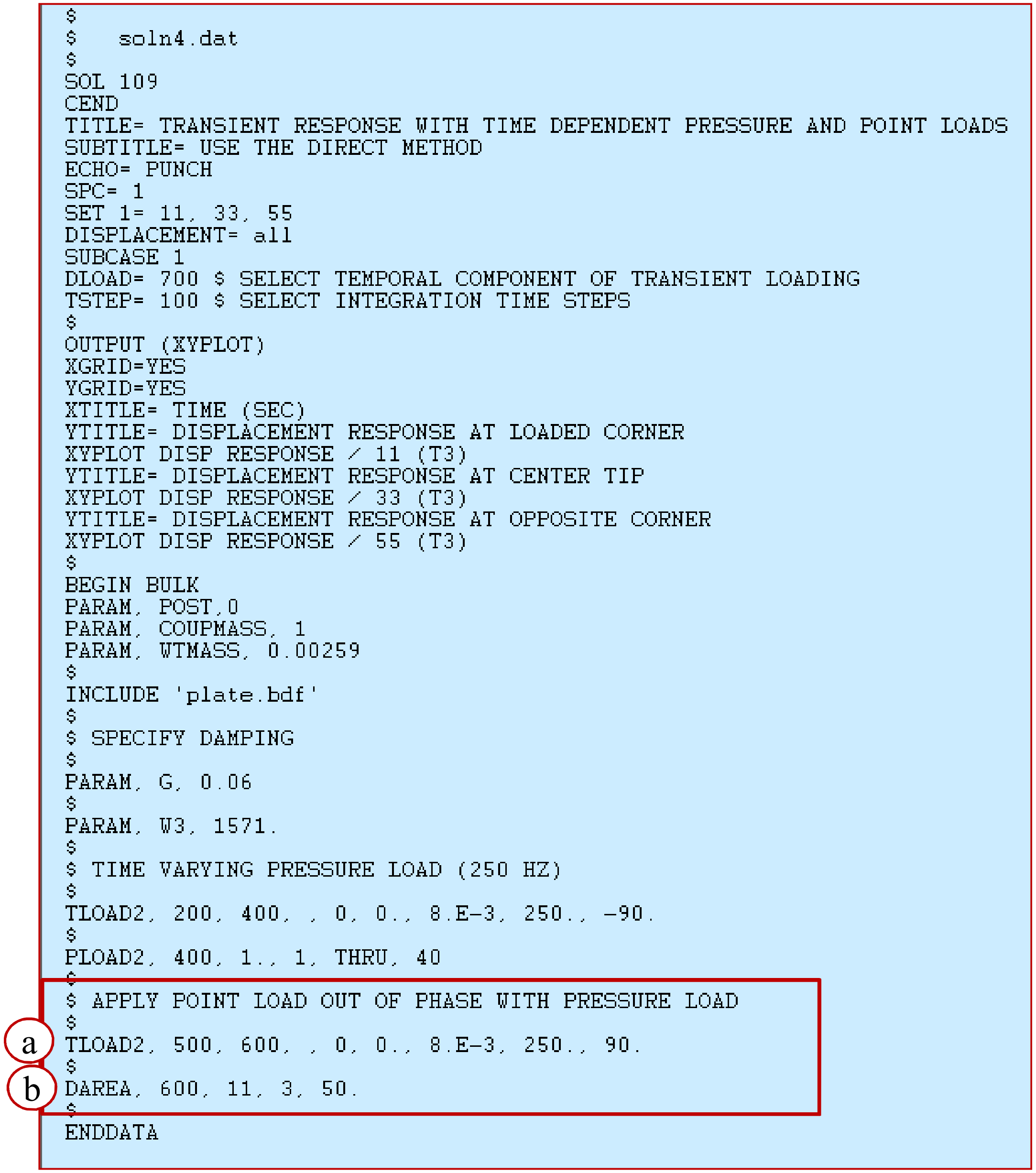
```
$
$   soln4.dat
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= all
SUBCASE 1
DLOAD= 700 $ SELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ SELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY DAMPING
$
PARAM, G, 0.06
$
PARAM, W3, 1571.
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
ⓐ TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
$
ⓑ PLOAD2, 400, 1., 1, THRU, 40
$
ENDDATA
```

Step 4. Add Time Dependent Point Load

Add the time dependent point load at the corner of the tip of the plate (grid point 11) , also varying at 250 Hz but 180^{o} out-of-phase with the pressure load.

a. Use the **TLOAD2** entry in combination with a **DAREA** entry and the above information.
   - Time = **0 to .008 sec**
   - Frequency = **250 HZ**
   - Phase angle = **90^{o}**

b. For the **DAREA** entry, note that the **50 lb** force is applied at grid **11** in the **Z** direction.



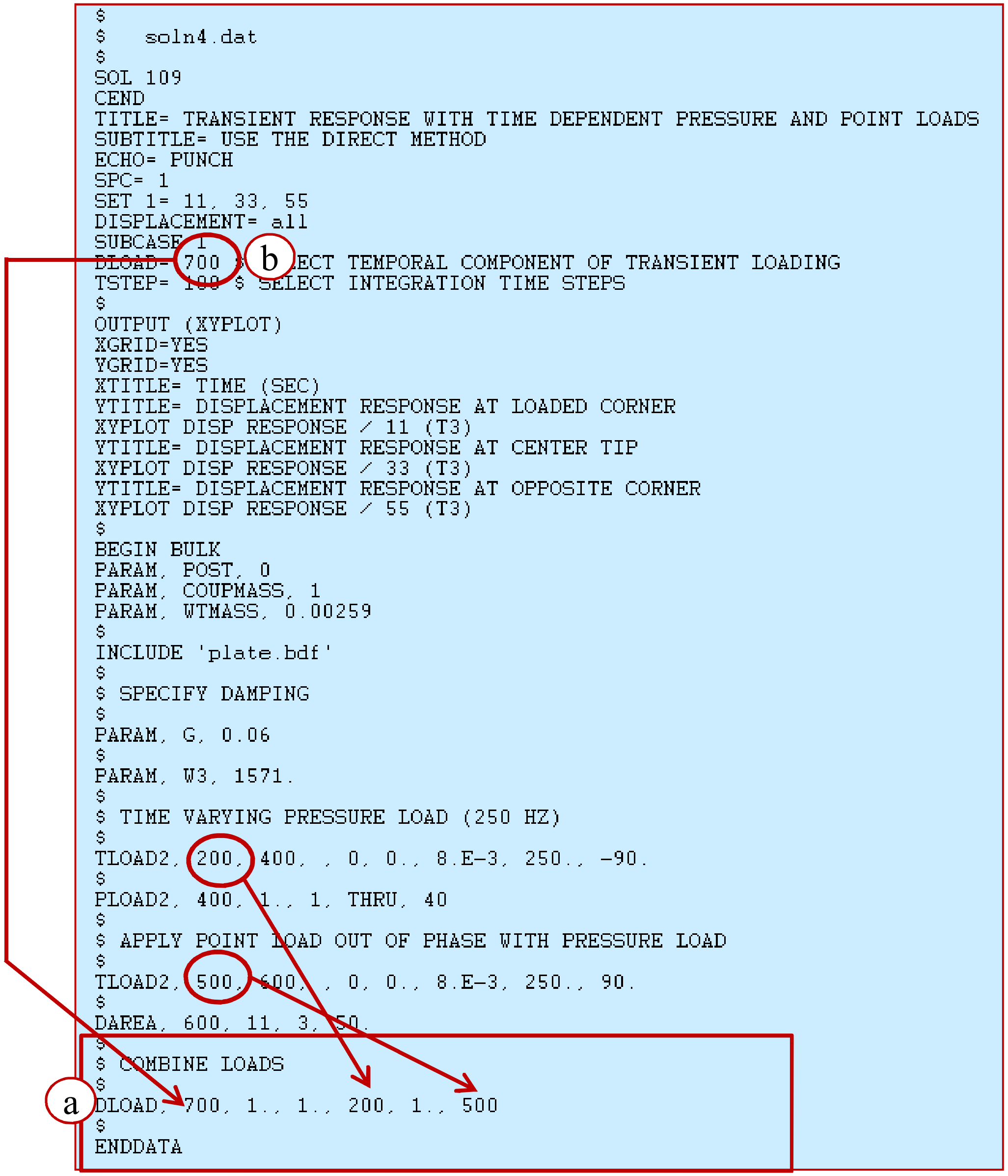
```
$
$   soln4.dat
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= all
SUBCASE 1
DLOAD= 700 $ SELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ SELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST,0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY DAMPING
$
PARAM, G, 0.06
$
PARAM, W3, 1571.
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
$
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD OUT OF PHASE WITH PRESSURE LOAD
$
TLOAD2, 500, 600, , 0, 0., 8.E-3, 250., 90.
$
DAREA, 600, 11, 3, 50.
$
ENDDATA
```

Step 5. Add the Combined Loads

Combine the pressure and point loads using a DLOAD entry.

a. For the **DLOAD** entry, define the scale as **1.** for both loads.

b. Make sure the **DLOAD** Case Control command indentification matches the SID for the **DLOAD** entry in the Bulk Data section.



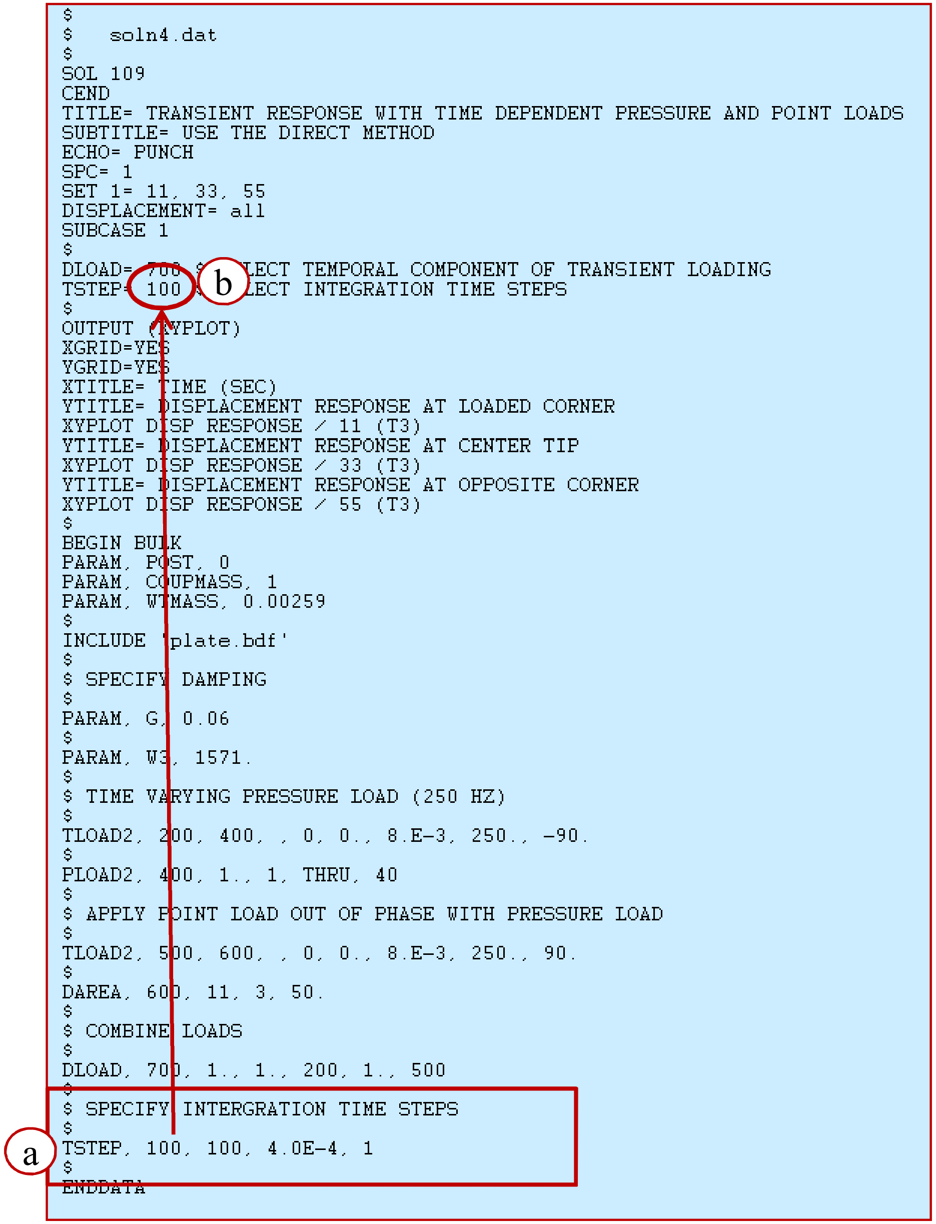
```
$
$   soln4.dat
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= all
SUBCASE 1
DLOAD= 700 $ SELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ SELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY DAMPING
$
PARAM, G, 0.06
$
PARAM, W3, 1571.
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
$
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD OUT OF PHASE WITH PRESSURE LOAD
$
TLOAD2, 500, 600, , 0, 0., 8.E-3, 250., 90.
$
DAREA, 600, 11, 3, 50.
$
$ COMBINE LOADS
$
DLOAD, 700, 1., 1., 200, 1., 500
$
ENDDATA
```

Step 6. Add the Integration Time Step

To add the Time step:

a. For the **TSTEP** entry, use **100** steps and a time increment of **.0004** seconds, so that the total time will be **.04** seconds.

b. Make sure that the **TSTEP** Case Control command indentification matches the SID for the **TSTEP** entry in the Bulk Data section.

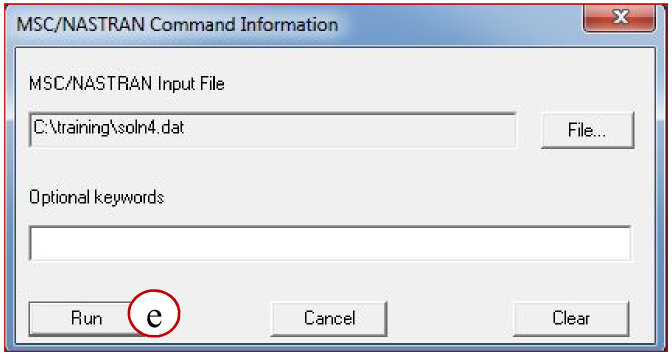


```
$
$   soln4.dat
$
SOL 109
CEND
TITLE= TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE= USE THE DIRECT METHOD
ECHO= PUNCH
SPC= 1
SET 1= 11, 33, 55
DISPLACEMENT= all
SUBCASE 1
$
DLOAD= 700 $ ELECT TEMPORAL COMPONENT OF TRANSIENT LOADING
TSTEP= 100 $ ELECT INTEGRATION TIME STEPS
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT CENTER TIP
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY DAMPING
$
PARAM, G, 0.06
$
PARAM, W3, 1571.
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
$
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD OUT OF PHASE WITH PRESSURE LOAD
$
TLOAD2, 500, 600, , 0, 0., 8.E-3, 250., 90.
$
DAREA, 600, 11, 3, 50.
$
$ COMBINE LOADS
$
DLOAD, 700, 1., 1., 200, 1., 500
$
$ SPECIFY INTERGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
ENDDATA
```

Step 7. Save and Run the New Input File

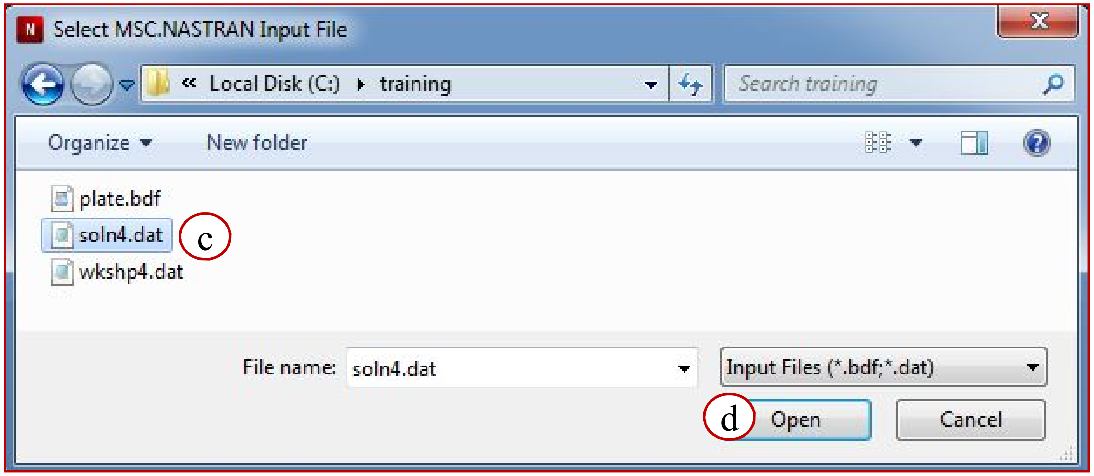
Save and run the modified file in Nastran.

a. Save the modified file as **soln4.dat**.
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln4.dat**.
d. Click **Open**.
e. Click **Run**.


MSC/NASTRAN Command Information

MSC/NASTRAN Input File: C:\training\soln4.dat

Optional keywords:


Select MSC.NASTRAN Input File

« Local Disk (C:) ▸ training

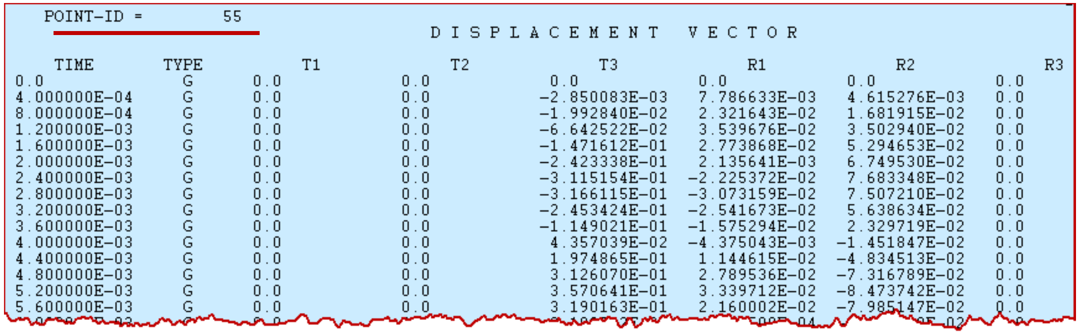
- plate.bdf
- soln4.dat
- wkshp4.dat

File name: soln4.dat

Input Files (*.bdf;*.dat)

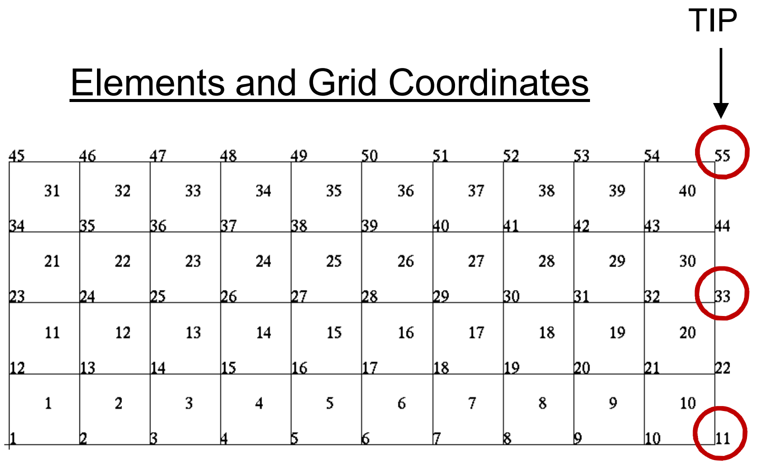
Step 8. Review the Results

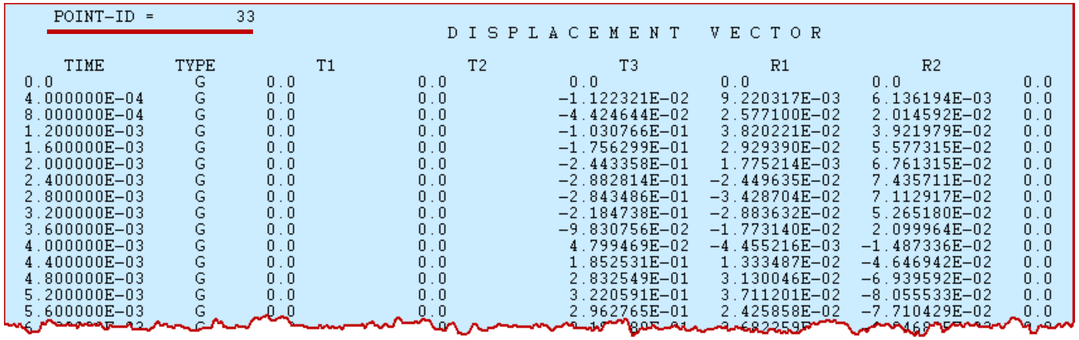
To see the results open the soln4.f06 file. The three grid points of interest lie along the tip of the plate, grid points 11, 33, 55.



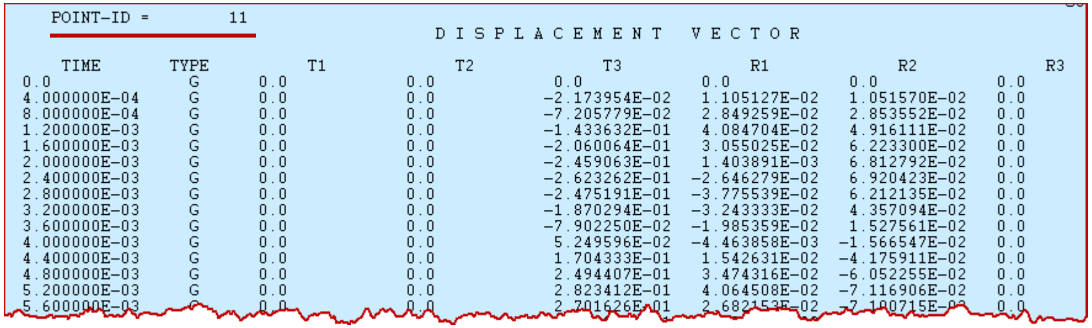
```
    POINT-ID =         55
                                         D I S P L A C E M E N T   V E C T O R

     TIME         TYPE          T1             T2             T3             R1             R2             R3
0.0                G      0.0            0.0            0.0            0.0            0.0            0.0
4.000000E-04       G      0.0            0.0           -2.850083E-03   7.786633E-03   4.615276E-03   0.0
8.000000E-04       G      0.0            0.0           -1.992840E-02   2.321643E-02   1.681915E-02   0.0
1.200000E-03       G      0.0            0.0           -6.642522E-02   3.539676E-02   3.502940E-02   0.0
1.600000E-03       G      0.0            0.0           -1.471612E-01   2.773868E-02   5.294653E-02   0.0
2.000000E-03       G      0.0            0.0           -2.423338E-01   2.135641E-03   6.749530E-02   0.0
2.400000E-03       G      0.0            0.0           -3.115154E-01  -2.225372E-02   7.683348E-02   0.0
2.800000E-03       G      0.0            0.0           -3.166115E-01  -3.073159E-02   7.507210E-02   0.0
3.200000E-03       G      0.0            0.0           -2.453424E-01  -2.541673E-02   5.638634E-02   0.0
3.600000E-03       G      0.0            0.0           -1.149021E-01  -1.575294E-02   2.329719E-02   0.0
4.000000E-03       G      0.0            0.0            4.357039E-02  -4.375043E-03  -1.451847E-02   0.0
4.400000E-03       G      0.0            0.0            1.974865E-01   1.144615E-02  -4.834513E-02   0.0
4.800000E-03       G      0.0            0.0            3.126070E-01   2.789536E-02  -7.316789E-02   0.0
5.200000E-03       G      0.0            0.0            3.570641E-01   3.339712E-02  -8.473742E-02   0.0
5.600000E-03       G      0.0            0.0            3.190163E-01   2.160002E-02  -7.985147E-02   0.0
```

Elements and Grid Coordinates





```
    POINT-ID =         33
                                         D I S P L A C E M E N T   V E C T O R

     TIME         TYPE          T1             T2             T3             R1             R2
0.0                G      0.0            0.0            0.0            0.0            0.0            0.0
4.000000E-04       G      0.0            0.0           -1.122321E-02   9.220317E-03   6.136194E-03   0.0
8.000000E-04       G      0.0            0.0           -4.424644E-02   2.577100E-02   2.014592E-02   0.0
1.200000E-03       G      0.0            0.0           -1.030766E-01   3.820221E-02   3.921979E-02   0.0
1.600000E-03       G      0.0            0.0           -1.756299E-01   2.929390E-02   5.577315E-02   0.0
2.000000E-03       G      0.0            0.0           -2.443358E-01   1.775214E-03   6.761315E-02   0.0
2.400000E-03       G      0.0            0.0           -2.882814E-01  -2.449635E-02   7.435711E-02   0.0
2.800000E-03       G      0.0            0.0           -2.843486E-01  -3.428704E-02   7.112917E-02   0.0
3.200000E-03       G      0.0            0.0           -2.184738E-01  -2.883632E-02   5.265180E-02   0.0
3.600000E-03       G      0.0            0.0           -9.830756E-02  -1.773140E-02   2.099964E-02   0.0
4.000000E-03       G      0.0            0.0            4.799469E-02  -4.455216E-03  -1.487336E-02   0.0
4.400000E-03       G      0.0            0.0            1.852531E-01   1.333487E-02  -4.646942E-02   0.0
4.800000E-03       G      0.0            0.0            2.832549E-01   3.130046E-02  -6.939592E-02   0.0
5.200000E-03       G      0.0            0.0            3.220591E-01   3.711201E-02  -8.055533E-02   0.0
5.600000E-03       G      0.0            0.0            2.962765E-01   2.425858E-02  -7.710429E-02   0.0
```



```
    POINT-ID =         11
                                         D I S P L A C E M E N T   V E C T O R

     TIME         TYPE          T1             T2             T3             R1             R2             R3
0.0                G      0.0            0.0            0.0            0.0            0.0            0.0
4.000000E-04       G      0.0            0.0           -2.173954E-02   1.105127E-02   1.051570E-02   0.0
8.000000E-04       G      0.0            0.0           -7.205779E-02   2.849259E-02   2.853552E-02   0.0
1.200000E-03       G      0.0            0.0           -1.433632E-01   4.084704E-02   4.916111E-02   0.0
1.600000E-03       G      0.0            0.0           -2.060064E-01   3.055025E-02   6.223300E-02   0.0
2.000000E-03       G      0.0            0.0           -2.459063E-01   1.403891E-03   6.812792E-02   0.0
2.400000E-03       G      0.0            0.0           -2.623262E-01  -2.646279E-02   6.920423E-02   0.0
2.800000E-03       G      0.0            0.0           -2.475191E-01  -3.775539E-02   6.212135E-02   0.0
3.200000E-03       G      0.0            0.0           -1.870294E-01  -3.243333E-02   4.357094E-02   0.0
3.600000E-03       G      0.0            0.0           -7.902250E-02  -1.985359E-02   1.527561E-02   0.0
4.000000E-03       G      0.0            0.0            5.249596E-02  -4.463858E-03  -1.566547E-02   0.0
4.400000E-03       G      0.0            0.0            1.704333E-01   1.542631E-02  -4.175911E-02   0.0
4.800000E-03       G      0.0            0.0            2.494407E-01   3.474316E-02  -6.052255E-02   0.0
5.200000E-03       G      0.0            0.0            2.823412E-01   4.064508E-02  -7.116906E-02   0.0
5.600000E-03       G      0.0            0.0            2.701626E-01   2.682153E-02  -7.100715E-02   0.0
```

Step 9. Convert Results to Graph

After submitting the solution file in Nastran, it will create a soln4.plt file. This file need to convert to a soln4.ps that can then be read with any postscript viewer to create a graph file.

a. Open a cmd window. (CMD.exe)

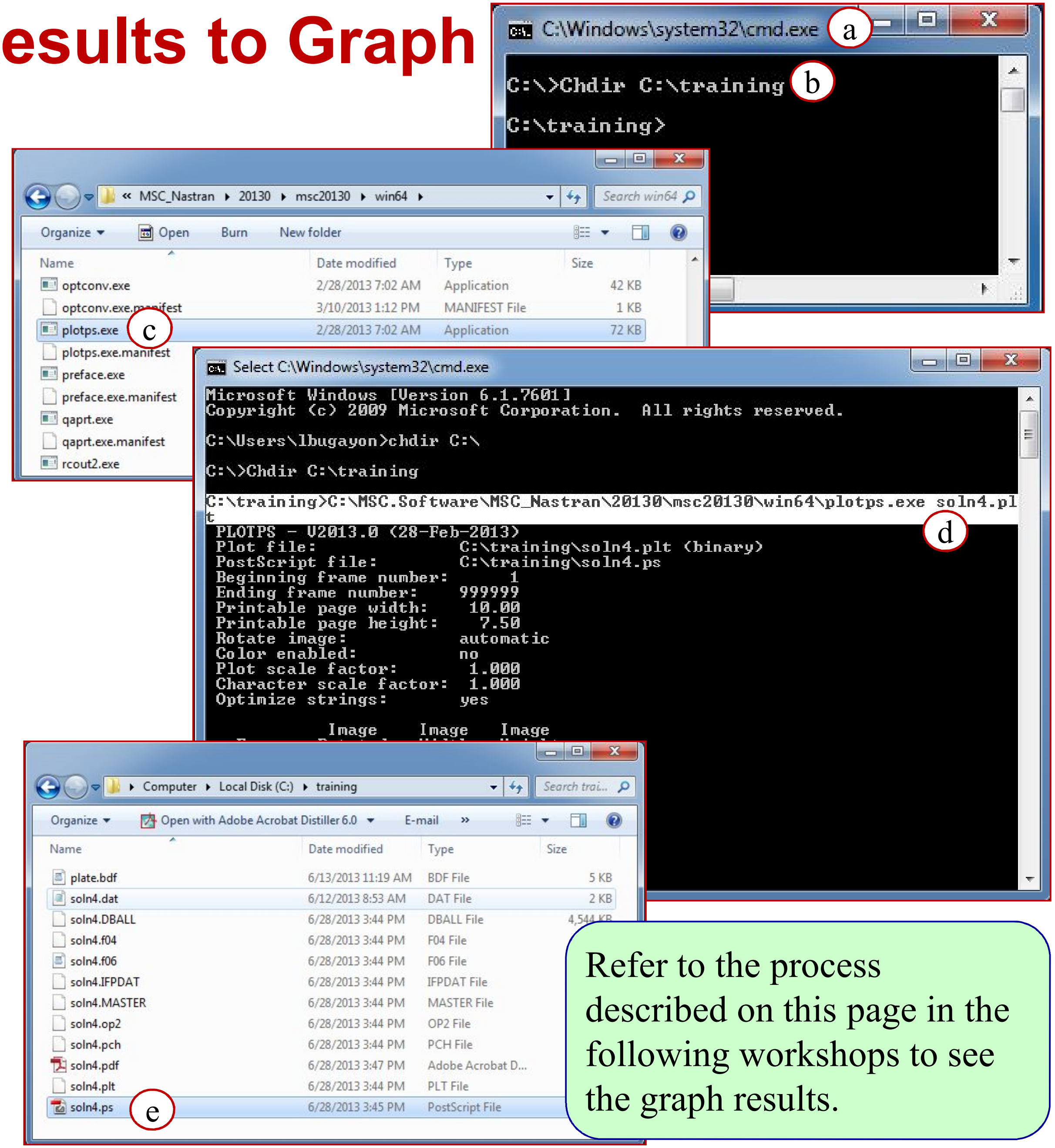
b. Change the current directory to the one in which the **soln4.plt** file is located. (for this this example *c:\training*)

c. Need to use the file **plotps.exe** in the directory C:**\MSC.Software\MSC_Nastran\20130\msc20130\win64.** Check to make sure this file exists there.

d. In the cmd window, type in the following.
   - **C:\MSC.Software\MSC_Nastran\20130\msc20130\win64\plotps.exe soln4.plt**

e. This should have created a new file **soln4.ps**. Check to make sure that it is now in your directory.

f. Open the file, it should automatically use *Acrobat Distiller* to create the **soln10a.pdf** file. This file contains the 3 graph results requested in XY Plot.



```
C:\>Chdir C:\training

C:\training>
```

Name	Date modified	Type	Size
optconv.exe	2/28/2013 7:02 AM	Application	42 KB
optconv.exe.manifest	3/10/2013 1:12 PM	MANIFEST File	1 KB
plotps.exe	2/28/2013 7:02 AM	Application	72 KB
plotps.exe.manifest			
preface.exe			
preface.exe.manifest			
qaprt.exe			
qaprt.exe.manifest			
rcout2.exe			

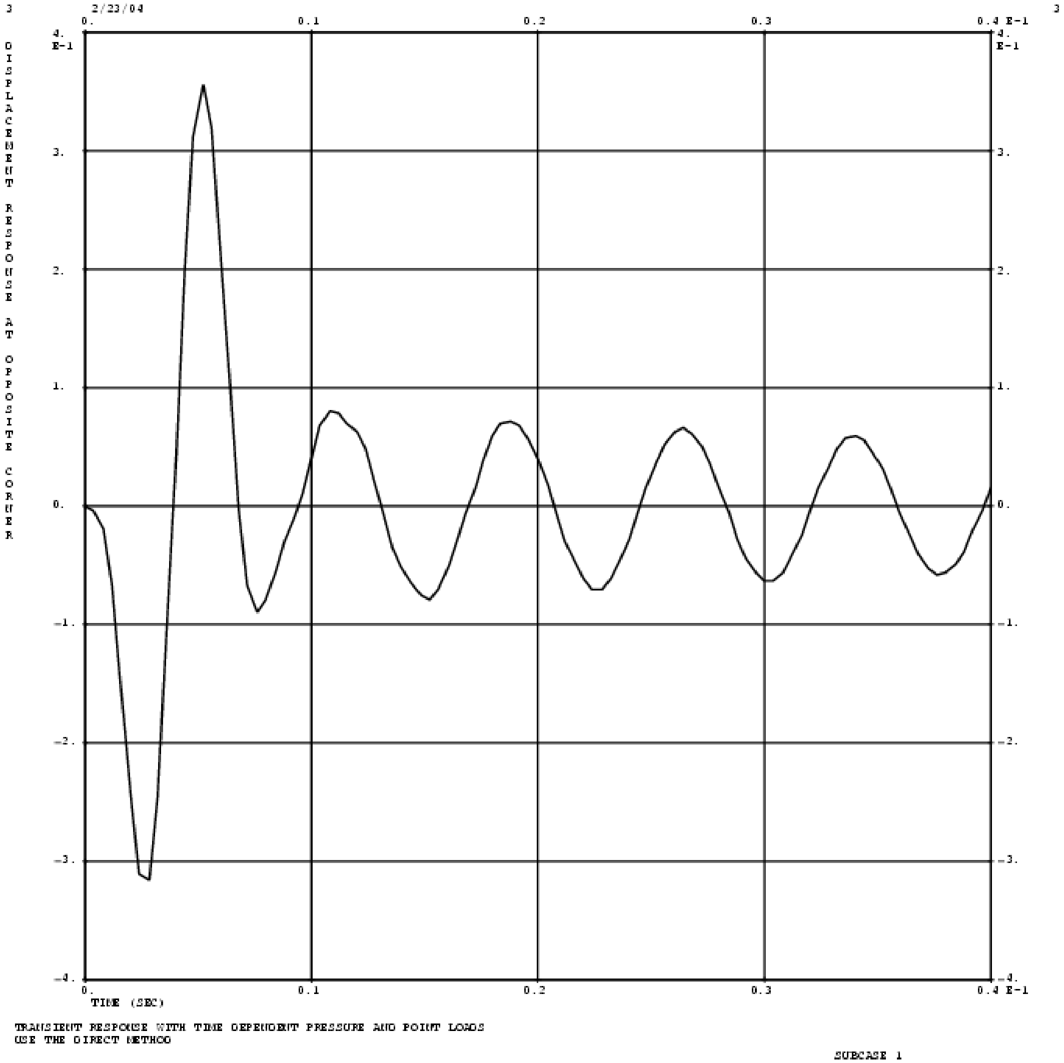
```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\lbugayon>chdir C:\

C:\>Chdir C:\training

C:\training>C:\MSC.Software\MSC_Nastran\20130\msc20130\win64\plotps.exe soln4.pl
t
 PLOTPS - V2013.0 (28-Feb-2013)
 Plot file:                C:\training\soln4.plt (binary)
 PostScript file:          C:\training\soln4.ps
 Beginning frame number:        1
 Ending frame number:      999999
 Printable page width:      10.00
 Printable page height:      7.50
 Rotate image:             automatic
 Color enabled:            no
 Plot scale factor:         1.000
 Character scale factor:    1.000
 Optimize strings:         yes

           Image     Image    Image
```

Name	Date modified	Type	Size
plate.bdf	6/13/2013 11:19 AM	BDF File	5 KB
soln4.dat	6/12/2013 8:53 AM	DAT File	2 KB
soln4.DBALL	6/28/2013 3:44 PM	DBALL File	4,544 KB
soln4.f04	6/28/2013 3:44 PM	F04 File	
soln4.f06	6/28/2013 3:44 PM	F06 File	
soln4.IFPDAT	6/28/2013 3:44 PM	IFPDAT File	
soln4.MASTER	6/28/2013 3:44 PM	MASTER File	
soln4.op2	6/28/2013 3:44 PM	OP2 File	
soln4.pch	6/28/2013 3:44 PM	PCH File	
soln4.pdf	6/28/2013 3:47 PM	Adobe Acrobat D...	
soln4.plt	6/28/2013 3:44 PM	PLT File	
soln4.ps	6/28/2013 3:45 PM	PostScript File	

Refer to the process described on this page in the following workshops to see the graph results.

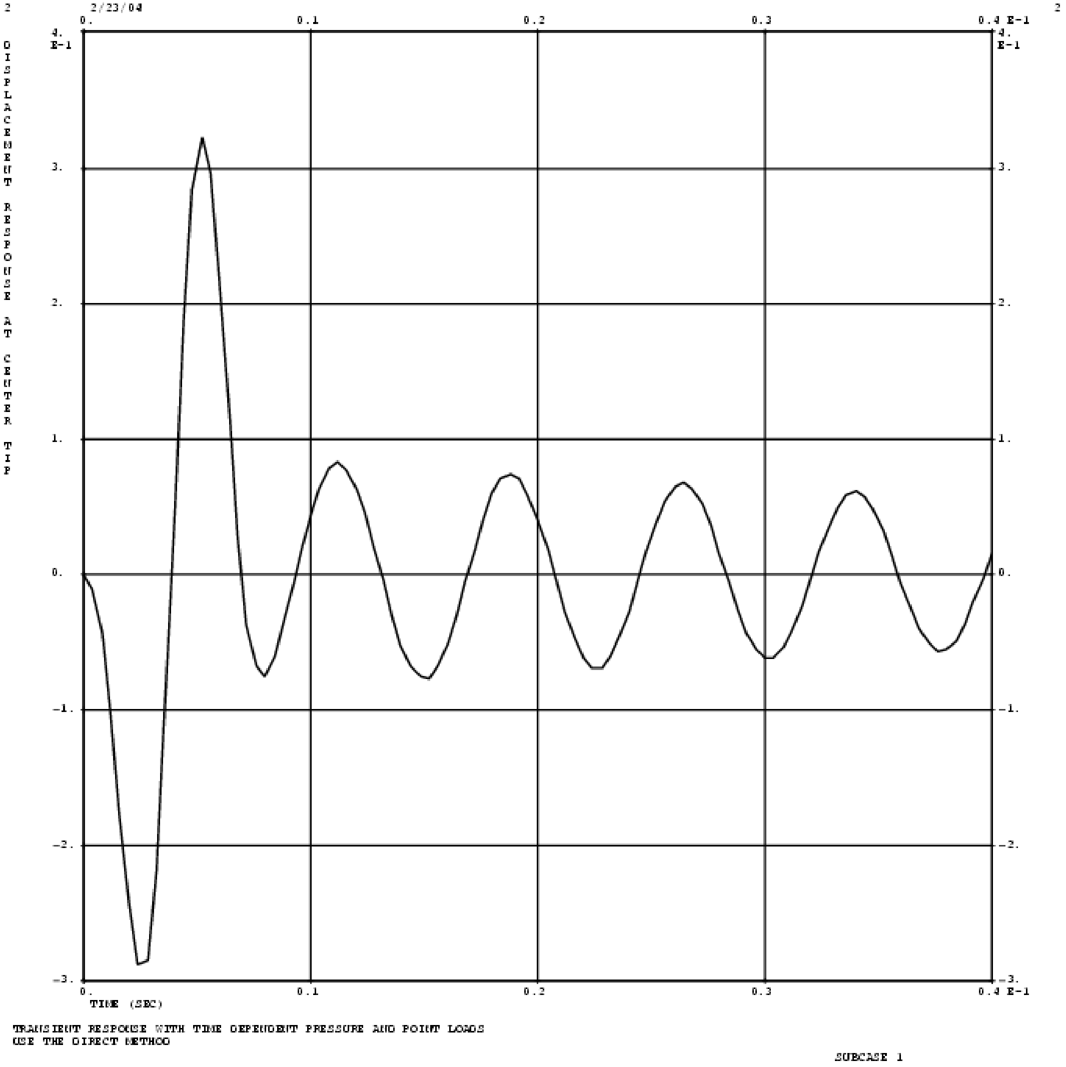
Step 10. View the Graph Results

Review the displacement response graph at the opposite corner of the point load. (grid 55)



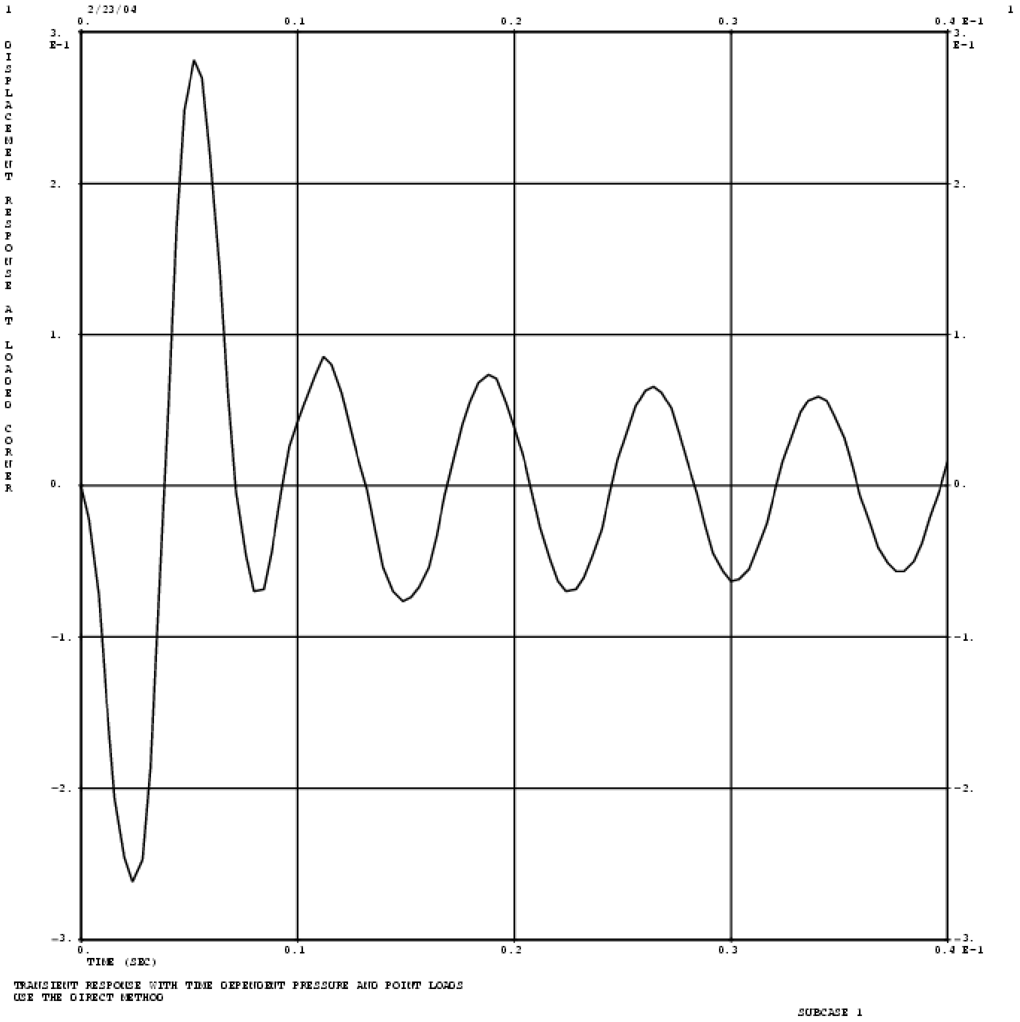
Step 10. View the Graph Results (Cont.)

Review the displacement response graph at the center of the tip (grid 33)



Step 10. View the Graph Results (Cont.)

Review the displacement response graph at the loaded corner. (grid point 11)



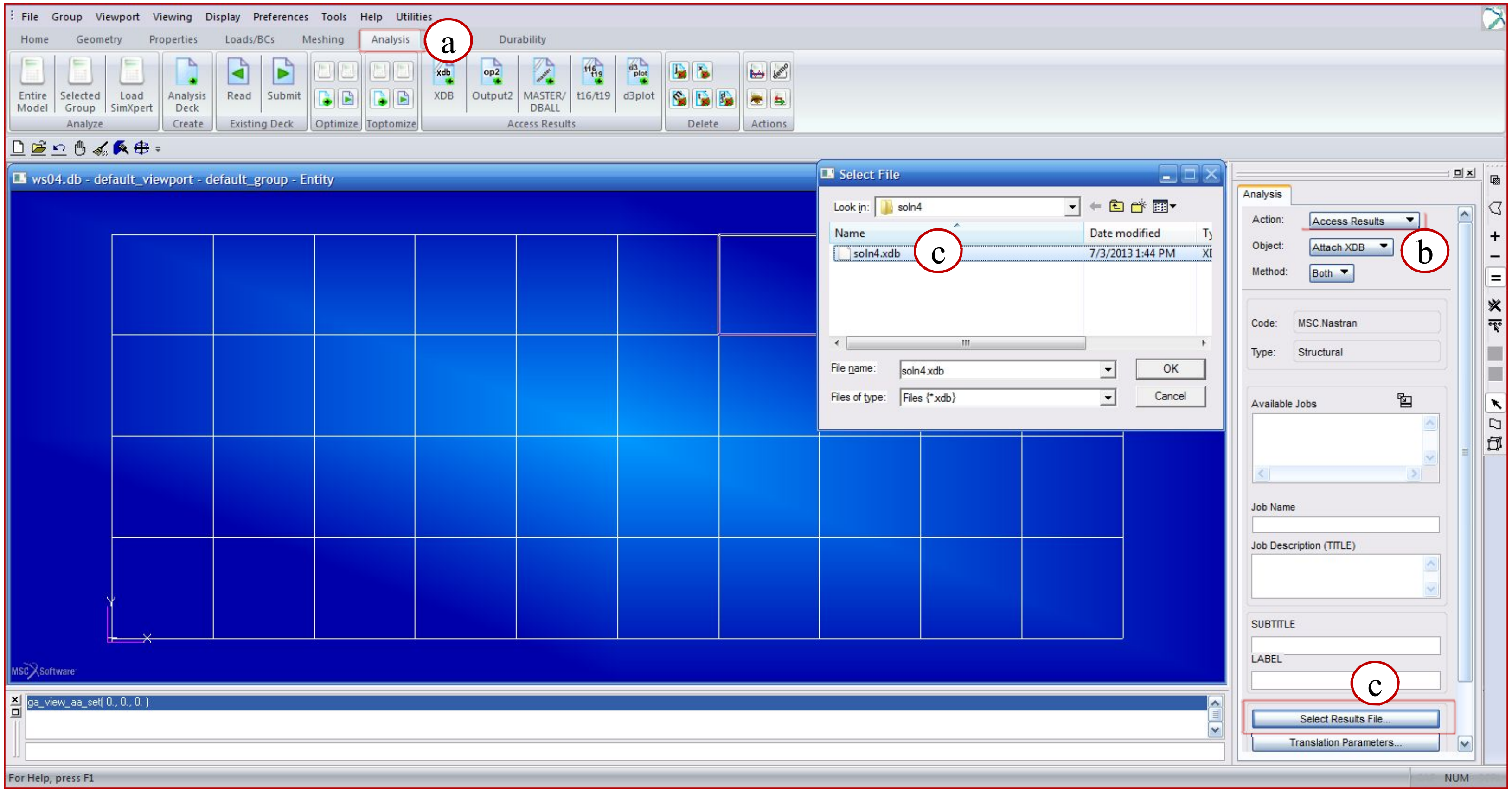
Step 11. XY Plot Using Patran

Open New Patran DB then Go to

a. Analysis

b. Access Results>Attach XDB>Both

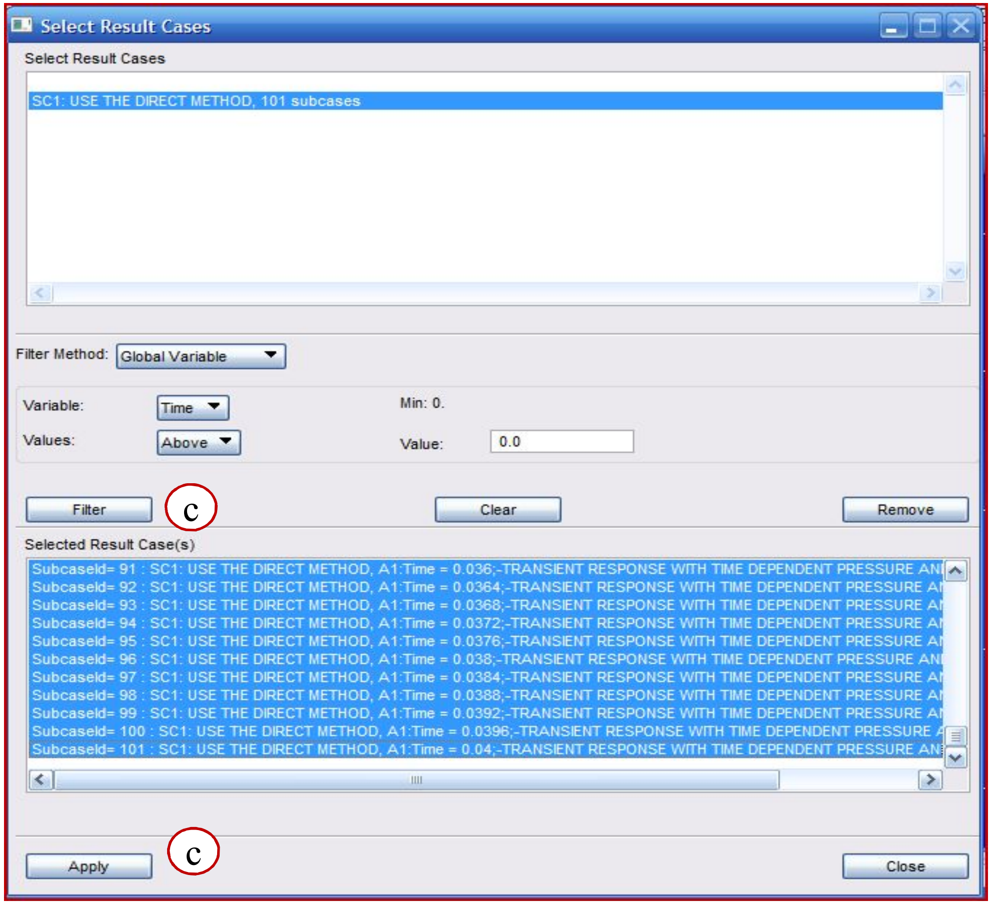
c. Select Results File>Soln4.xdb



Action: Access Results
Object: Attach XDB
Method: Both
Code: MSC.Nastran
Type: Structural

Step 11. XY Plot Using Patran (Cont.)

a. Go to Results – Create>Graph>Y vs X
b. Click on the Result Case.
c. Click on Filter and select all Result Cases. Hit Apply.



Select Result Cases

SC1: USE THE DIRECT METHOD, 101 subcases

Filter Method: Global Variable

Variable: Time

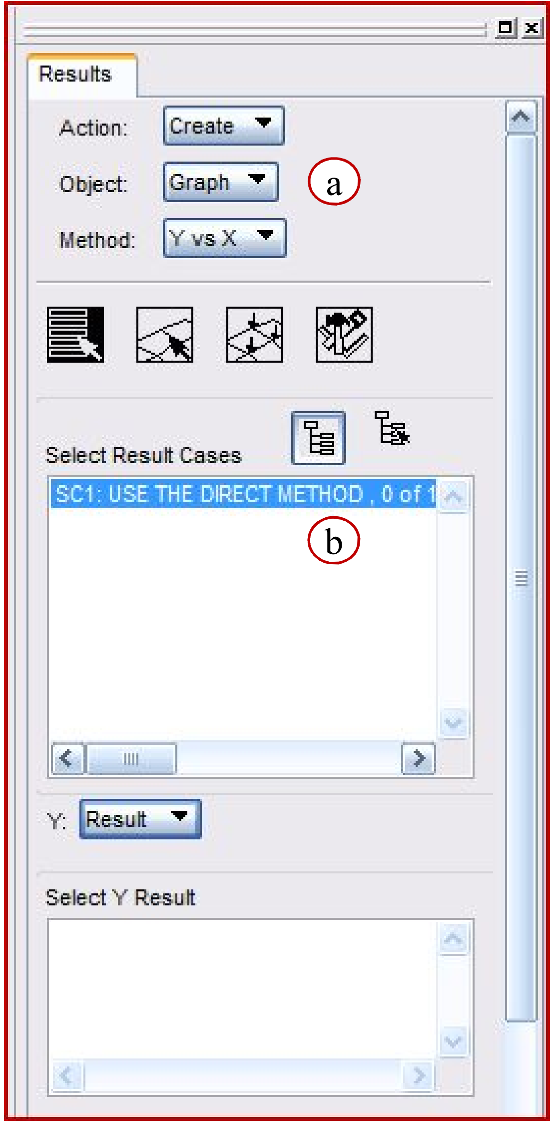
Values: Above

Min: 0.

Value: 0.0

Selected Result Case(s)

Subcaseld= 91 : SC1: USE THE DIRECT METHOD, A1:Time = 0.036;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AN
Subcaseld= 92 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0364;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 93 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0368;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 94 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0372;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 95 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0376;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 96 : SC1: USE THE DIRECT METHOD, A1:Time = 0.038;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AN
Subcaseld= 97 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0384;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 98 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0388;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 99 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0392;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE A
Subcaseld= 100 : SC1: USE THE DIRECT METHOD, A1:Time = 0.0396;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE
Subcaseld= 101 : SC1: USE THE DIRECT METHOD, A1:Time = 0.04;-TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AN



Action: Create

Object: Graph

Method: Y vs X

Select Result Cases

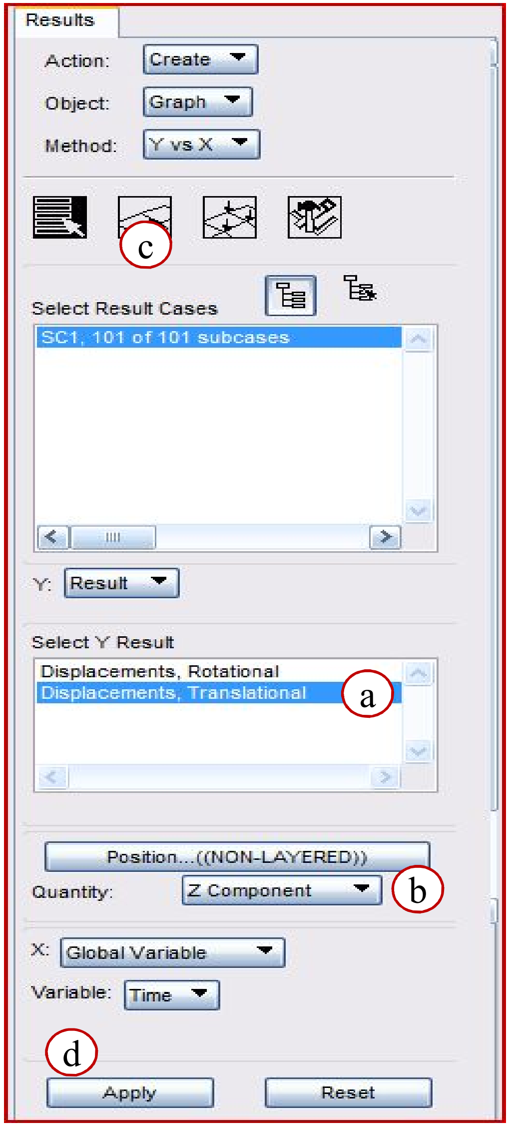
SC1: USE THE DIRECT METHOD , 0 of 1

Y: Result

Select Y Result

Step 11. XY Plot Using Patran (Cont.)

a. Select Y: Result - Displacement, Translational
b. Select Quantity – Z Component
c. Click on Icon “Target Entities” and select Node 55
d. Hit Apply.



Action: Create
Object: Graph
Method: Y vs X

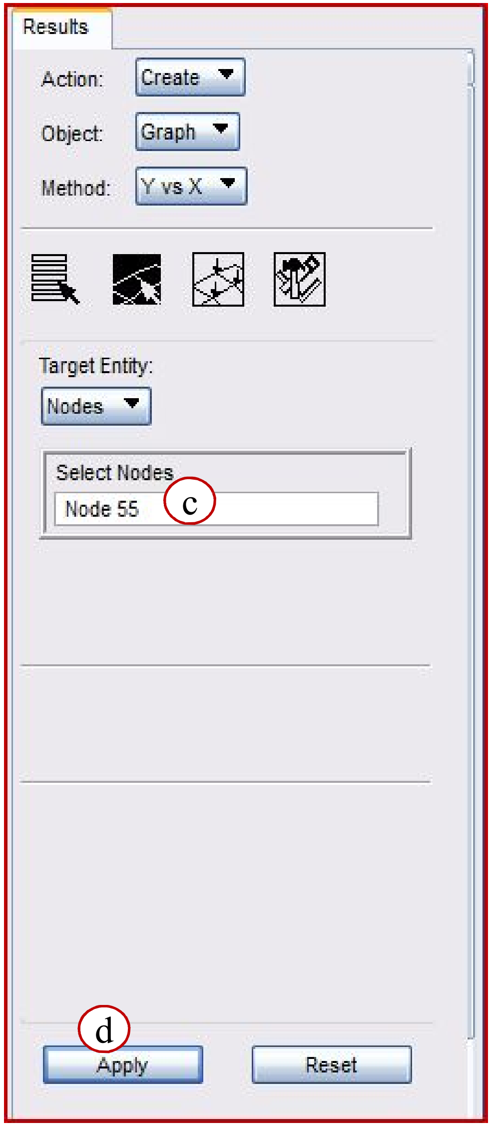
Select Result Cases
SC1, 101 of 101 subcases

Y: Result

Select Y Result
Displacements, Rotational
Displacements, Translational

Position...((NON-LAYERED))
Quantity: Z Component

X: Global Variable
Variable: Time



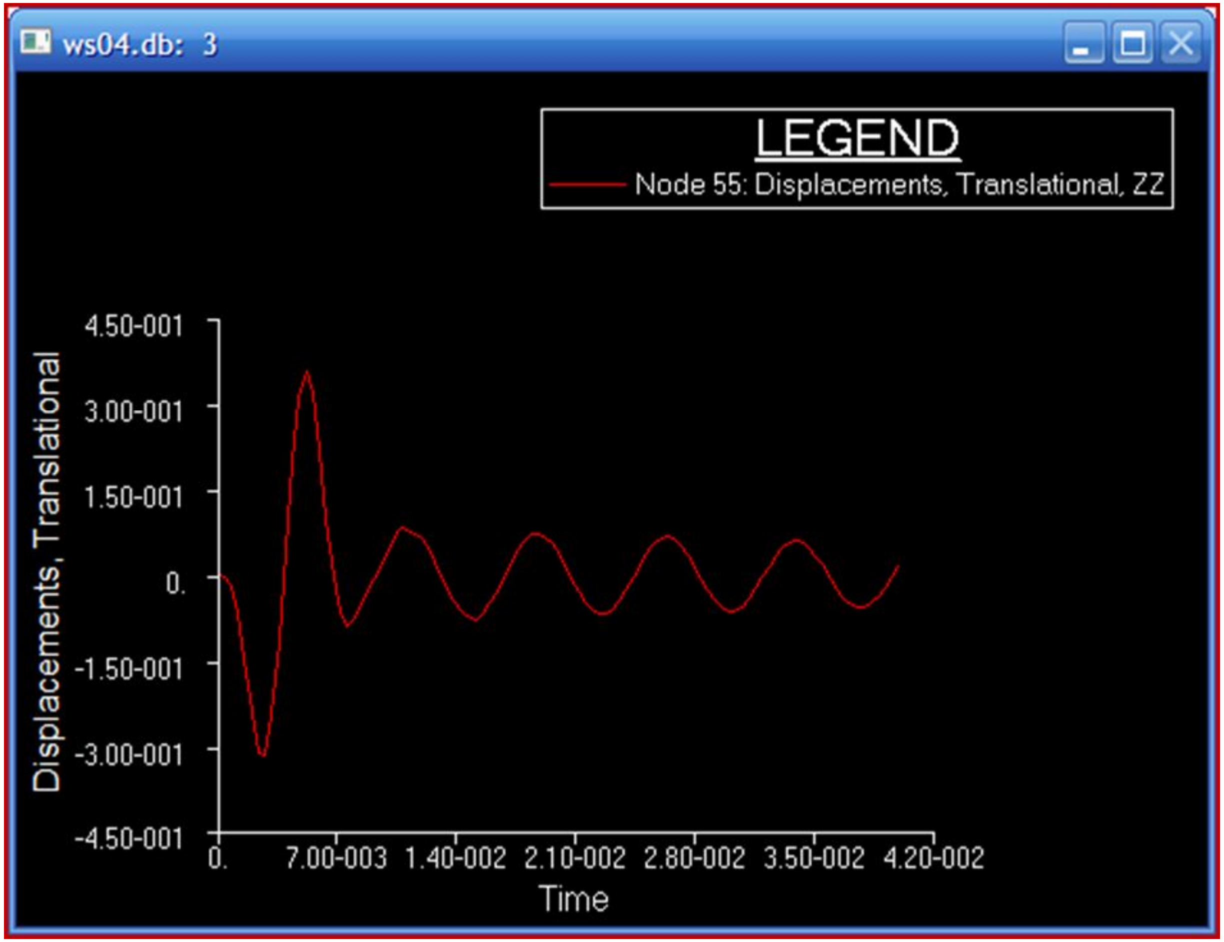
Action: Create
Object: Graph
Method: Y vs X

Target Entity: Nodes

Select Nodes
Node 55

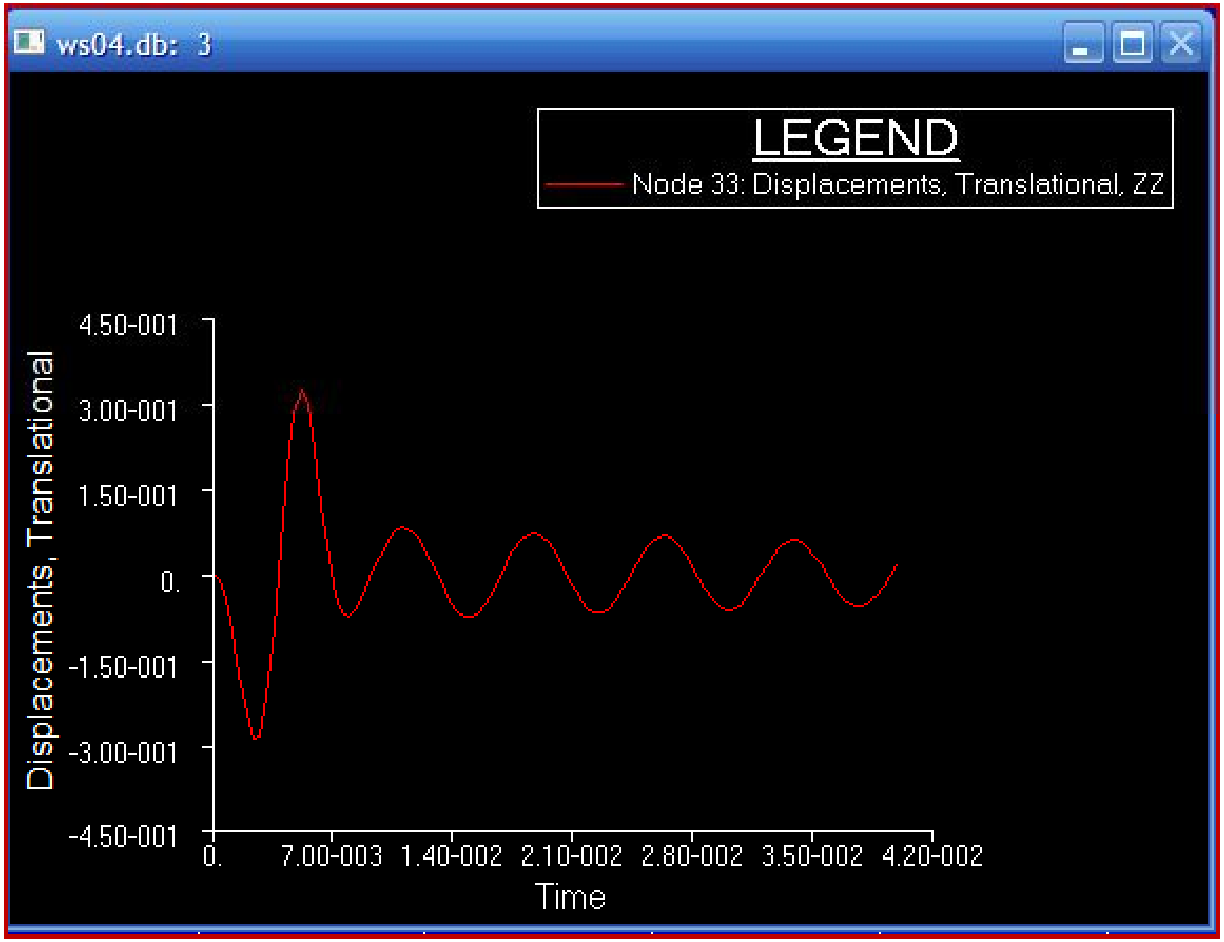
Step 11. XY Plot Using Patran (Cont.)

Review the displacement response graph at the opposite corner of the point load. (grid 55)



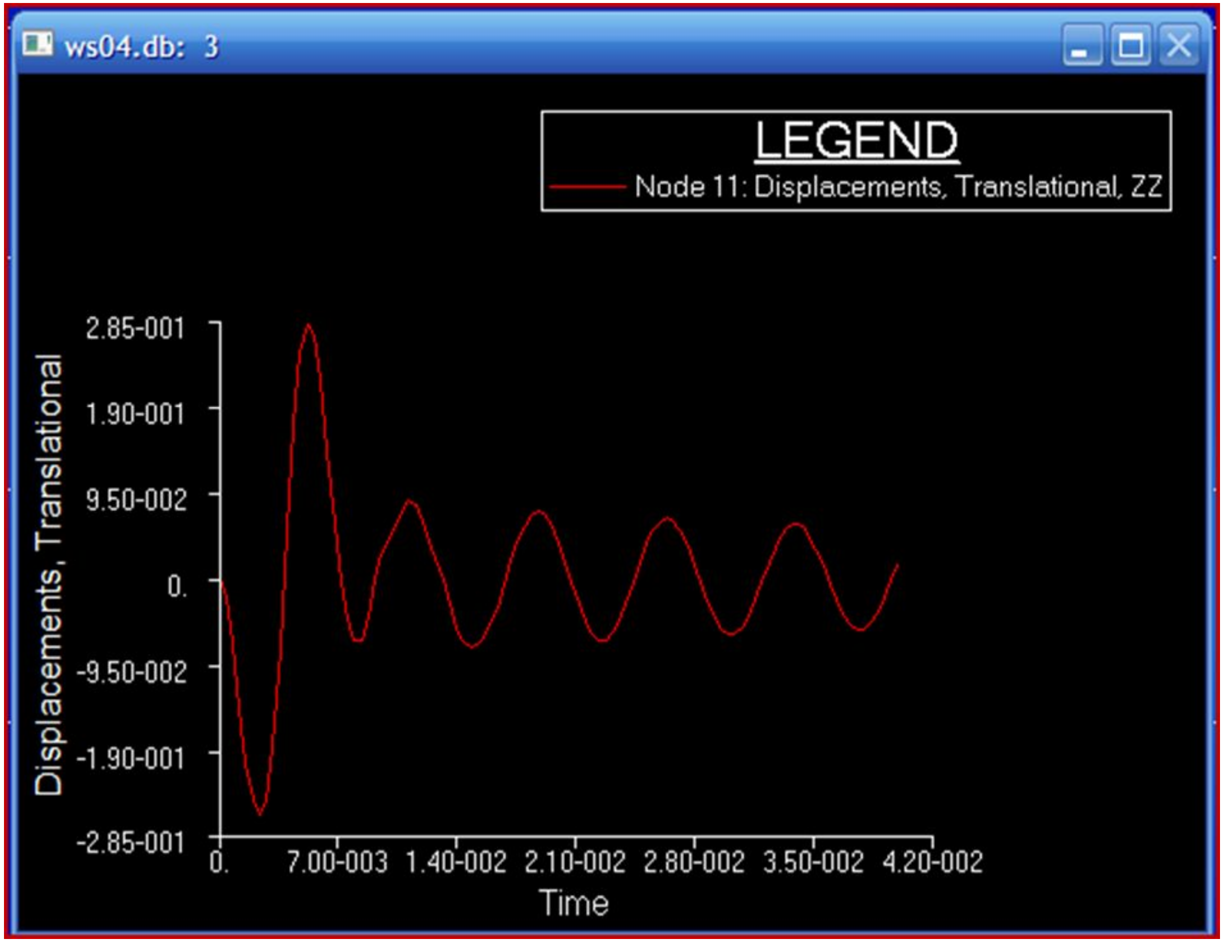
Step 11. XY Plot Using Patran (Cont.)

Similarly, review the displacement response graph at the center of the tip (grid 33)



Step 11. XY Plot Using Patran (Cont.)

Similarly, review the displacement response graph at the loaded corner. (grid point 11)



WORKSHOP 5
MODAL TRANSIENT RESPONSE

- **Workshop Objective**
  - Using the modal method, determine the transient response of the flat rectangular plate (from Workshop 1) subject to time-varying excitation as described below.

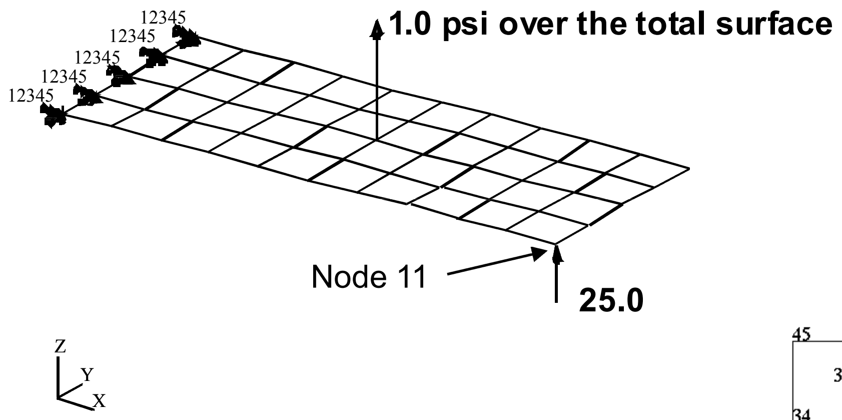
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp5.dat

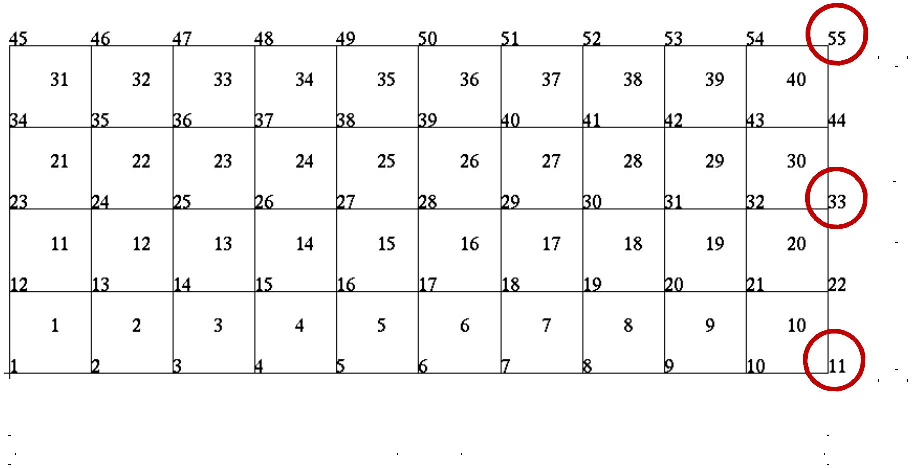
- **Problem Description**
  - This structure is excited by a 1 psi pressure load over the total surface of the plate varying at 250 Hz. In addition, a 25 lb force is applied at a corner of the tip also varying at 250 Hz, but starting 0.004 seconds after the pressure load begins. Both time-dependent dynamic loads are applied for duration of 0.008 seconds. Use a modal damping of z = 0.03 for all modes. Carry out the analysis for 0.04 seconds.

- **Problem Description Continued:**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

Loads and Boundary Condition



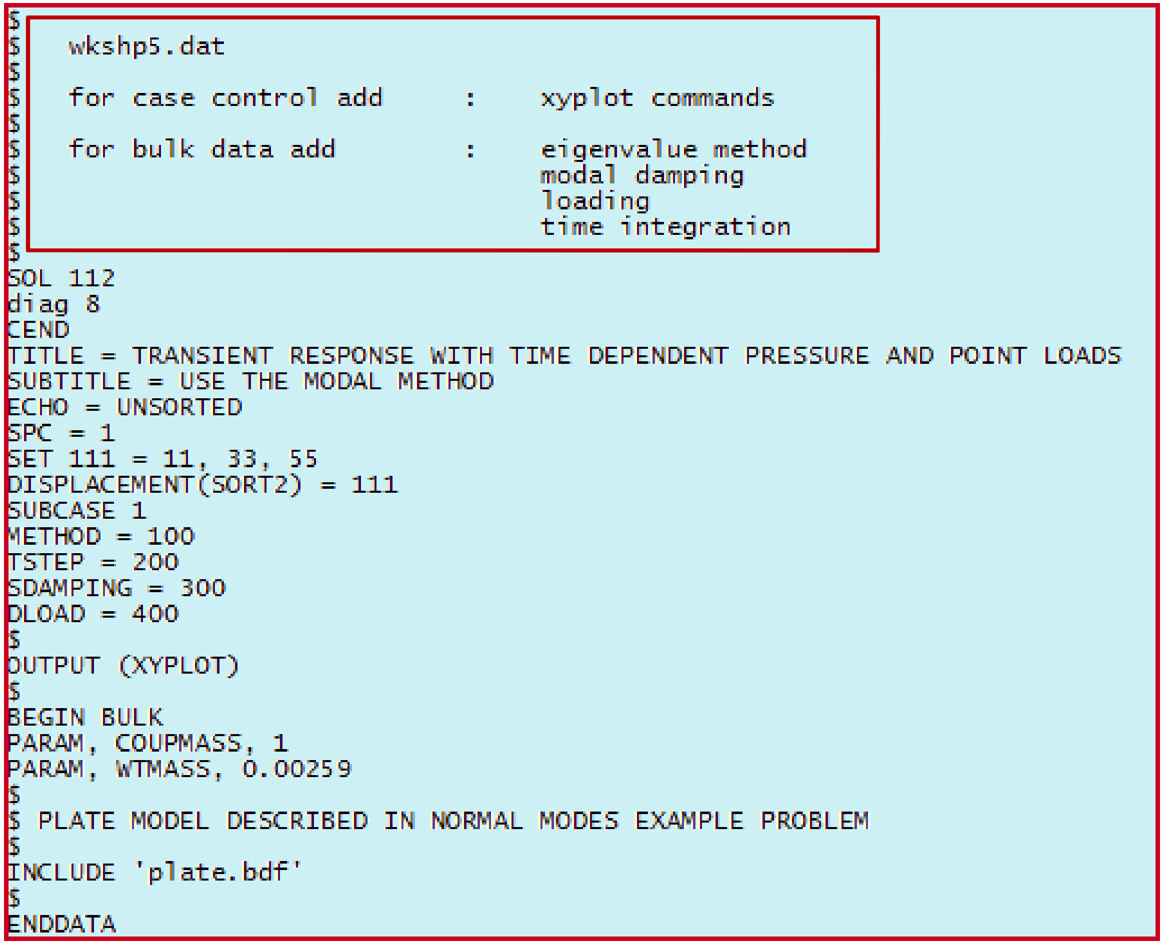
Elements and Grid Coordinates



- **Suggested Steps**
  1. Open and review the input file wkshp5.dat.
  2. Add XY plot commands for displacement transient graph.
  3. Add eigenvalue method.
  4. Add modal damping.
  5. Add time dependent pressure load.
  6. Add time dependent point load.
  7. Add combined loads.
  8. Add the time integration step.
  9. Save and run the new input file in MSC Nastran.
  10. Review the MSC Nastran results using the solution file soln5.f06.
  11. Review the graph results.

Step 1. Open and Review the Input File wkshp5.dat

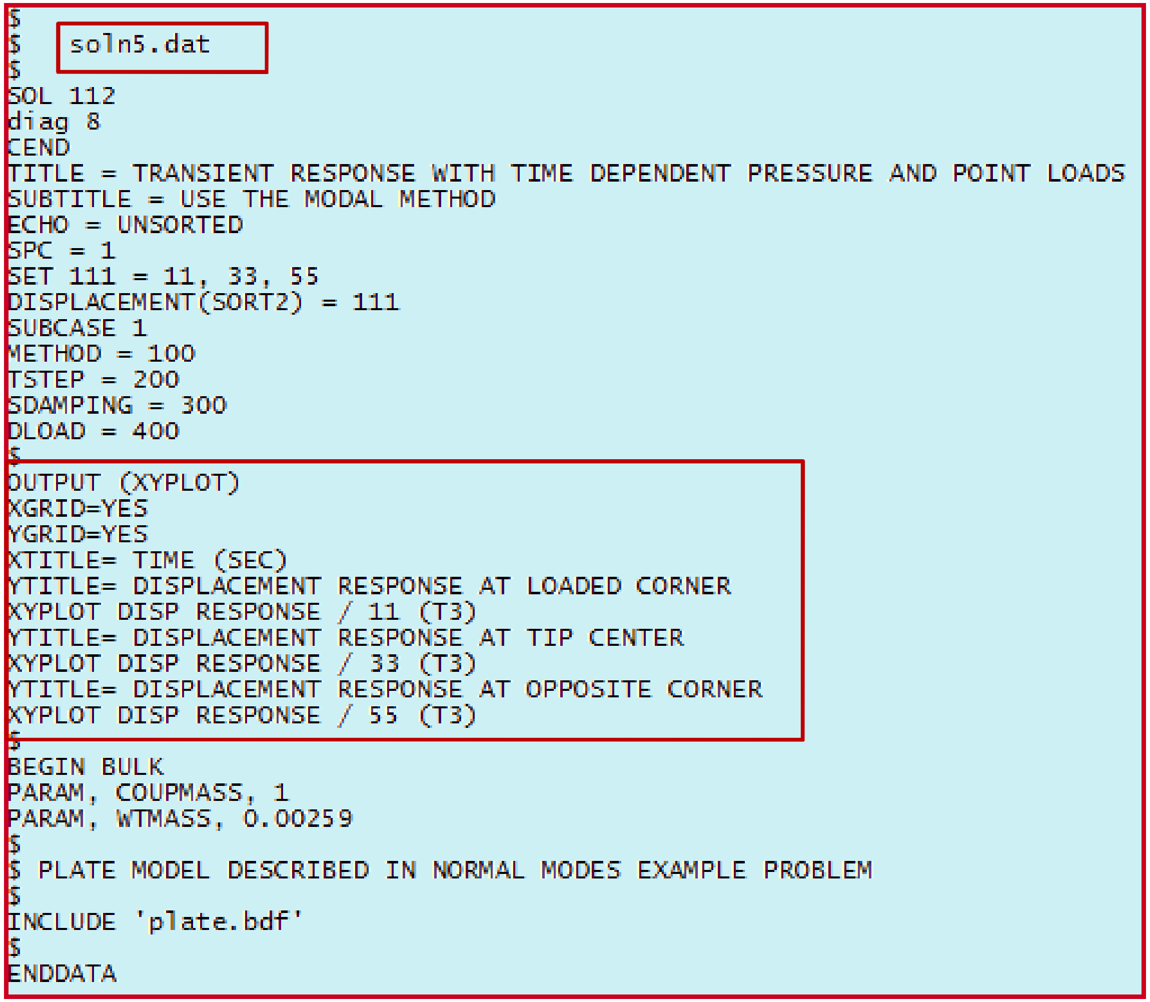
The file wkshp5.dat is the starting input file to be modified.



```
$
$   wkshp5.dat
$
$   for case control add     :    xyplot commands
$
$   for bulk data add        :    eigenvalue method
$                                 modal damping
$                                 loading
$                                 time integration
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 2. Add XY Plot Commands for Graph

Change file name to **soln5. dat** and add the XY plot commands to graph the displacement response at grid points **11**, **33**, and **55**, as shown to the right.



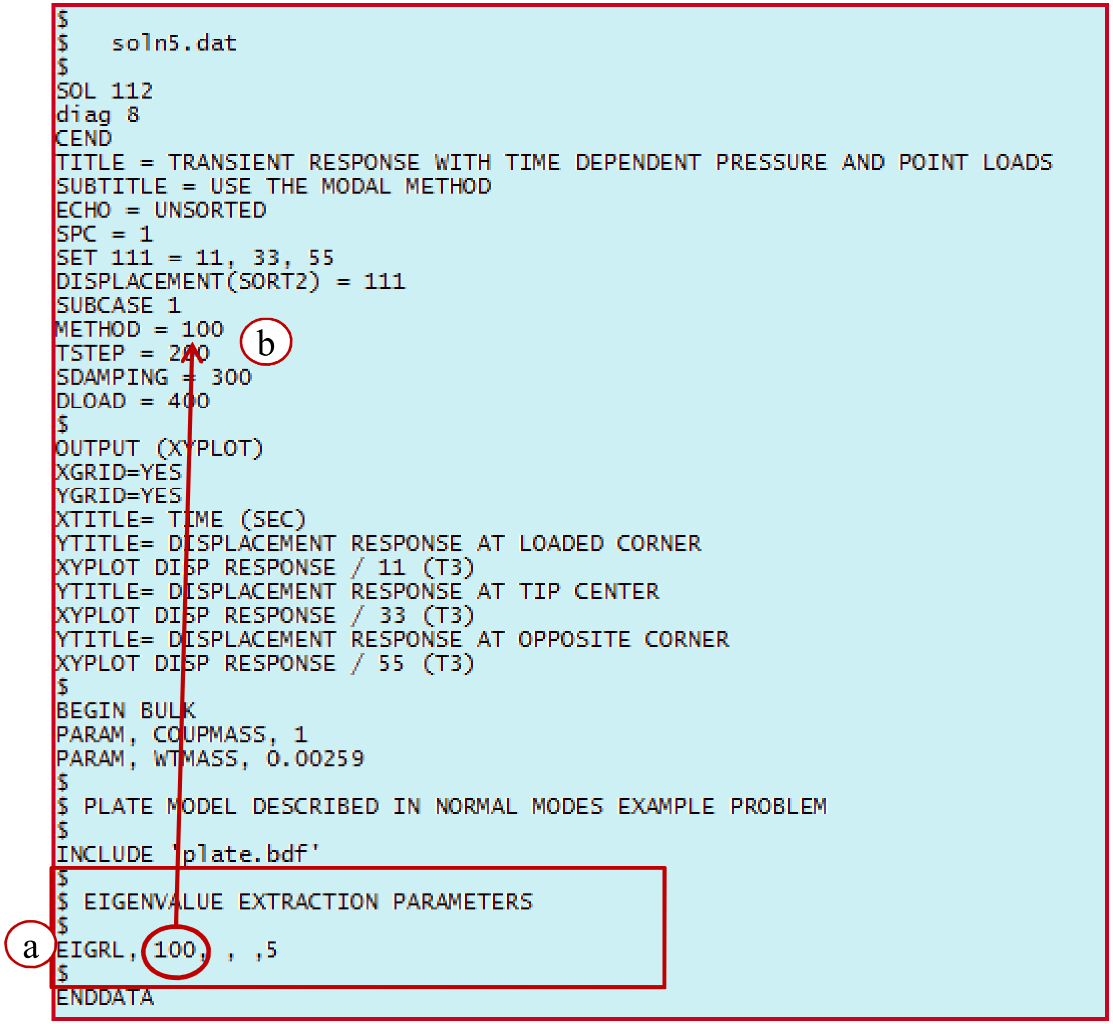
```
$
$  soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 3. Add Eigenvalue Method

Add the eigenvalue Method:

a. Use the **EIGRL** entry specifying **5** roots.

b. Make sure that the **METHOD** Case Control command identification number matches the **EIGRL** SID.

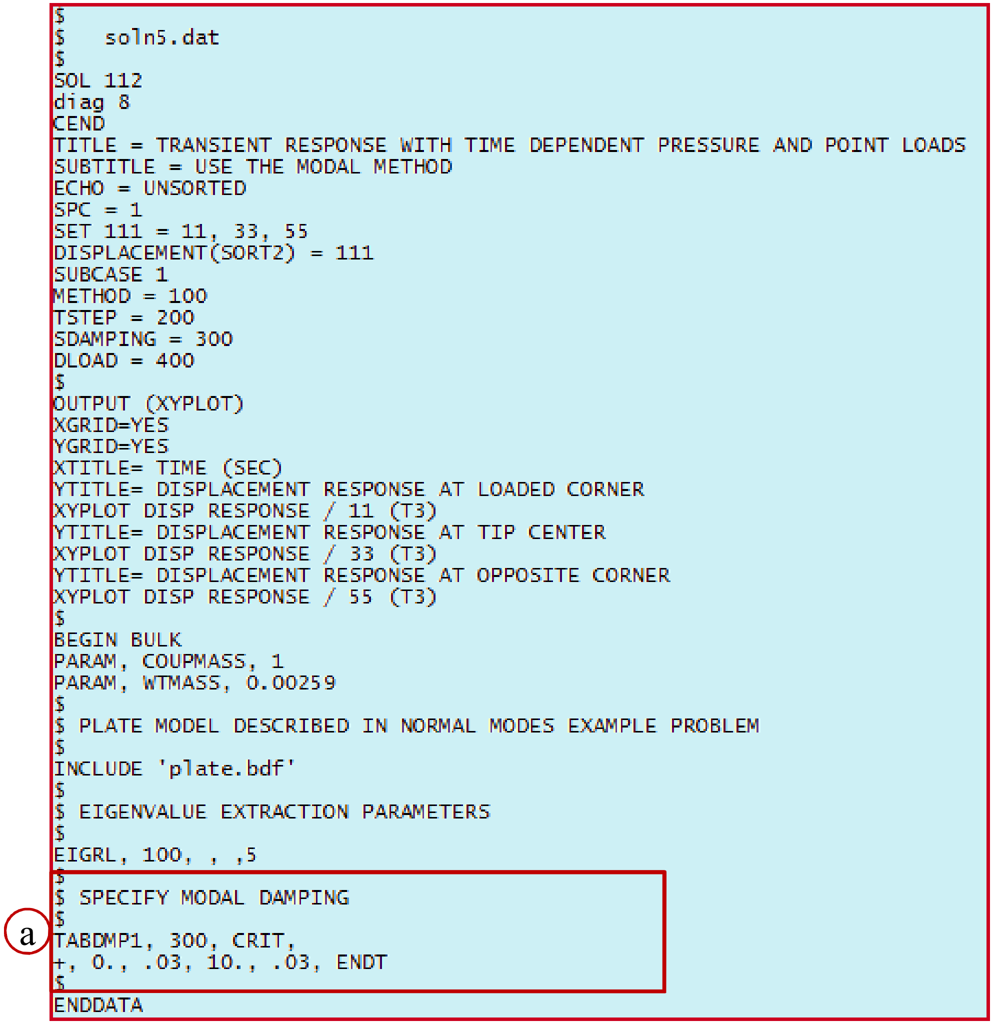


```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
ENDDATA
```

Step 4. Add Modal Damping

Add the modal damping:

a. Use the **TABDMP1** entry and the given information on page WS-3:
  - TID = **300** (note must match identification number from SDAMPING in Case Control)
  - Type = **CRIT**
  - First Natural Freq. = **0.0**
  - Damping Value = **.03**
  - Last Natural Freq.= **10.0** (see note below)
  - Damping Value = **.03**

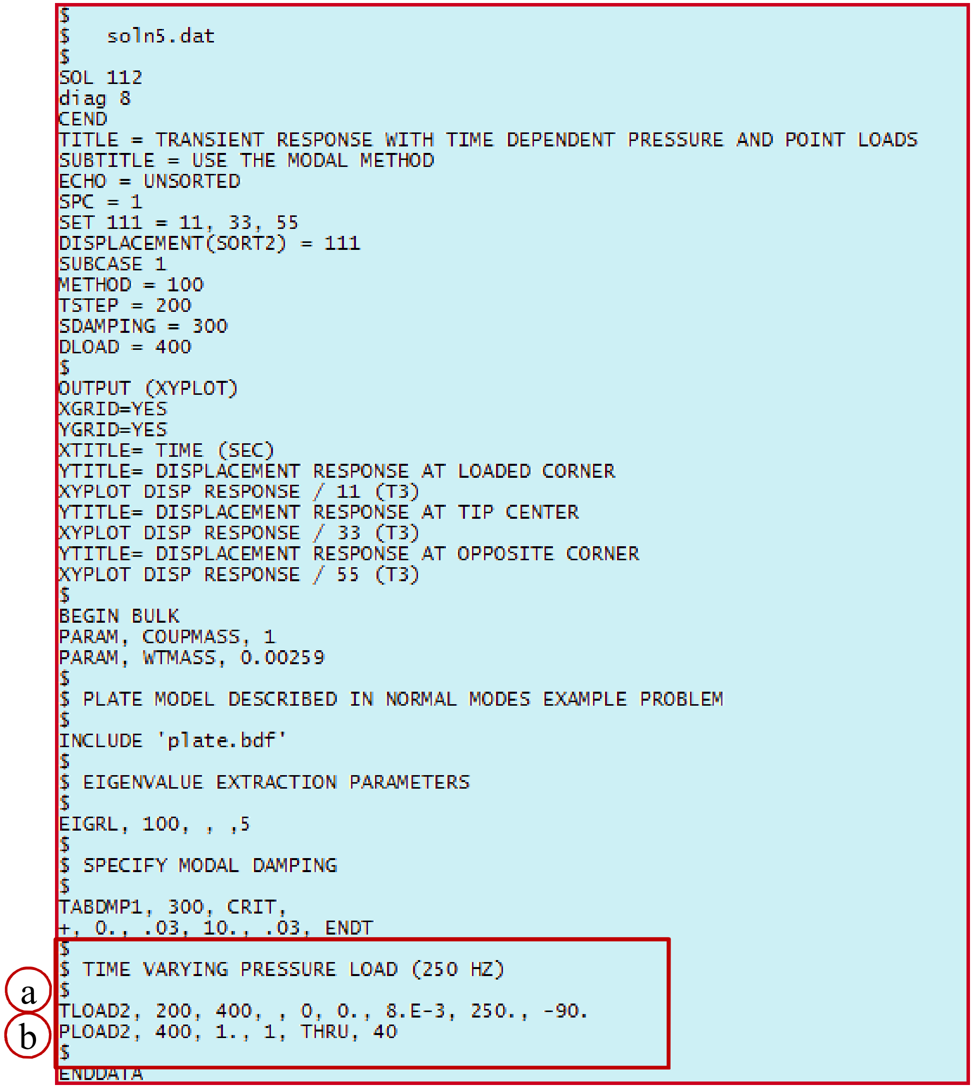


```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
ENDDATA
```

Step 5. Add Time Dependent Pressure Load

Add the time dependent pressure load of 1 psi over the entire plate varying at 250 HZ.

a. Use a **TLOAD2** entry in combination with a **PLOAD2** and the given information on page WS5-3:
   - Time = **0 to .008 sec**
   - Frequency = **250 HZ**
   - Phase angle = **-90°**
b. For the **PLOAD** entry, apply the pressure of **1 psi** over all the elements of the plate. (**1 through 40**)



```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
PLOAD2, 400, 1., 1, THRU, 40
$
ENDDATA
```

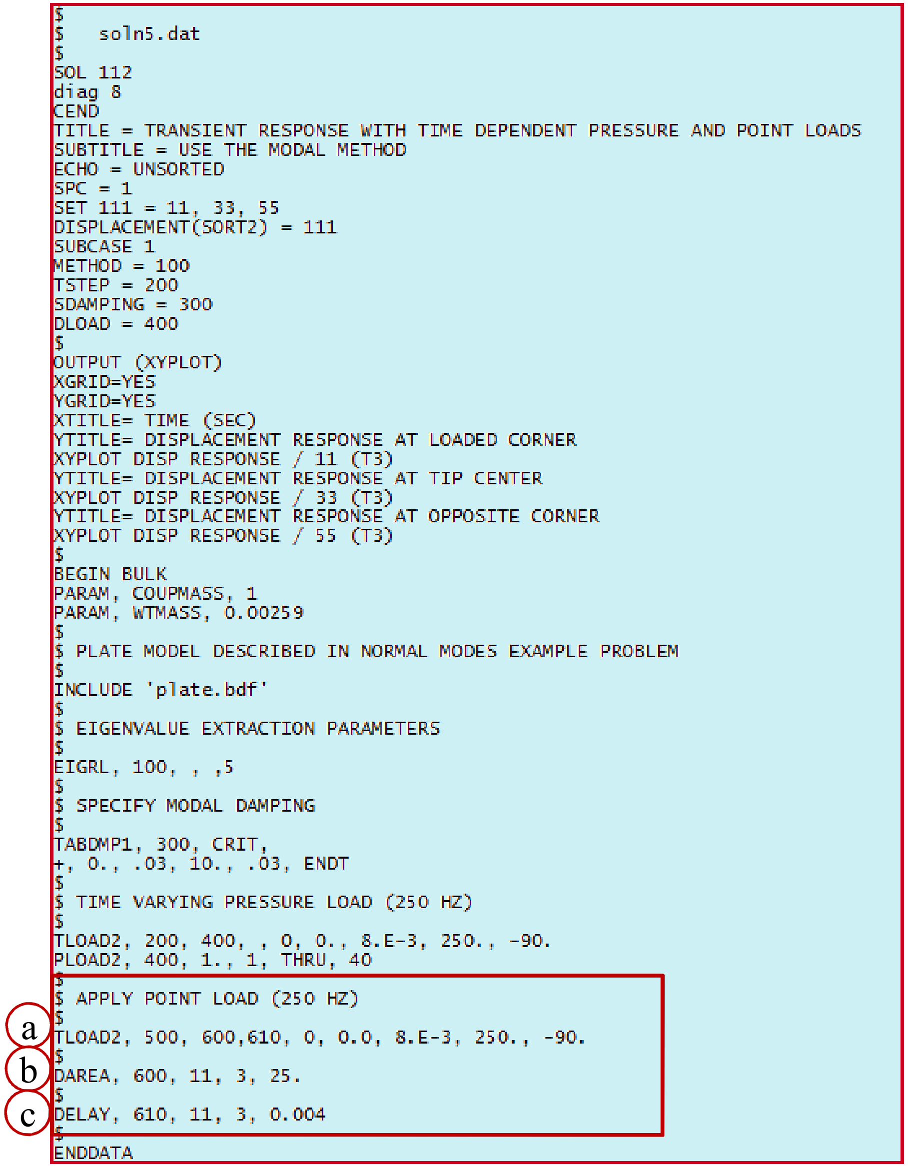
Step 6. Add Time Dependent Point Load

Add the time dependent 25 lb point load at the corner of tip of the plate (grid 11) varying at 250 Hz, but starting 0.004 seconds after the pressure load begins.

a. Use the **TLOAD2** entry in combination with **DAREA** and **DELAY** entries and the above information.
    - Time = **0 to .008 sec**
    - Frequency = **250 HZ**
    - Phase angle = **-90º**

b. For the **DAREA** entry, note that the **25 lb** force is applied at Grid point **11** in the Z direction.

c. The **DELAY** entry will define the time delay of **.004** secs for this load.

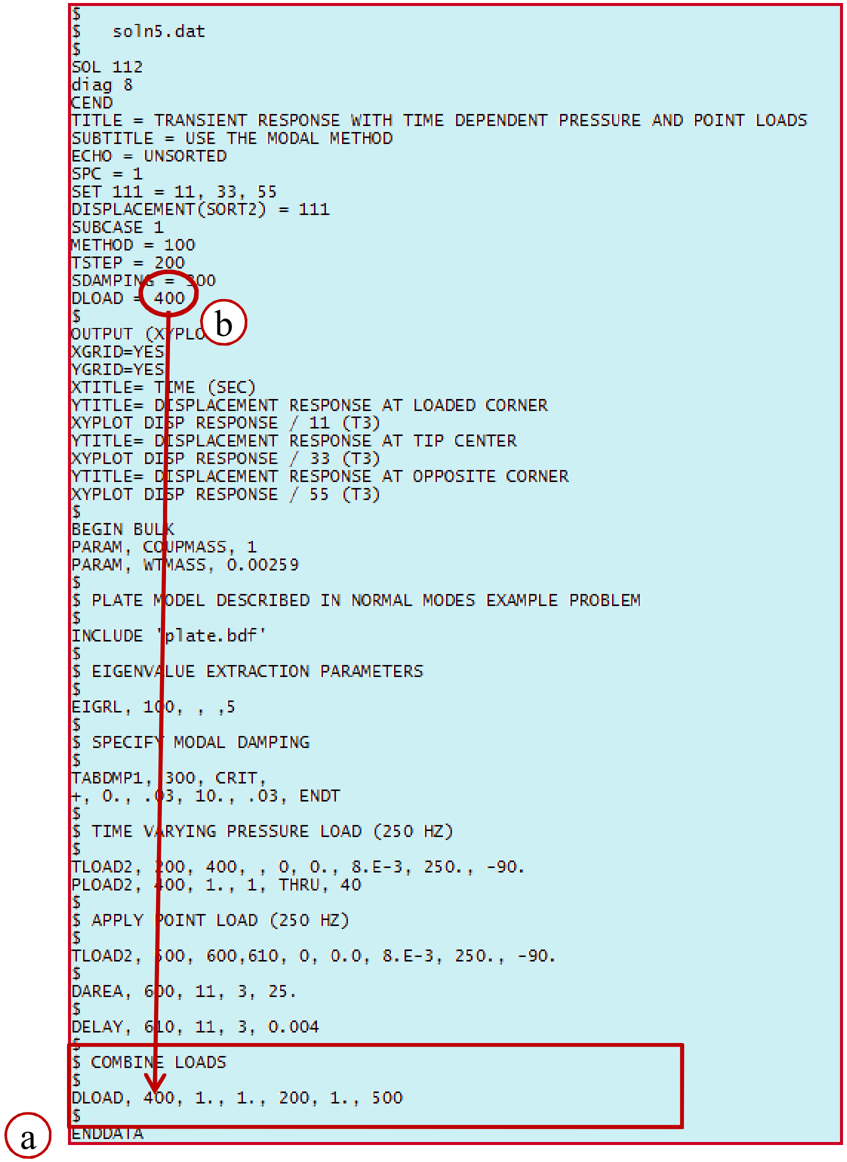


```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD (250 HZ)
$
TLOAD2, 500, 600,610, 0, 0.0, 8.E-3, 250., -90.
$
DAREA, 600, 11, 3, 25.
$
DELAY, 610, 11, 3, 0.004
$
ENDDATA
```

Step 7. Add Combined Loads

Combine the pressure and point loads using a DLOAD entry.

a. For the **DLOAD** entry, define the scale as **1.0** for both loads.
b. Make sure the **DLOAD** Case Control command indentification matches the SID for the **DLOAD** entry in the Bulk Data section.



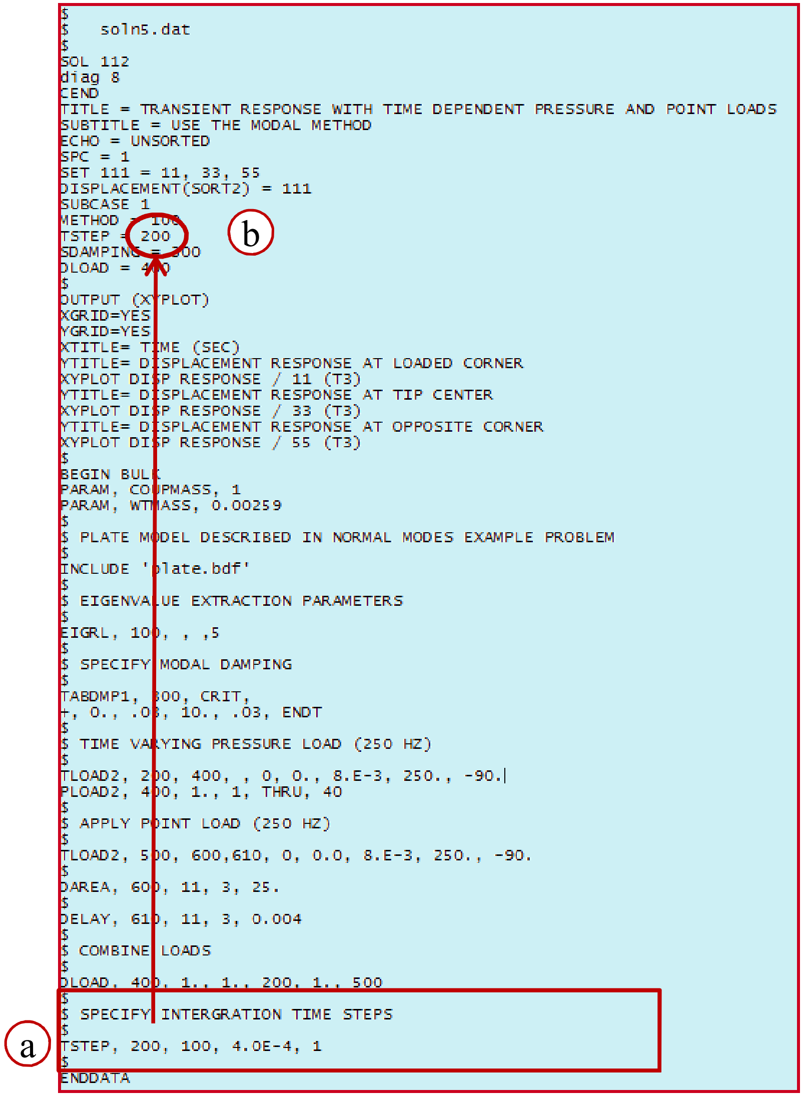
```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLO
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD (250 HZ)
$
TLOAD2, 500, 600,610, 0, 0.0, 8.E-3, 250., -90.
$
DAREA, 600, 11, 3, 25.
$
DELAY, 610, 11, 3, 0.004
$
$ COMBINE LOADS
$
DLOAD, 400, 1., 1., 200, 1., 500
$
ENDDATA
```

Step 8. Add Time Integration Step

Add the time step:

a. For the **TSTEP** entry, use **200** steps and a time increment of **.0004** seconds, so that the total time will be .04 seconds.

b. Make sure that the T**STEP** case control command indentification matches the SID for the **TSTEP** entry in the Bulk Data section.

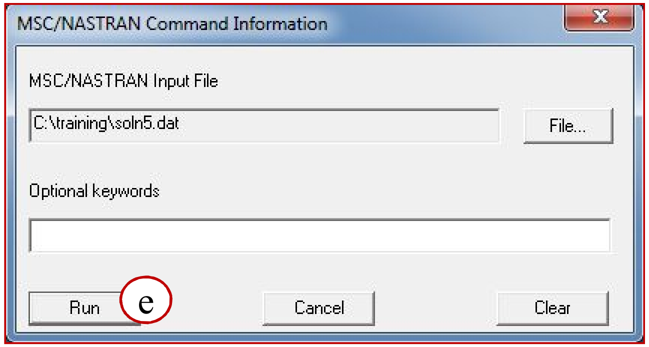


```
$
$   soln5.dat
$
SOL 112
diag 8
CEND
TITLE = TRANSIENT RESPONSE WITH TIME DEPENDENT PRESSURE AND POINT LOADS
SUBTITLE = USE THE MODAL METHOD
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2) = 111
SUBCASE 1
METHOD = 100
TSTEP = 200
SDAMPING = 300
DLOAD = 400
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= DISPLACEMENT RESPONSE AT LOADED CORNER
XYPLOT DISP RESPONSE / 11 (T3)
YTITLE= DISPLACEMENT RESPONSE AT TIP CENTER
XYPLOT DISP RESPONSE / 33 (T3)
YTITLE= DISPLACEMENT RESPONSE AT OPPOSITE CORNER
XYPLOT DISP RESPONSE / 55 (T3)
$
BEGIN BULK
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE PROBLEM
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, , ,5
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ TIME VARYING PRESSURE LOAD (250 HZ)
$
TLOAD2, 200, 400, , 0, 0., 8.E-3, 250., -90.
PLOAD2, 400, 1., 1, THRU, 40
$
$ APPLY POINT LOAD (250 HZ)
$
TLOAD2, 500, 600,610, 0, 0.0, 8.E-3, 250., -90.
$
DAREA, 600, 11, 3, 25.
$
DELAY, 610, 11, 3, 0.004
$
$ COMBINE LOADS
$
DLOAD, 400, 1., 1., 200, 1., 500
$
$ SPECIFY INTERGRATION TIME STEPS
$
TSTEP, 200, 100, 4.0E-4, 1
$
ENDDATA
```

Step 9. Save and Run the New Input File

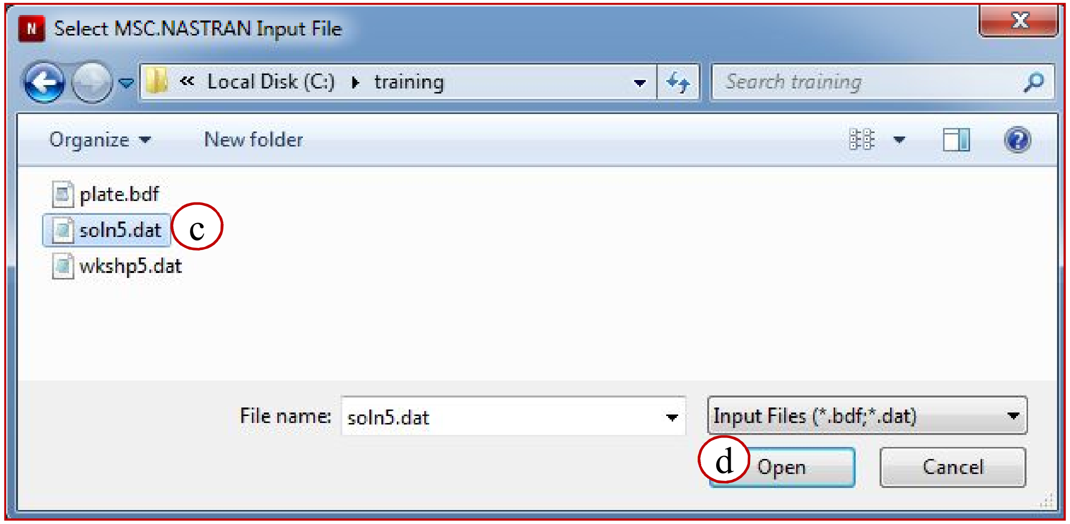
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln5.dat**.
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln5.dat**.
d. Click **Open**.
e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln5.dat

Optional keywords:

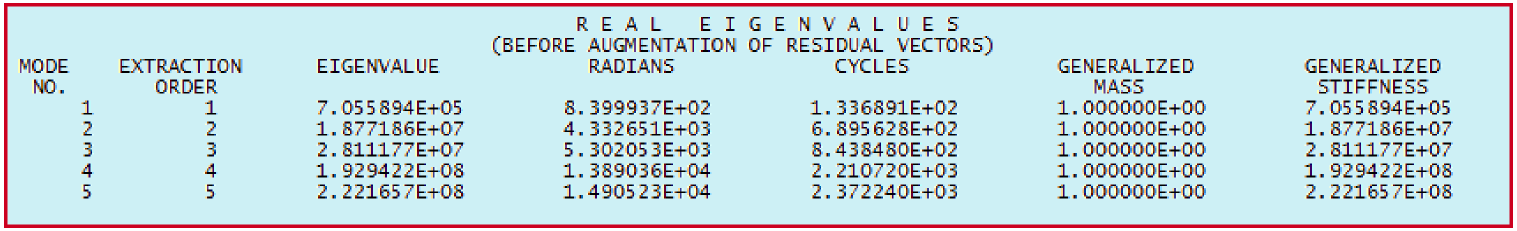


File name: soln5.dat

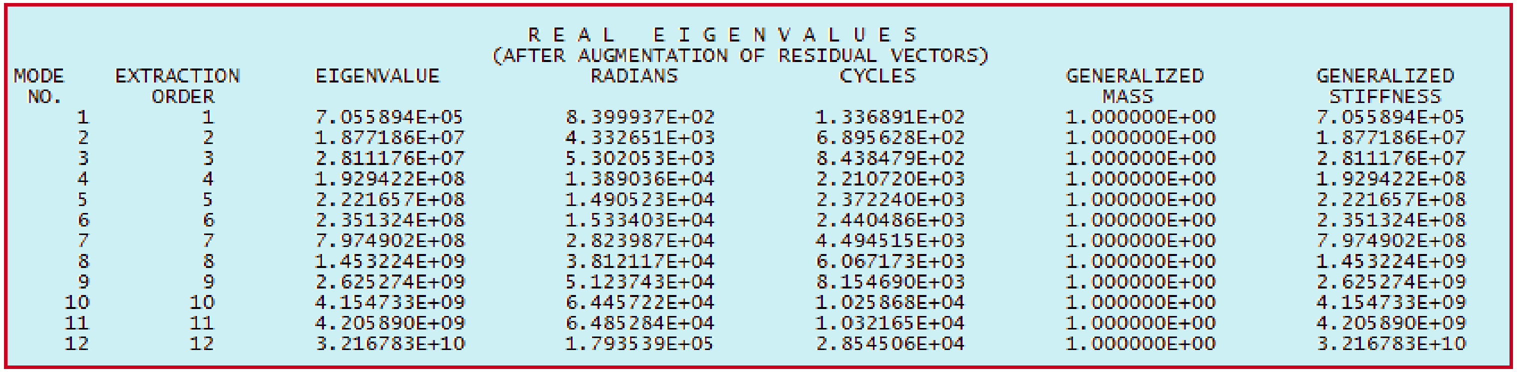
Input Files (*.bdf;*.dat)

Step 10. Review the Results in the Solution File

Open the soln5.f06 file to see the results



```
                                   R E A L   E I G E N V A L U E S
                           (BEFORE AUGMENTATION OF RESIDUAL VECTORS)
MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
 NO.       ORDER                                                                       MASS              STIFFNESS
     1         1        7.055894E+05        8.399937E+02        1.336891E+02        1.000000E+00        7.055894E+05
     2         2        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
     3         3        2.811177E+07        5.302053E+03        8.438480E+02        1.000000E+00        2.811177E+07
     4         4        1.929422E+08        1.389036E+04        2.210720E+03        1.000000E+00        1.929422E+08
     5         5        2.221657E+08        1.490523E+04        2.372240E+03        1.000000E+00        2.221657E+08
```

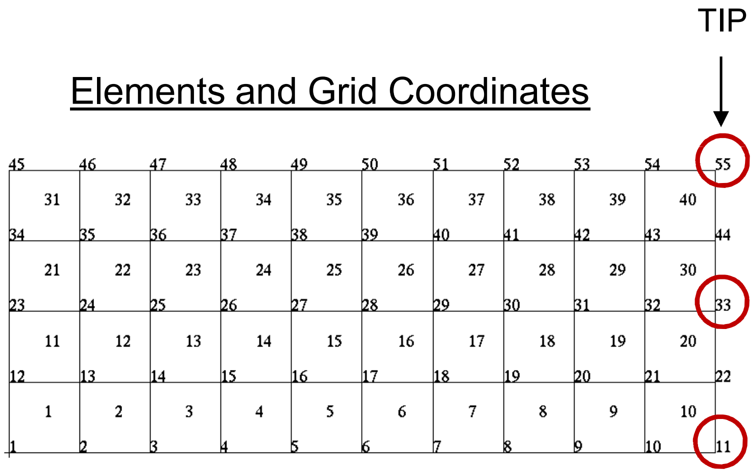


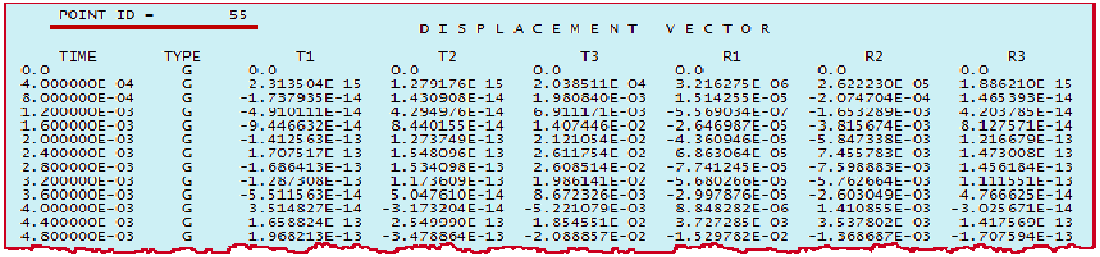
```
                                   R E A L   E I G E N V A L U E S
                            (AFTER AUGMENTATION OF RESIDUAL VECTORS)
MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
 NO.       ORDER                                                                       MASS              STIFFNESS
     1         1        7.055894E+05        8.399937E+02        1.336891E+02        1.000000E+00        7.055894E+05
     2         2        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
     3         3        2.811176E+07        5.302053E+03        8.438479E+02        1.000000E+00        2.811176E+07
     4         4        1.929422E+08        1.389036E+04        2.210720E+03        1.000000E+00        1.929422E+08
     5         5        2.221657E+08        1.490523E+04        2.372240E+03        1.000000E+00        2.221657E+08
     6         6        2.351324E+08        1.533403E+04        2.440486E+03        1.000000E+00        2.351324E+08
     7         7        7.974902E+08        2.823987E+04        4.494515E+03        1.000000E+00        7.974902E+08
     8         8        1.453224E+09        3.812117E+04        6.067173E+03        1.000000E+00        1.453224E+09
     9         9        2.625274E+09        5.123743E+04        8.154690E+03        1.000000E+00        2.625274E+09
    10        10        4.154733E+09        6.445722E+04        1.025868E+04        1.000000E+00        4.154733E+09
    11        11        4.205890E+09        6.485284E+04        1.032165E+04        1.000000E+00        4.205890E+09
    12        12        3.216783E+10        1.793539E+05        2.854506E+04        1.000000E+00        3.216783E+10
```

Step 10. Review the Results in the Solution File (Cont.)

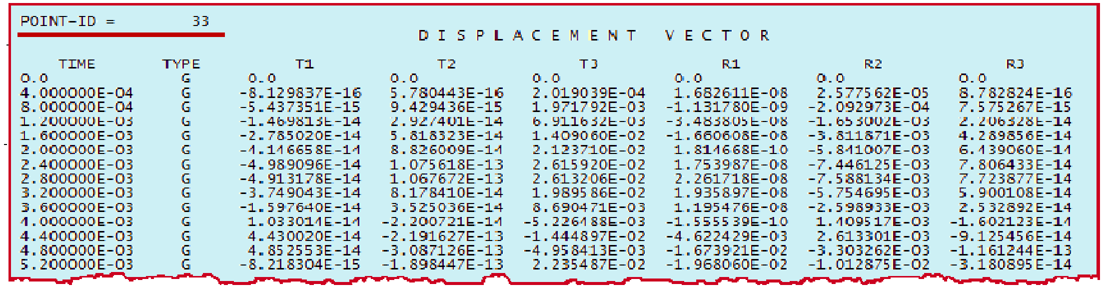
The three grid points of interest for the displacement vector lie along the tip of the plate, grid points 55, 33, 11.

Elements and Grid Coordinates

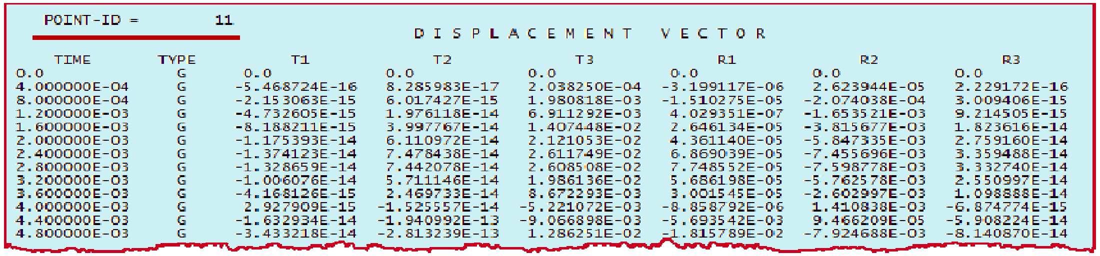




```
     POINT ID -         55
                                                    D I S P L A C E M E N T   V E C T O R

     TIME          TYPE          T1              T2              T3              R1              R2              R3
0.0                 G        0.0             0.0             0.0             0.0             0.0             0.0
4.000000E 04        G        2.313504E 15    1.279176E 15    2.038511E 04    3.216275E 06    2.622230E 05    1.886210E 15
8.000000E-04        G       -1.737935E-14    1.430908E-14    1.980840E-03    1.514255E-05   -2.074704E-04    1.465393E-14
1.200000E-03        G       -4.910111E-14    4.294976E-14    6.911171E-03   -5.569034E-07   -1.653289E-03    4.203785E-14
1.600000E-03        G       -9.446632E-14    8.440155E-14    1.407446E-02   -2.646987E-05   -3.815674E-03    8.127571E-14
2.000000E-03        G       -1.412563E-13    1.273749E-13    2.121054E-02   -4.360946E-05   -5.847338E-03    1.216679E-13
2.400000E 03        G        1.707517E 13    1.548096E 13    2.611754E 02    6.863064E 05    7.455783E 03    1.473008E 13
2.800000E-03        G       -1.686413E-13    1.534098E-13    2.608514E-02   -7.741245E-05   -7.598883E-03    1.456184E-13
3.200000E-03        G       -1.287308E-13    1.173609E-13    1.986141E-02   -5.680266E-05   -5.762664E-03    1.111551E-13
3.600000E-03        G       -5.511563E-14    5.047610E-14    8.672326E-03   -2.997876E-05   -2.603049E-03    4.766625E-14
4.000000E-03        G        3.514827E-14   -3.173204E-14   -5.221079E-03    8.848282E-06    1.410855E-03   -3.025671E-14
4.400000E 03        G        1.658824E 13    2.549990E 13    1.854551E 02    3.727285E 03    3.537802E 03    1.417569E 13
4.800000E-03        G        1.968213E-13   -3.478864E-13   -2.088857E-02   -1.529782E-02   -1.368687E-03   -1.707594E-13
```



```
POINT-ID =          33
                                                    D I S P L A C E M E N T   V E C T O R

     TIME          TYPE          T1              T2              T3              R1              R2              R3
0.0                 G        0.0             0.0             0.0             0.0             0.0             0.0
4.000000E-04        G       -8.129837E-16    5.780443E-16    2.019039E-04    1.682611E-08    2.577562E-05    8.782824E-16
8.000000E-04        G       -5.437351E-15    9.429436E-15    1.971792E-03   -1.131780E-09   -2.092973E-04    7.575267E-15
1.200000E-03        G       -1.469813E-14    2.927401E-14    6.911632E-03   -3.483805E-08   -1.653002E-03    2.206328E-14
1.600000E-03        G       -2.785020E-14    5.818323E-14    1.409060E-02   -1.660608E-08   -3.811871E-03    4.289856E-14
2.000000E-03        G       -4.146658E-14    8.826009E-14    2.123710E-02    1.814668E-10   -5.841007E-03    6.439060E-14
2.400000E-03        G       -4.989096E-14    1.075618E-13    2.615920E-02    1.753987E-08   -7.446125E-03    7.806433E-14
2.800000E-03        G       -4.913178E-14    1.067672E-13    2.613206E-02    2.261718E-08   -7.588134E-03    7.723877E-14
3.200000E-03        G       -3.749043E-14    8.178410E-14    1.989586E-02    1.935897E-08   -5.754695E-03    5.900108E-14
3.600000E-03        G       -1.597640E-14    3.525036E-14    8.690471E-03    1.195476E-08   -2.598933E-03    2.532892E-14
4.000000E-03        G        1.033014E-14   -2.200721E-14   -5.226488E-03   -1.555539E-10    1.409517E-03   -1.602123E-14
4.400000E-03        G        4.430020E-14   -2.191627E-13   -1.444897E-02   -4.622429E-03    2.613301E-03   -9.125456E-14
4.800000E-03        G        4.852553E-14   -3.087126E-13   -4.958413E-03   -1.673921E-02   -3.303262E-03   -1.161244E-13
5.200000E-03        G       -8.218304E-15   -1.898447E-13    2.235487E-02   -1.968060E-02   -1.012875E-02   -3.180895E-14
```

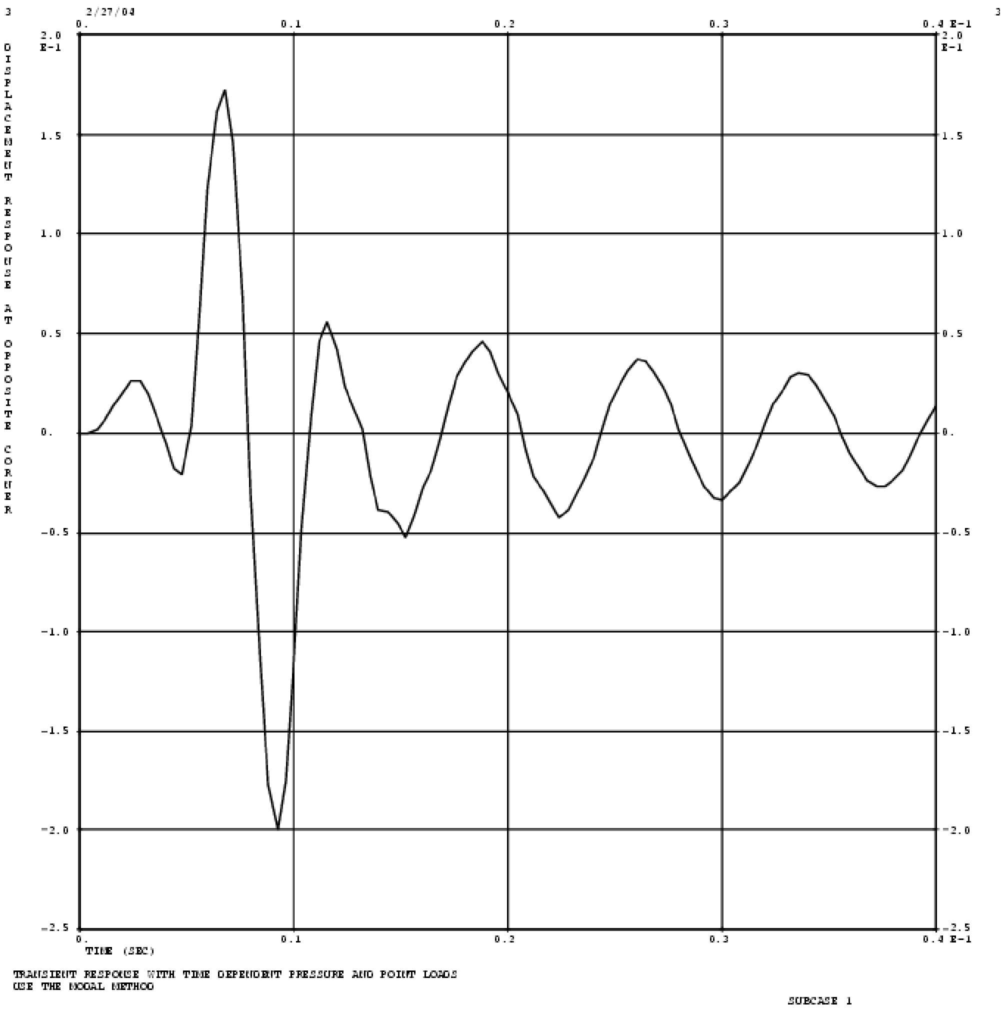


```
     POINT-ID =          11
                                                    D I S P L A C E M E N T   V E C T O R

     TIME          TYPE          T1              T2              T3              R1              R2              R3
0.0                 G        0.0             0.0             0.0             0.0             0.0             0.0
4.000000E-04        G       -5.468724E-16    8.285983E-17    2.038250E-04   -3.199117E-06    2.623944E-05    2.229172E-16
8.000000E-04        G       -2.153063E-15    6.017427E-15    1.980818E-03   -1.510275E-05   -2.074038E-04    3.009406E-15
1.200000E-03        G       -4.732605E-15    1.976118E-14    6.911292E-03    4.029351E-07   -1.653521E-03    9.214505E-15
1.600000E-03        G       -8.188211E-15    3.997767E-14    1.407448E-02    2.646134E-05   -3.815677E-03    1.823616E-14
2.000000E-03        G       -1.175393E-14    6.110972E-14    2.121053E-02    4.361140E-05   -5.847335E-03    2.759160E-14
2.400000E-03        G       -1.374123E-14    7.478438E-14    2.611749E-02    6.869039E-05   -7.455696E-03    3.359488E-14
2.800000E-03        G       -1.328659E-14    7.442078E-14    2.608508E-02    7.748552E-05   -7.598778E-03    3.332740E-14
3.200000E-03        G       -1.006076E-14    5.711146E-14    1.986136E-02    5.686198E-05   -5.762578E-03    2.550997E-14
3.600000E-03        G       -4.168126E-15    2.469733E-14    8.672293E-03    3.001545E-05   -2.602997E-03    1.098888E-14
4.000000E-03        G        2.927909E-15   -1.525557E-14   -5.221072E-03   -8.858792E-06    1.410838E-03   -6.874774E-15
4.400000E-03        G       -1.632934E-14   -1.940992E-13   -9.066898E-03   -5.693542E-03    9.466209E-05   -5.908224E-14
4.800000E-03        G       -3.433218E-14   -2.813239E-13    1.286251E-02   -1.815789E-02   -7.924688E-03   -8.140870E-14
```

Step 11. Review the Graph Results

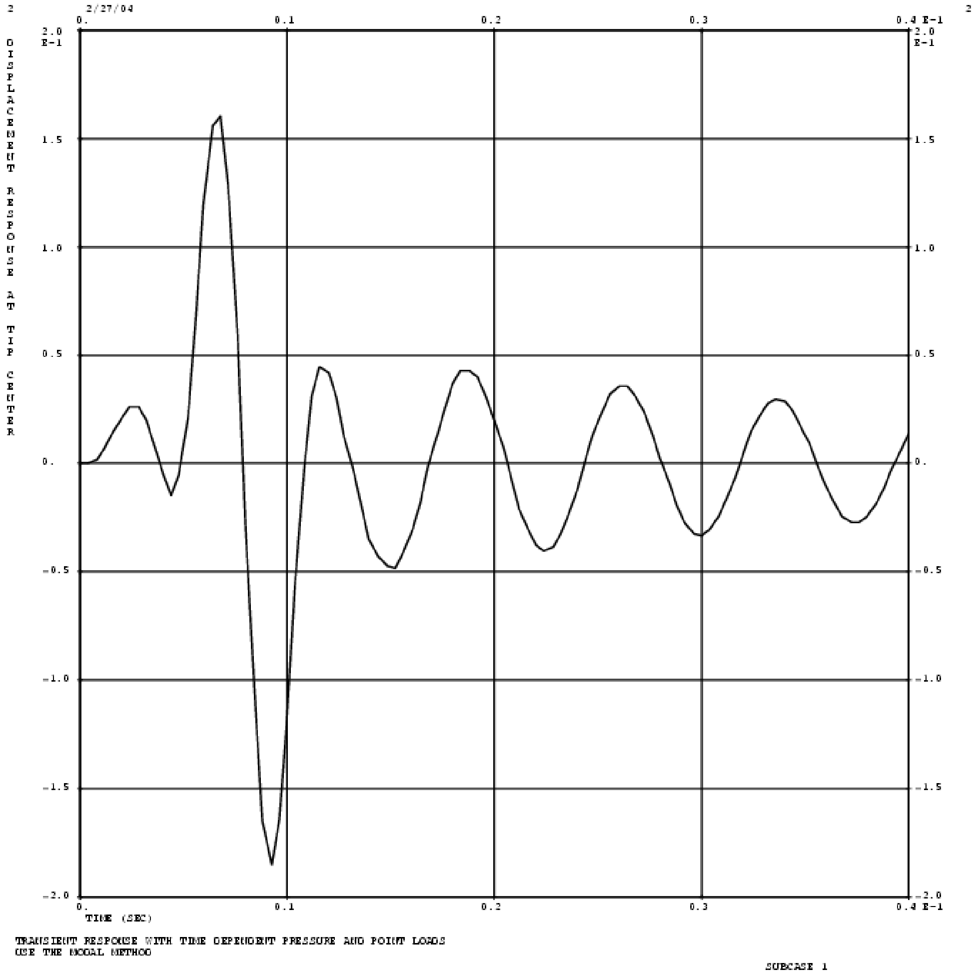
Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions given in workshop 4, step 9

Review the displacement response graph at the opposite corner of the point load. (grid 55)



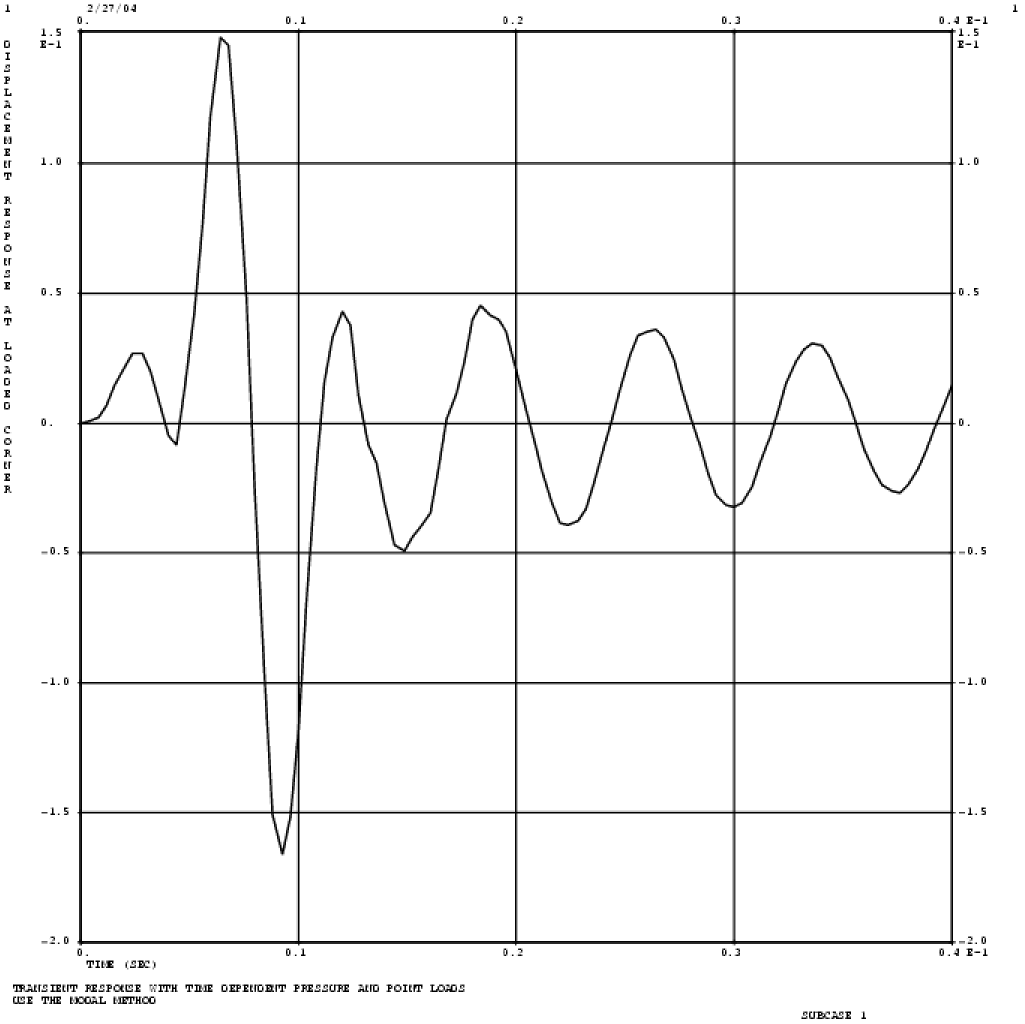
Step 11. Review the Graph Results (Cont.)

Review the displacement response graph at the center of the tip of the plate. (grid 33)



Step 11. Review the Graph Results (Cont.)

Review the displacement response graph at the loaded corner. (grid 11)



WORKSHOP 6
DIRECT FREQUENCY RESPONSE

- **Workshop Objective**
  - Using the direct method, determine the frequency response of the flat rectangular plate (from Workshop 1) subject to frequency-varying excitation as described below.

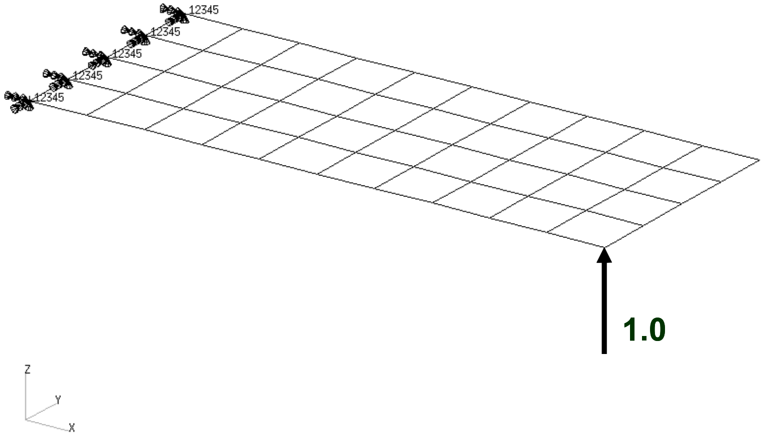
- **Software Version**
  - MSC Nastran 2013

- **Required Files**
  - plate.bdf
  - wkshp6.dat

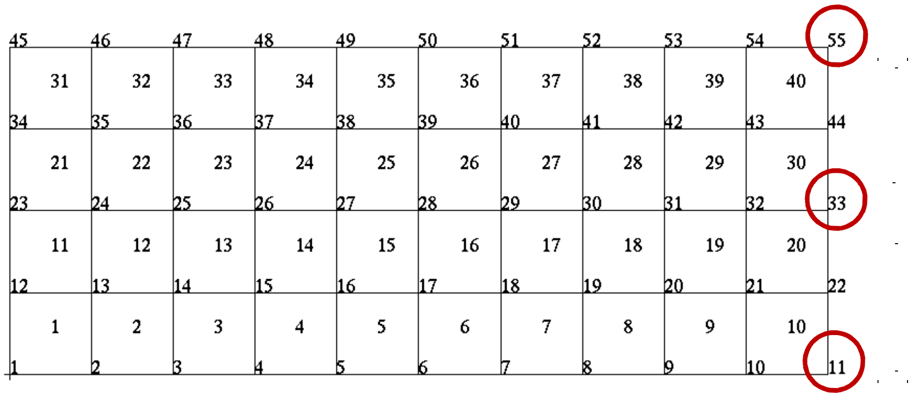
- **Problem Description**
  - The structure is excited by a unit load at a corner of the tip. Use a frequency step of 20 Hz between a range of 20 and 1000 Hz. Use structural damping of g=0.06.

- **Problem Description Continued**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

Loads and Boundary Condition



Elements and Grid Coordinates



- **Suggested Steps**
  1. Open and review the input file wkshp6.dat.
  2. Add structural damping.
  3. Add the point load.
  4. Add frequencies of applied loading.
  5. Save and run the new input file in MSC Nastran.
  6. Review the MSC Nastran results using the solution file soln6.f06.
  7. Review the graph results.

Step 1. Open and Review the Input File wkshp6.dat

The file wkshp6.dat is the starting input file to be modified.

To complete input file add these entries

Output displacement response graphs at grid points 11, 33,55

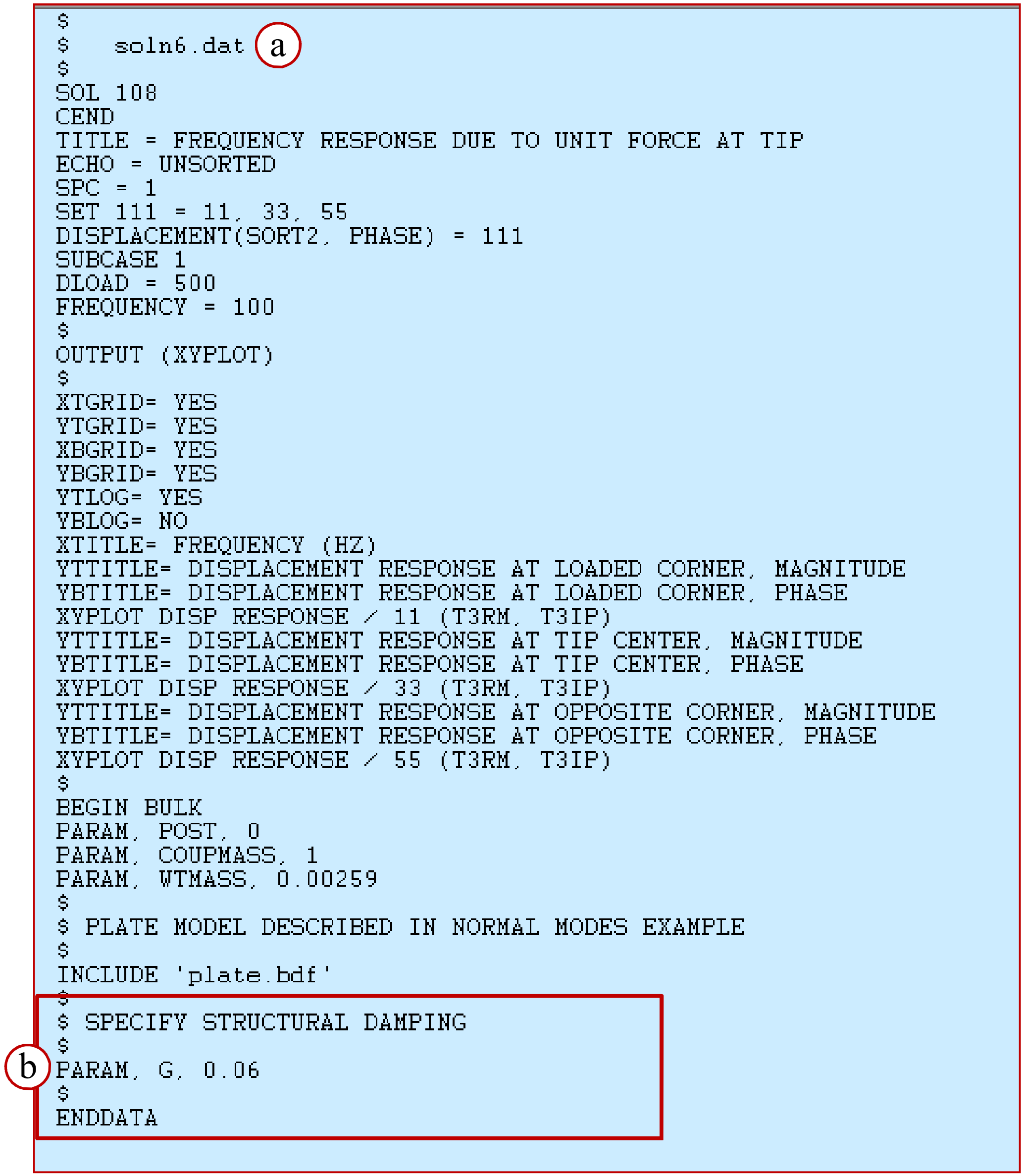
```
$
$    wkshp6.dat
$
$    add     :         structural damping
$                      loading
$                      frequencies of applied loadings
$
SOL 108
CEND
TITLE = FREQUENCY RESPONSE DUE TO UNIT FORCE AT TIP
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2, PHASE) = 111
SUBCASE 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
param,post,0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 2. Add Structural Damping

Add the appropriate parameters in the Bulk Data section for damping.

a. First rename the input file as **soln6.dat**.

b. Use **PARAM, G** with a value of **.06**.



```
$
$   soln6.dat
$
SOL 108
CEND
TITLE = FREQUENCY RESPONSE DUE TO UNIT FORCE AT TIP
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2, PHASE) = 111
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
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
ENDDATA
```

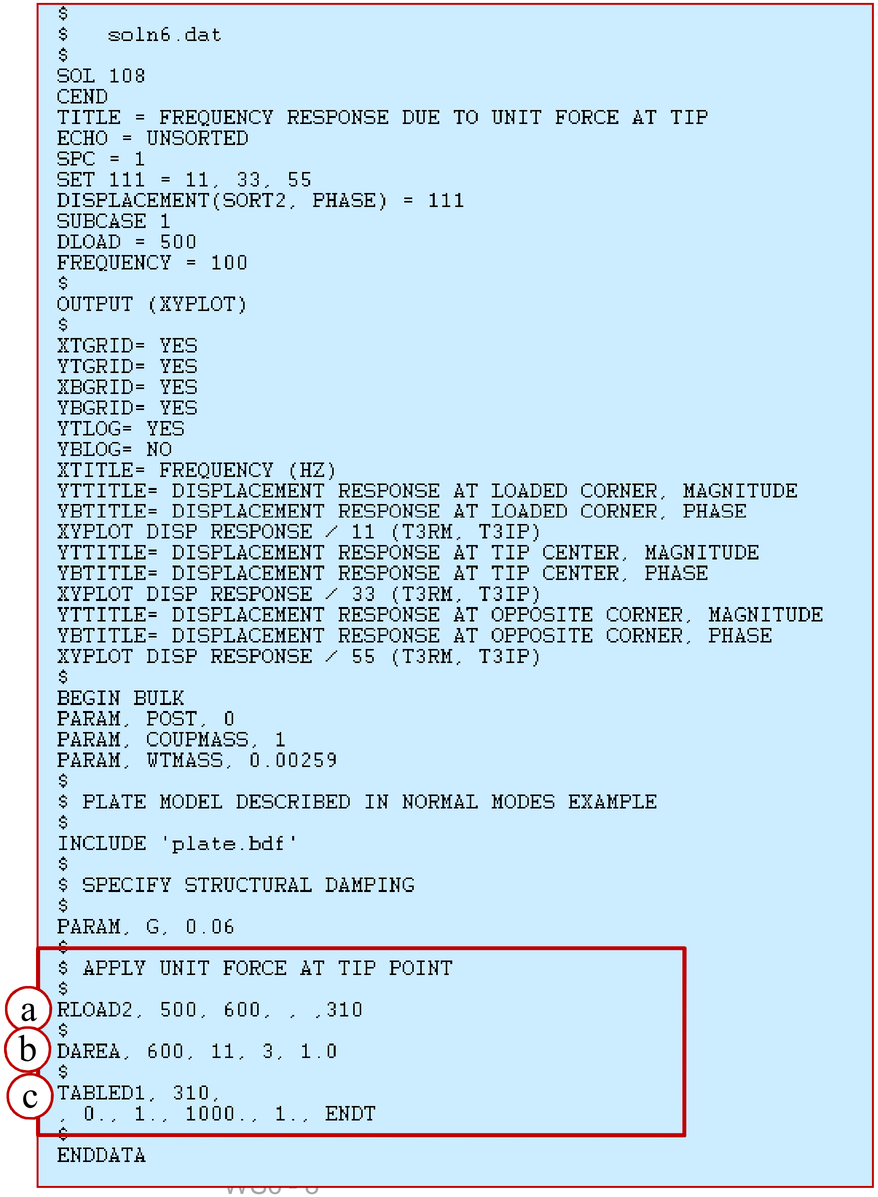
Step 3. Add the Point Load

Add unit point load at the corner of the tip of the plate (grid point 11).

a. Use the **RLOAD2** entry in combination with **DAREA** and **TABLED1** entries.

b. For the **DAREA** entry, note that the unit load is applied at grid point **11** in the Z direction.

c. The **TABLED1** entry defines the load as **1 psi** for all frequencies.

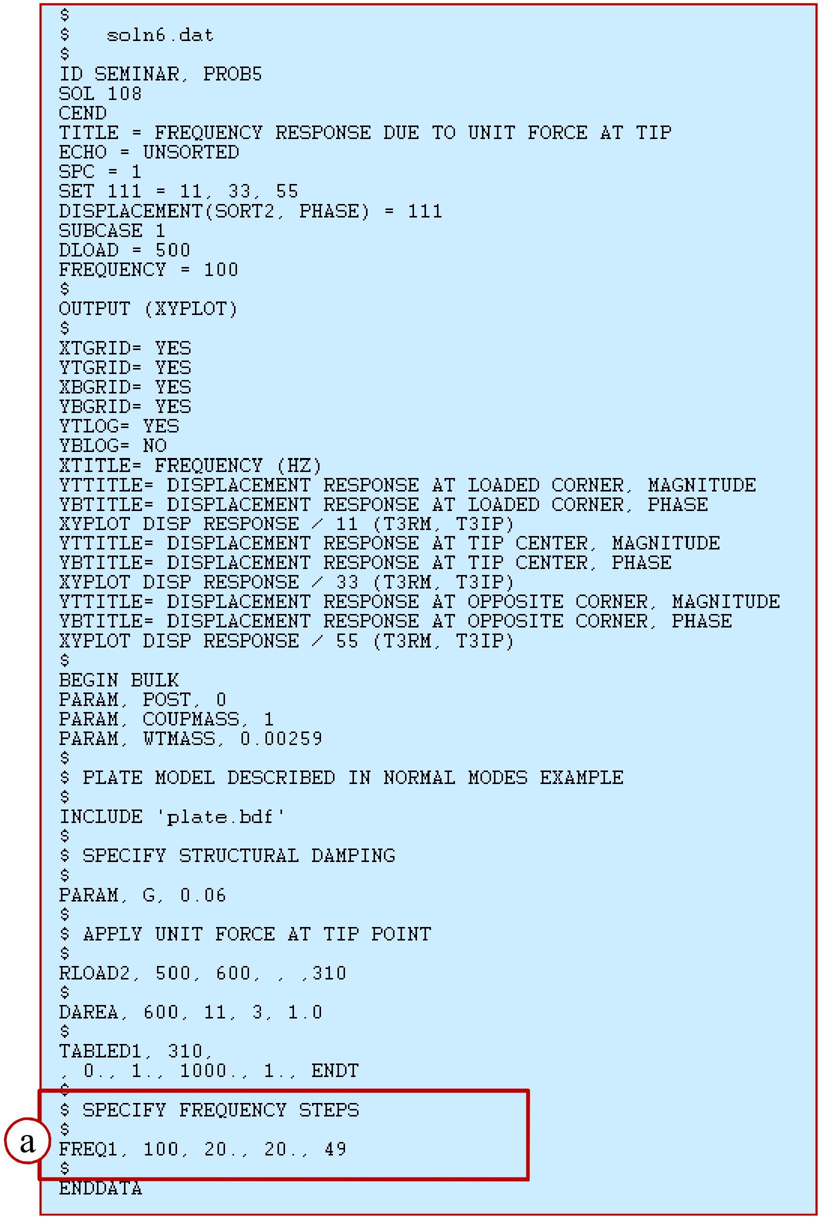


```
$
$   soln6.dat
$
SOL 108
CEND
TITLE = FREQUENCY RESPONSE DUE TO UNIT FORCE AT TIP
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2, PHASE) = 111
SUBCASE 1
DLOAD = 500
FREQUENCY = 100
$
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
YBLOG= NO
XTITLE= FREQUENCY (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
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY UNIT FORCE AT TIP POINT
$
RLOAD2, 500, 600, , ,310
$
DAREA, 600, 11, 3, 1.0
$
TABLED1, 310,
, 0., 1., 1000., 1., ENDT
$
ENDDATA
```

Step 4. Add Frequencies of Applied Loading

To add the frequency of the applied load use the FREQ1 entry.

a. From the given information you can obtain for the **FREQ1** entry:
  - First freq. = **20.0**
  - Frequency incr = **20.0**
  - Number of freq. increments = **49**

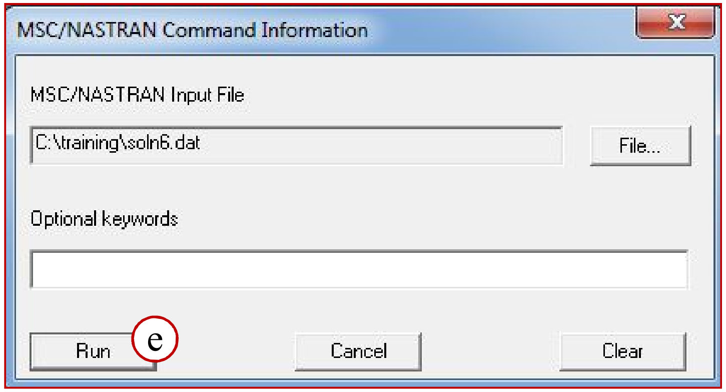


```
$
$   soln6.dat
$
ID SEMINAR, PROB5
SOL 108
CEND
TITLE = FREQUENCY RESPONSE DUE TO UNIT FORCE AT TIP
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(SORT2, PHASE) = 111
SUBCASE 1
DLOAD = 500
FREQUENCY = 100
$
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
YBLOG= 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
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY UNIT FORCE AT TIP POINT
$
RLOAD2, 500, 600, , ,310
$
DAREA, 600, 11, 3, 1.0
$
TABLED1, 310,
, 0., 1., 1000., 1., ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 5. Save and Run the New Input File

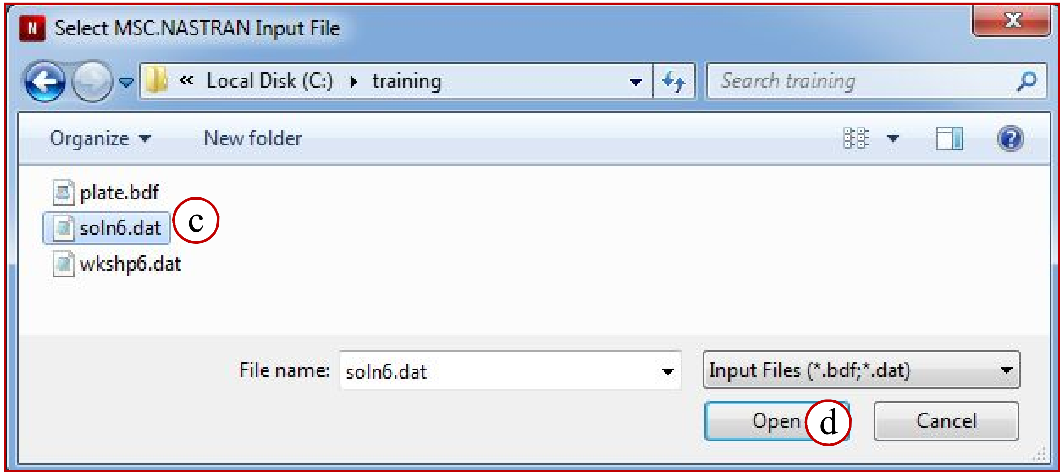
Save and run the modified file in Nastran.

a. Save the modified file as **soln6.dat**.
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln6.dat**.
d. Click **Open**.
e. Click **Run**.


MSC/NASTRAN Command Information

MSC/NASTRAN Input File: C:\training\soln6.dat

Optional keywords:


Select MSC.NASTRAN Input File

« Local Disk (C:) ▸ training

File name: soln6.dat

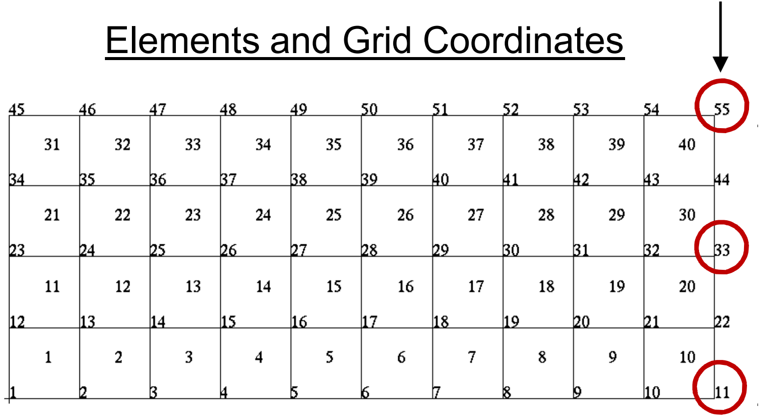
Input Files (*.bdf;*.dat)

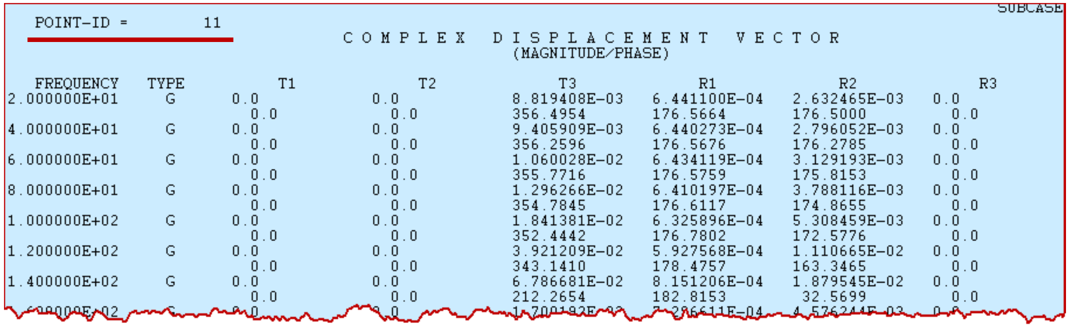
Step 6. Review the Results in the Solution File

To see the results open the soln6.f06 file. The three grid points of interest lie along the tip of the plate, grid points 11, 33, 55.

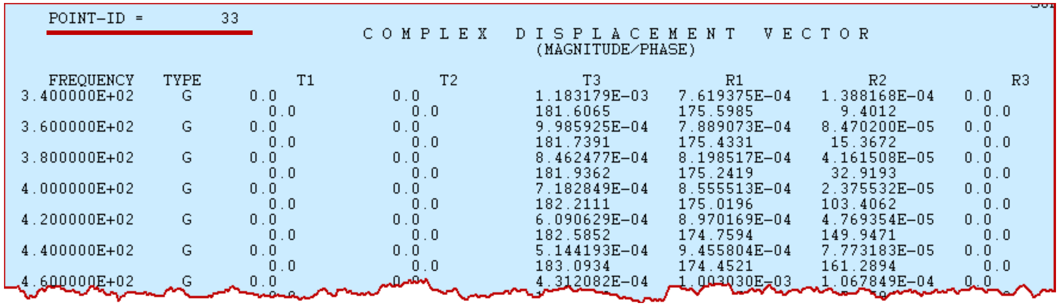
Elements and Grid Coordinates

Free Edge

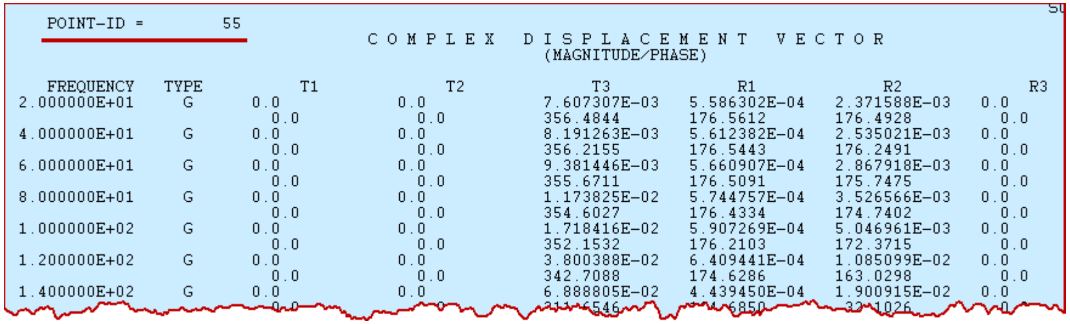




```
                                                                                                SUBCASE
    POINT-ID =         11
                                       C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                          (MAGNITUDE/PHASE)

    FREQUENCY   TYPE          T1              T2              T3              R1              R2              R3
2.000000E+01     G      0.0             0.0             8.819408E-03    6.441100E-04    2.632465E-03    0.0
                          0.0             0.0           356.4954        176.5664        176.5000          0.0
4.000000E+01     G      0.0             0.0             9.405909E-03    6.440273E-04    2.796052E-03    0.0
                          0.0             0.0           356.2596        176.5676        176.2785          0.0
6.000000E+01     G      0.0             0.0             1.060028E-02    6.434119E-04    3.129193E-03    0.0
                          0.0             0.0           355.7716        176.5759        175.8153          0.0
8.000000E+01     G      0.0             0.0             1.296266E-02    6.410197E-04    3.788116E-03    0.0
                          0.0             0.0           354.7845        176.6117        174.8655          0.0
1.000000E+02     G      0.0             0.0             1.841381E-02    6.325896E-04    5.308459E-03    0.0
                          0.0             0.0           352.4442        176.7802        172.5776          0.0
1.200000E+02     G      0.0             0.0             3.921209E-02    5.927568E-04    1.110665E-02    0.0
                          0.0             0.0           343.1410        178.4757        163.3465          0.0
1.400000E+02     G      0.0             0.0             6.786681E-02    8.151206E-04    1.879545E-02    0.0
                          0.0             0.0           212.2654        182.8153         32.5699          0.0
```



```
    POINT-ID =         33
                                       C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                          (MAGNITUDE/PHASE)

    FREQUENCY   TYPE          T1              T2              T3              R1              R2              R3
 3.400000E+02    G      0.0             0.0             1.183179E-03    7.619375E-04    1.388168E-04    0.0
                          0.0             0.0           181.6065        175.5985          9.4012          0.0
 3.600000E+02    G      0.0             0.0             9.985925E-04    7.889073E-04    8.470200E-05    0.0
                          0.0             0.0           181.7391        175.4331         15.3672          0.0
 3.800000E+02    G      0.0             0.0             8.462477E-04    8.198517E-04    4.161508E-05    0.0
                          0.0             0.0           181.9362        175.2419         32.9193          0.0
 4.000000E+02    G      0.0             0.0             7.182849E-04    8.555513E-04    2.375532E-05    0.0
                          0.0             0.0           182.2111        175.0196        103.4062          0.0
 4.200000E+02    G      0.0             0.0             6.090629E-04    8.970169E-04    4.769354E-05    0.0
                          0.0             0.0           182.5852        174.7594        149.9471          0.0
 4.400000E+02    G      0.0             0.0             5.144193E-04    9.455804E-04    7.773183E-05    0.0
                          0.0             0.0           183.0934        174.4521        161.2894          0.0
 4.600000E+02    G      0.0                             4.312082E-04    1.003030E-03    1.067849E-04    0.0
```



```
    POINT-ID =         55
                                       C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                          (MAGNITUDE/PHASE)

    FREQUENCY   TYPE          T1              T2              T3              R1              R2              R3
 2.000000E+01    G      0.0             0.0             7.607307E-03    5.586302E-04    2.371588E-03    0.0
                          0.0             0.0           356.4844        176.5612        176.4928          0.0
 4.000000E+01    G      0.0             0.0             8.191263E-03    5.612382E-04    2.535021E-03    0.0
                          0.0             0.0           356.2155        176.5443        176.2491          0.0
 6.000000E+01    G      0.0             0.0             9.381446E-03    5.660907E-04    2.867918E-03    0.0
                          0.0             0.0           355.6711        176.5091        175.7475          0.0
 8.000000E+01    G      0.0             0.0             1.173825E-02    5.744757E-04    3.526566E-03    0.0
                          0.0             0.0           354.6027        176.4334        174.7402          0.0
 1.000000E+02    G      0.0             0.0             1.718416E-02    5.907269E-04    5.046961E-03    0.0
                          0.0             0.0           352.1532        176.2103        172.3715          0.0
 1.200000E+02    G      0.0             0.0             3.800388E-02    6.409441E-04    1.085099E-02    0.0
                          0.0             0.0           342.7088        174.6286        163.0298          0.0
 1.400000E+02    G      0.0             0.0             6.888805E-02    4.439450E-04    1.900915E-02    0.0
```

Step 7. Review the Graph Results

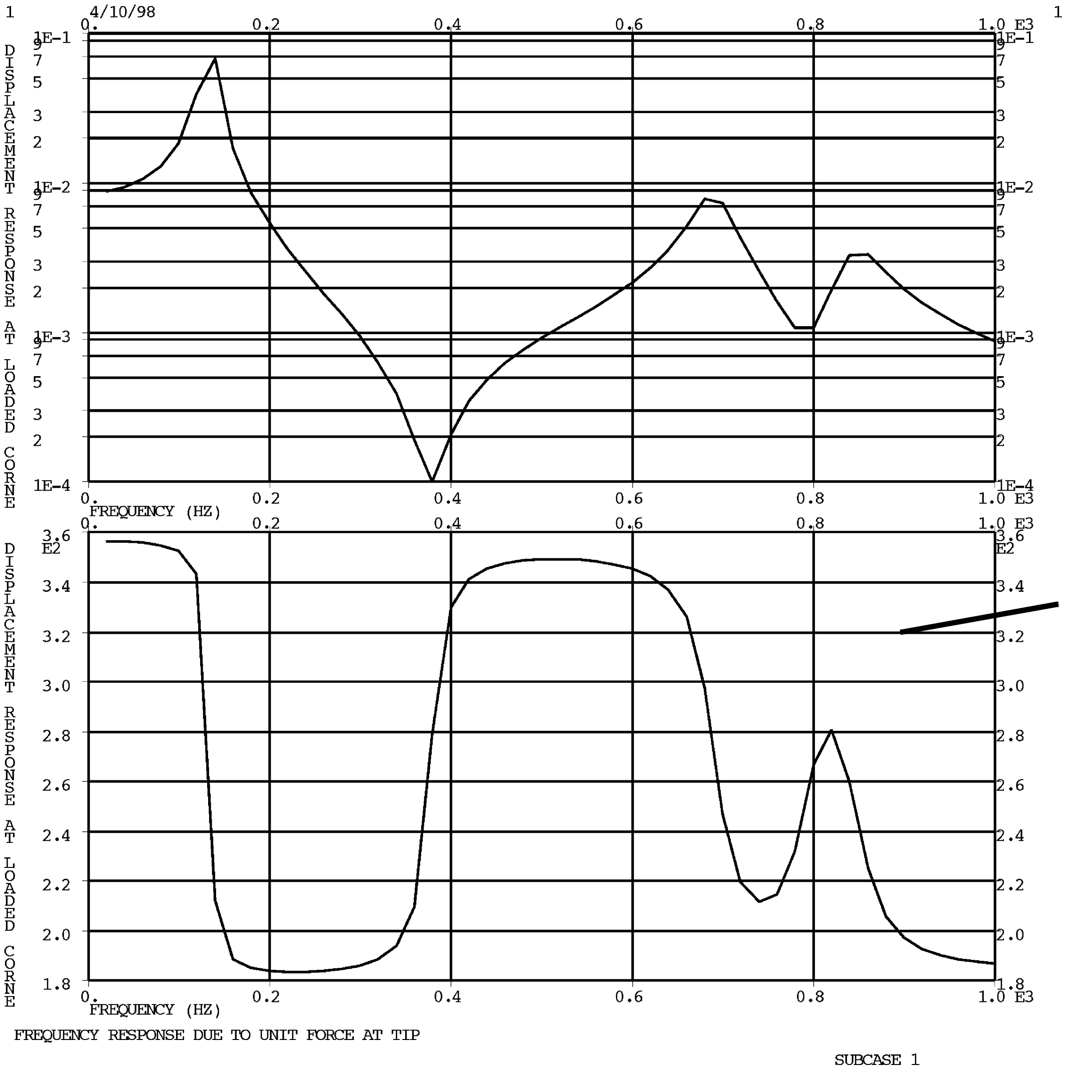
Recall that to obtain the graphs you will need to convert the .plt file to a .ps file, if needed, use the directions given in workshop 4, step 9

Review the displacement response graph at the loaded corner. (grid point 11)

The display of Phase will be different in Patran

-180º < Phase < 180º

Any Phase Lead larger 180º will be displayed as (Phase - 360º)

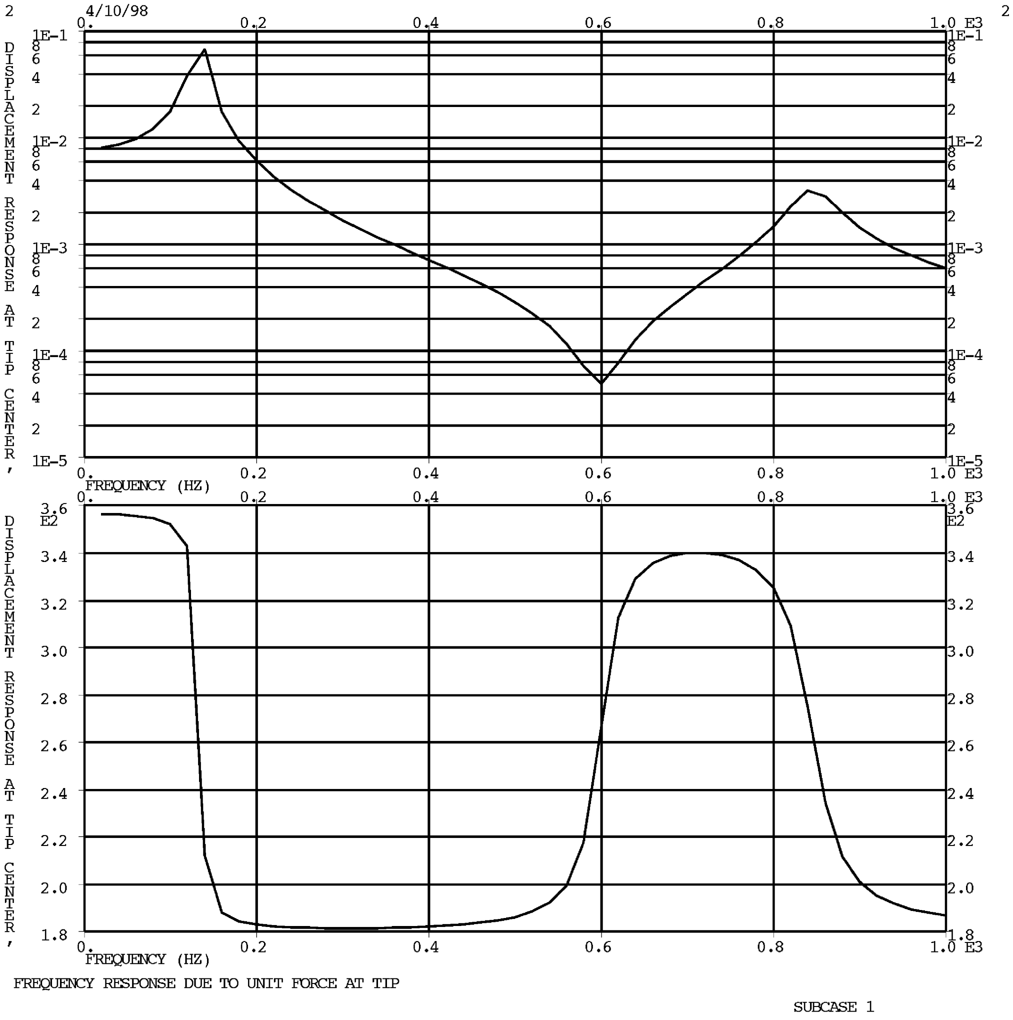


Phase Lead calculated by MSC Nastran:

0º < Phase < 360º

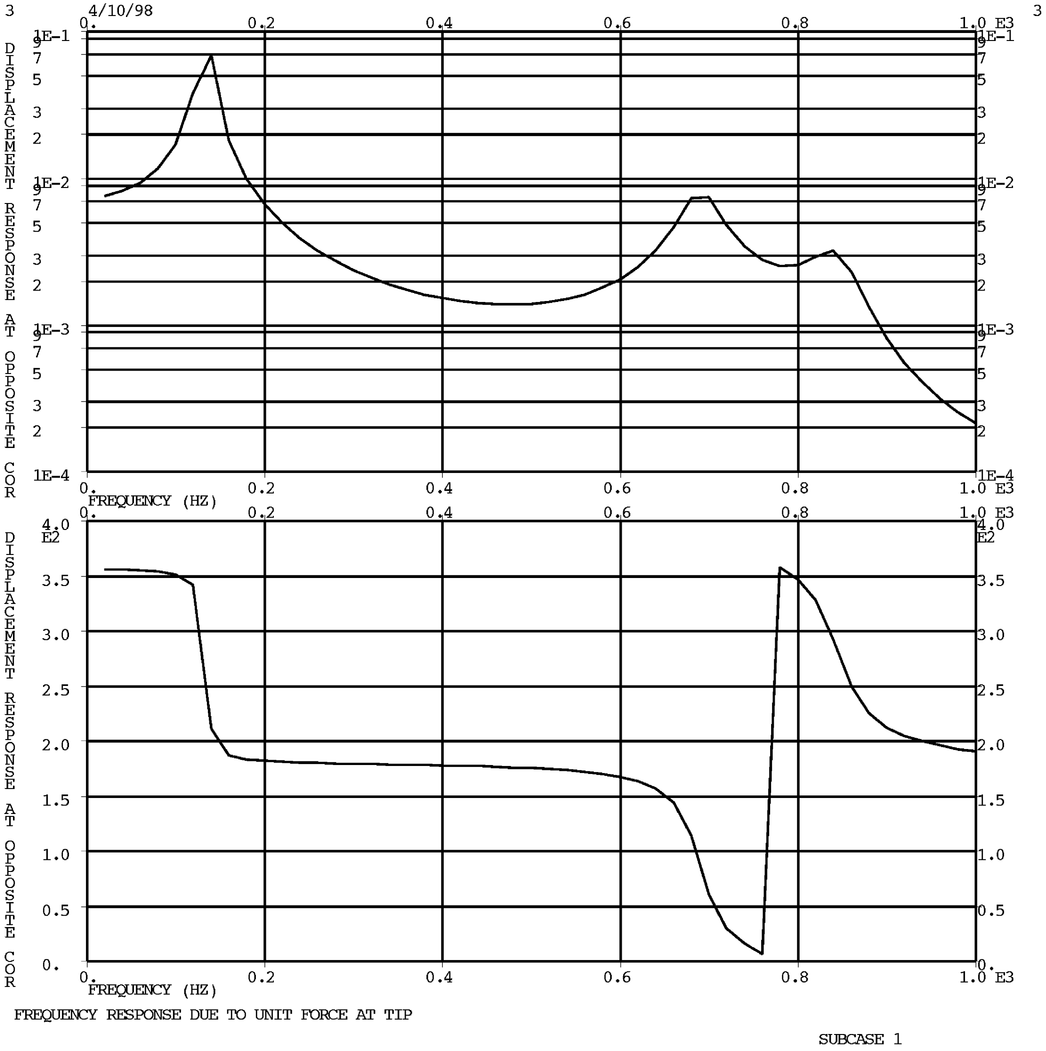
Step 7. Review the Graph Results (Cont.)

Review the displacement response graph at the center of tip of the plate. (grid 33)



Step 7. Review the Graph Results (Cont.)

Review the displacement response graph at the opposite corner of the point load. (grid point 55)

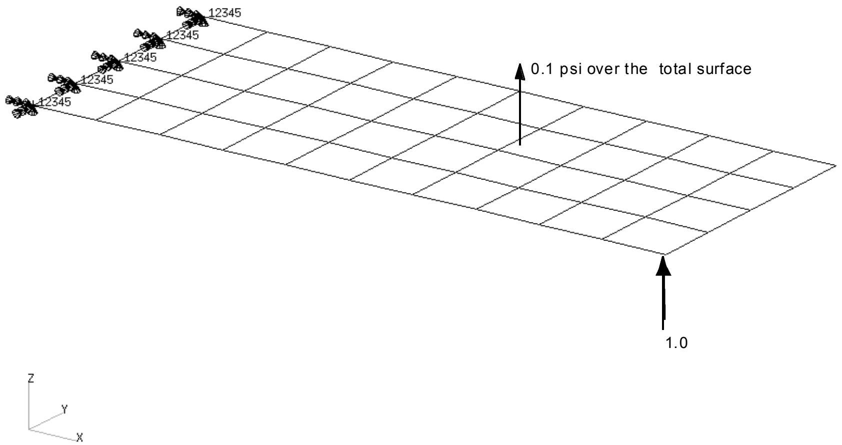


WORKSHOP 7
MODAL FREQUENCY RESPONSE

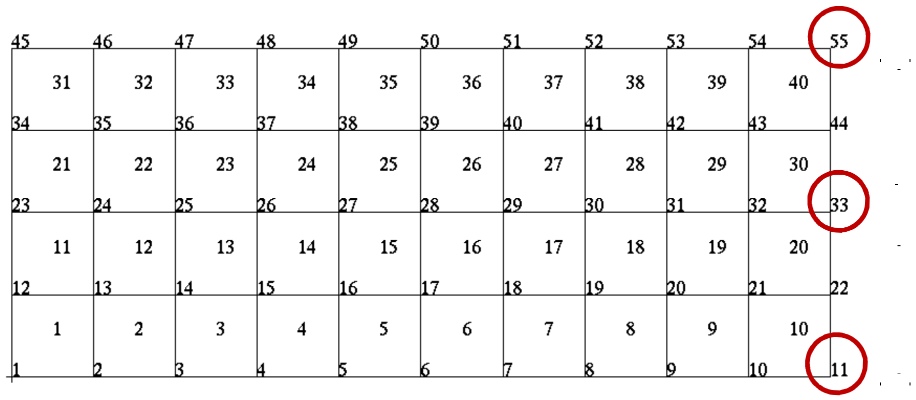
- **Workshop Objective**
  - Using the modal method, determine the frequency response of the flat rectangular plate (from Workshop 1) subject to a time varying excitation as described below.
- **Software Version**
  - MSC Nastran 2013
- **Required Files**
  - plate.bdf
  - wkshop7.dat
- **Problem Description**
  - The structure is excited by a 0.1 psi pressure load over the total surface of the plate and a 1.0 lb. force at a corner of the tip lagging 45^o. Use a modal damping ratio of z = 0.03. Use a frequency step of 20 Hz between a range of 20 and 1000 Hz; in addition, specify five evenly spaced excitation frequencies between the half power points of each resonant frequency between the range of 20-1000 Hz.

- **Problem Description Continued**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

Loads and Boundary Condition



Elements and Grid Coordinates

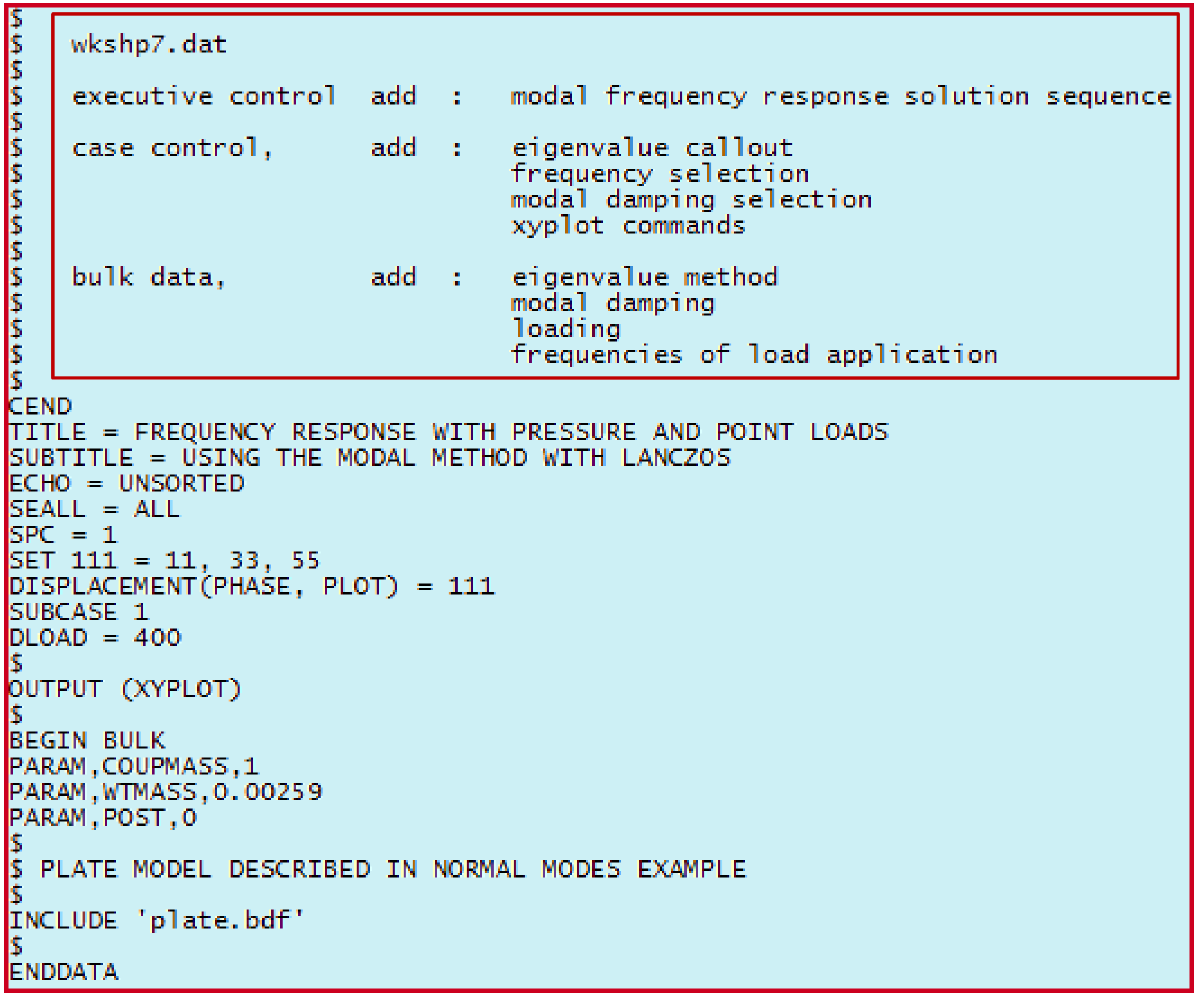


- **Suggested Steps**

  1. Open and review the input file wkshp7.dat
  2. Add Executive Control command for modal response solution sequence.
  3. Add the XY Plot commands to graph the displacement transient response.
  4. Add the other Case Control commands
     - METHOD
     - FREQUENCY
     - SDAMPING
  5. Add the eigenvalue method
  6. Add the modal damping.
  7. Add the pressure load.
  8. Add the point load.
  9. Add the combined loads.
  10. Add frequency of load application.
  11. Save and run the new input file in MSC Nastran.
  12. Review the MSC Nastran results using the solution file soln7.f06.
  13. Review the graph results.

Step 1. Open and Review the Input File wkshp7.dat

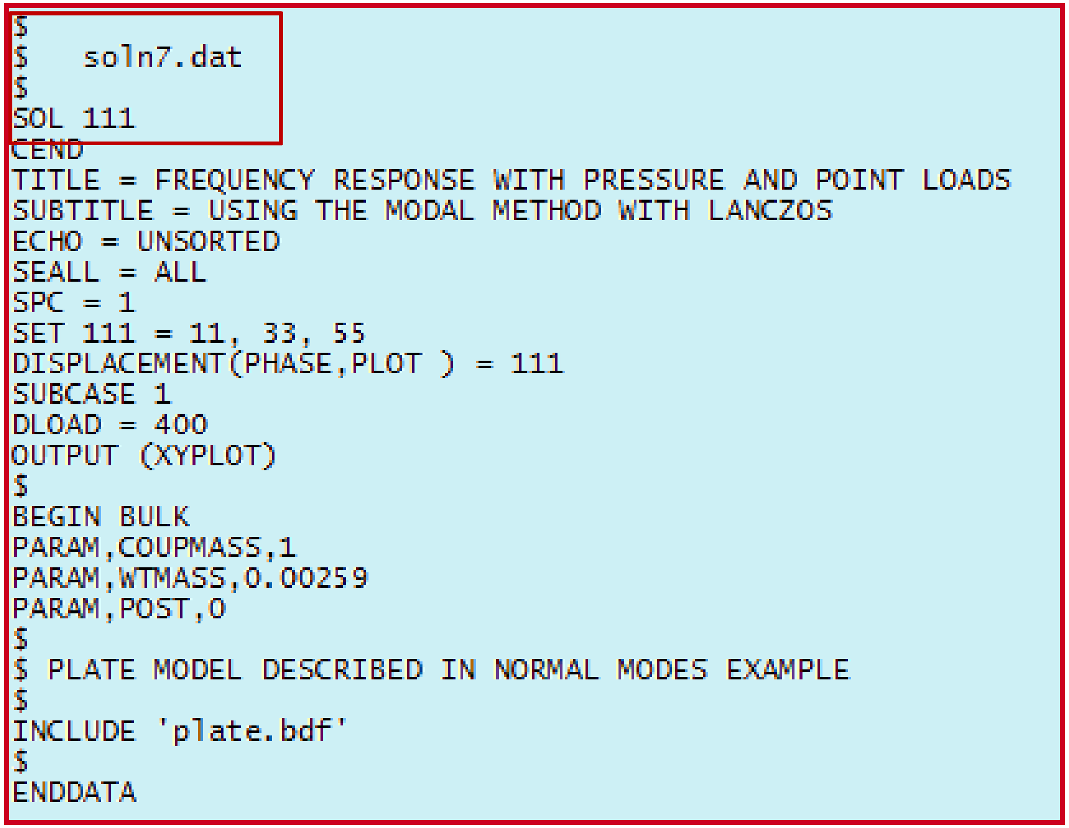
The file wkshp7.dat is the starting input file to be modified.



```
$
$   wkshp7.dat
$
$   executive control  add  :   modal frequency response solution sequence
$
$   case control,      add  :   eigenvalue callout
$                               frequency selection
$                               modal damping selection
$                               xyplot commands
$
$   bulk data,         add  :   eigenvalue method
$                               modal damping
$                               loading
$                               frequencies of load application
$
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE, PLOT) = 111
SUBCASE 1
DLOAD = 400
$
OUTPUT (XYPLOT)
$
BEGIN BULK
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 2. Add Executive Control Command

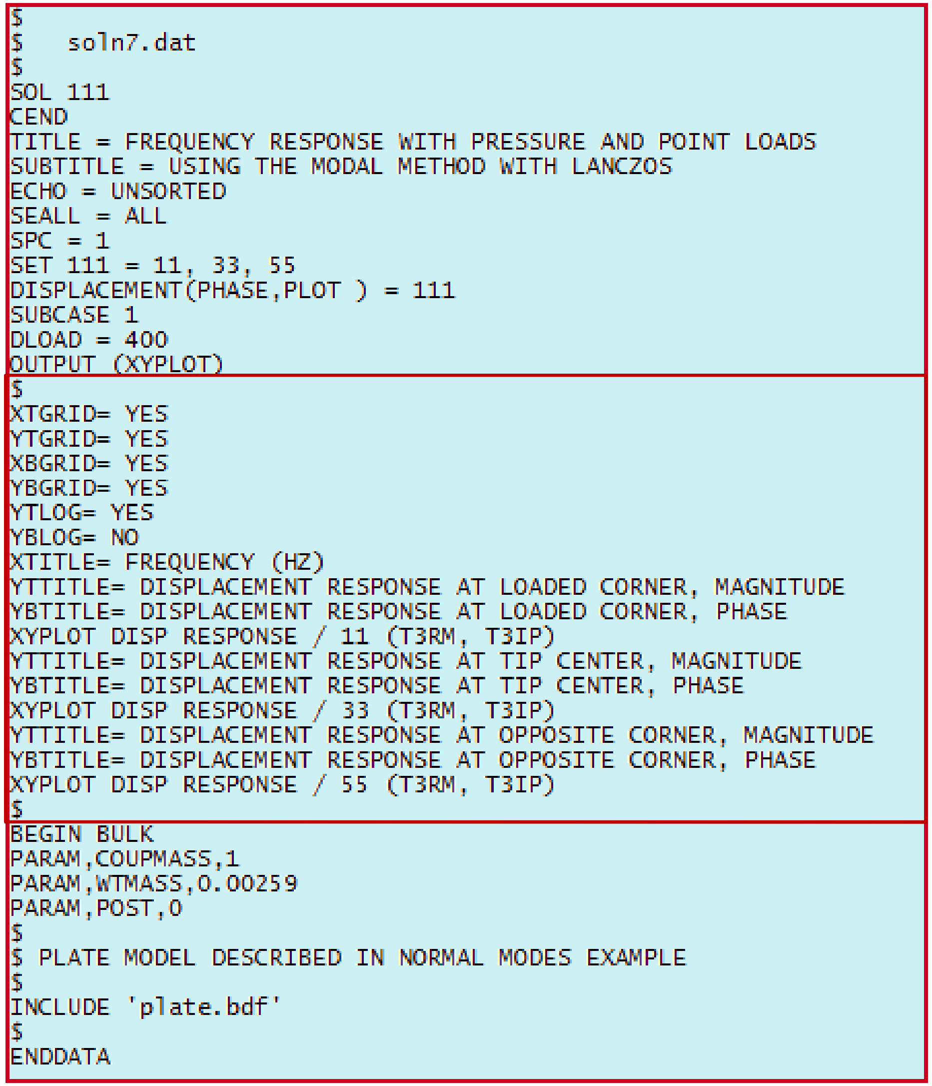
Change the file name to **soln7.dat** and add the modal response solution sequence, **SOL 111**



```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
SUBCASE 1
DLOAD = 400
OUTPUT (XYPLOT)
$
BEGIN BULK
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 3. Add the XY Plot Commands for Graph

Add the **XYPLOT** commands to graph the displacement response at **Grid points 11, 33,** and **55,** as shown to the right.

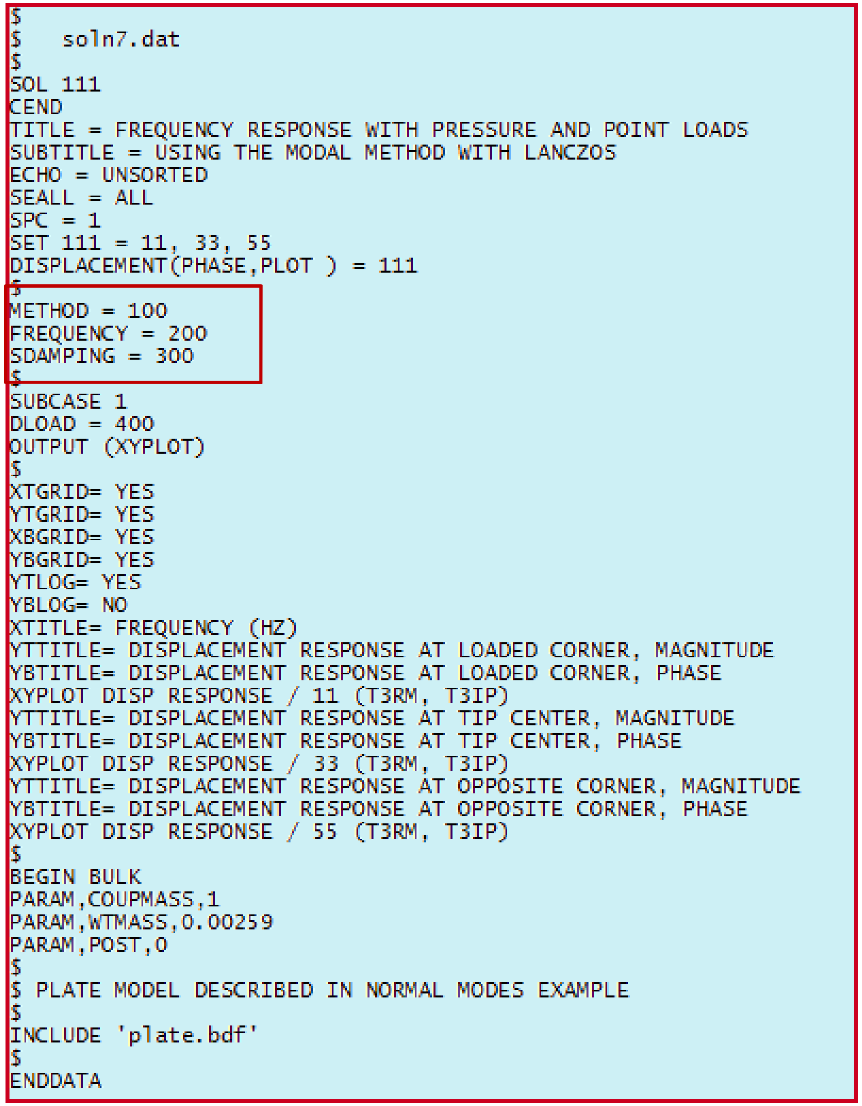


```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
SUBCASE 1
DLOAD = 400
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= YES
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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 4. Add Other Case Control Commands

You will need the following additional case control commands

- **METHOD** – eigenvalue callout
- **FREQUENCY** – frequency selection
- **SDAMPING** – modal damping selection



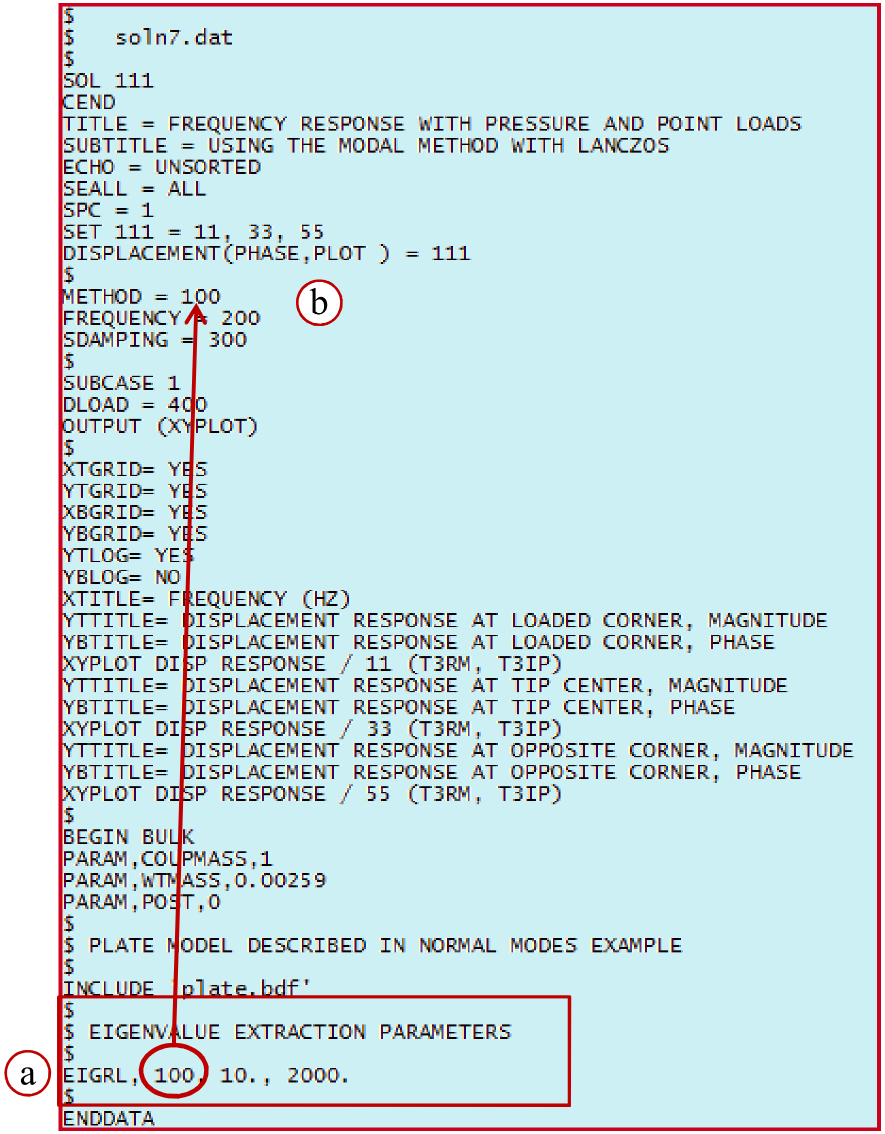
```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 5. Add Eigenvalue Method

To add the eigenvalue Method:

a. Use the **EIGRL** entry with a frequency range of interest from **10 to 2000**.

b. Make sure that the **METHOD** Case Control command identification number matches the **EIGRL** SID.



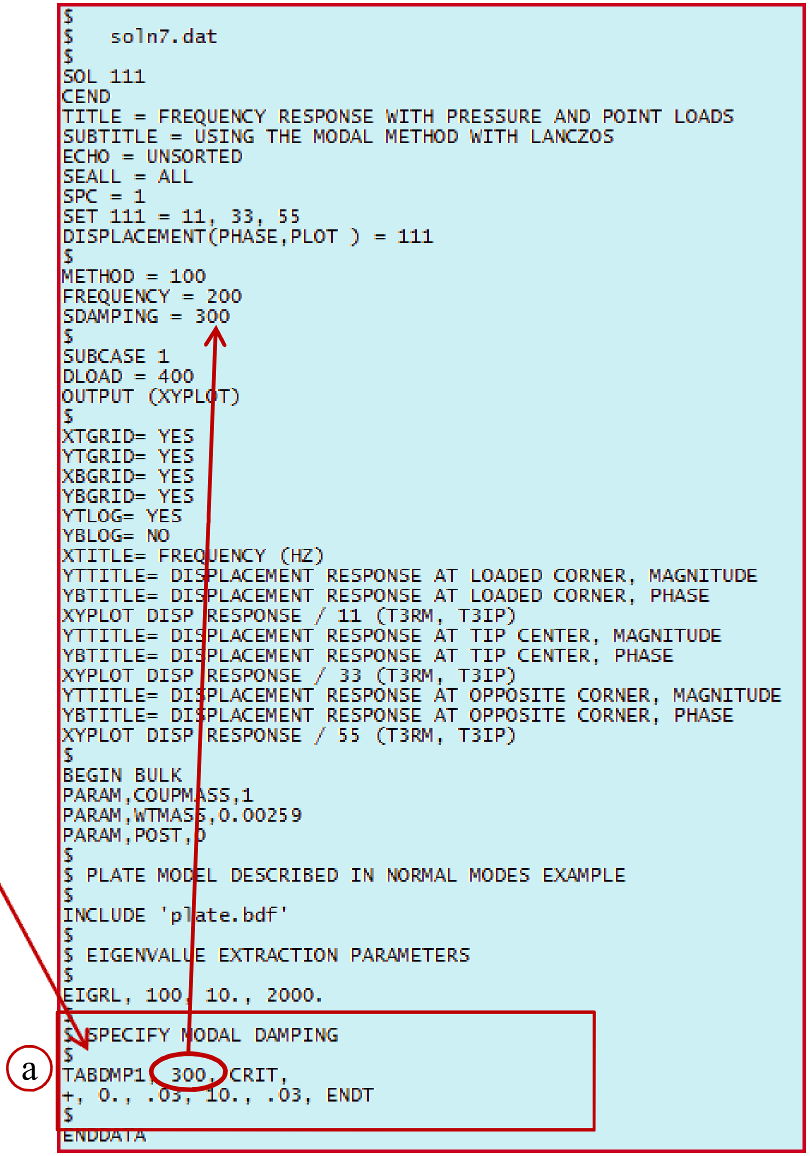
```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
ENDDATA
```

Step 6. Add Modal Damping

To add the modal damping:

a. Use the **TABDMP1** entry and the given information on page WS-3
   - TID = **300** (note must match identification number from SDAMPING in Case Control)
   - Type = **CRIT**
   - First Natural Freq. = **0.0**
   - Damping Value = **.03**
   - Last Natural Freq.= **10.0** (see note below)
   - Damping Value = **.03**

Tables in MSC Nastran are extrapolated. Since in this case, the table represents a straight line, then any two points on that line will work.

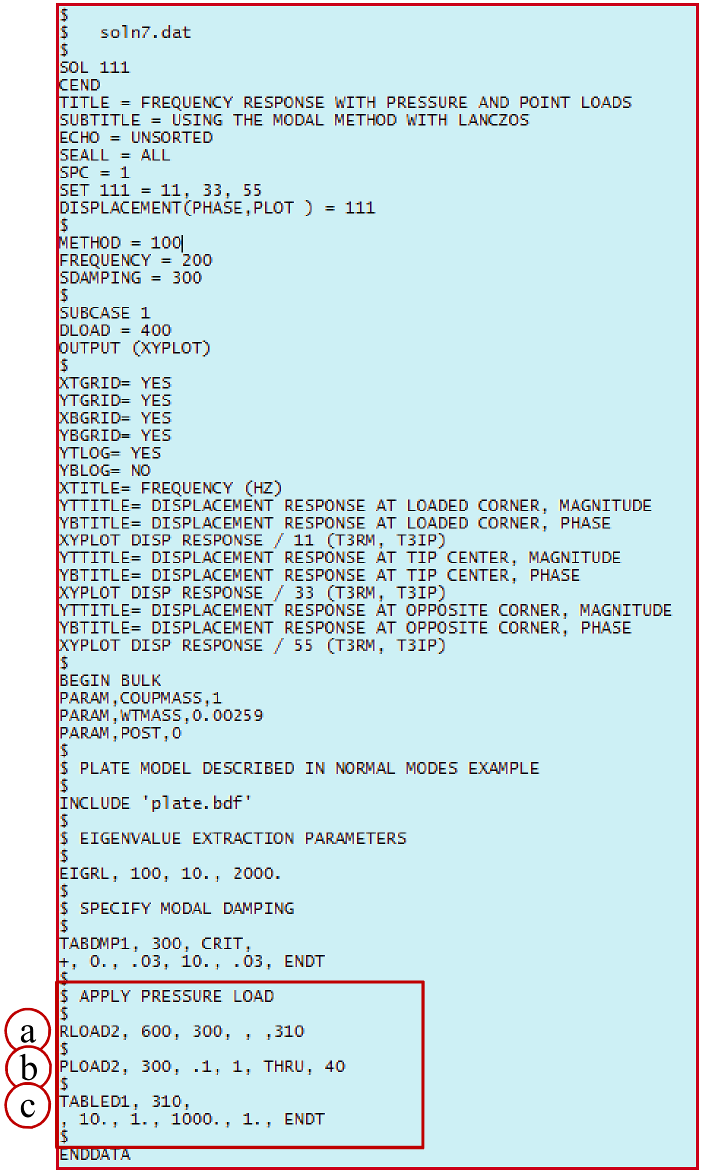


```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
ENDDATA
```

Step 7. Add the Pressure Load

Add the 0.1 psi pressure load over the total surface of the plate.

a. Use a **RLOAD2** entry in combination with a **PLOAD2** and **TABLED1** entries.
b. For the **PLOAD2** entry, apply the pressure load of .1 psi over the elements of the plate. (**1 through 40**)
c. The **TABLED1** entry specifies the scale factor to be applied to the **PLOAD2** which then defines the load as **.1 psi** for all frequencies.

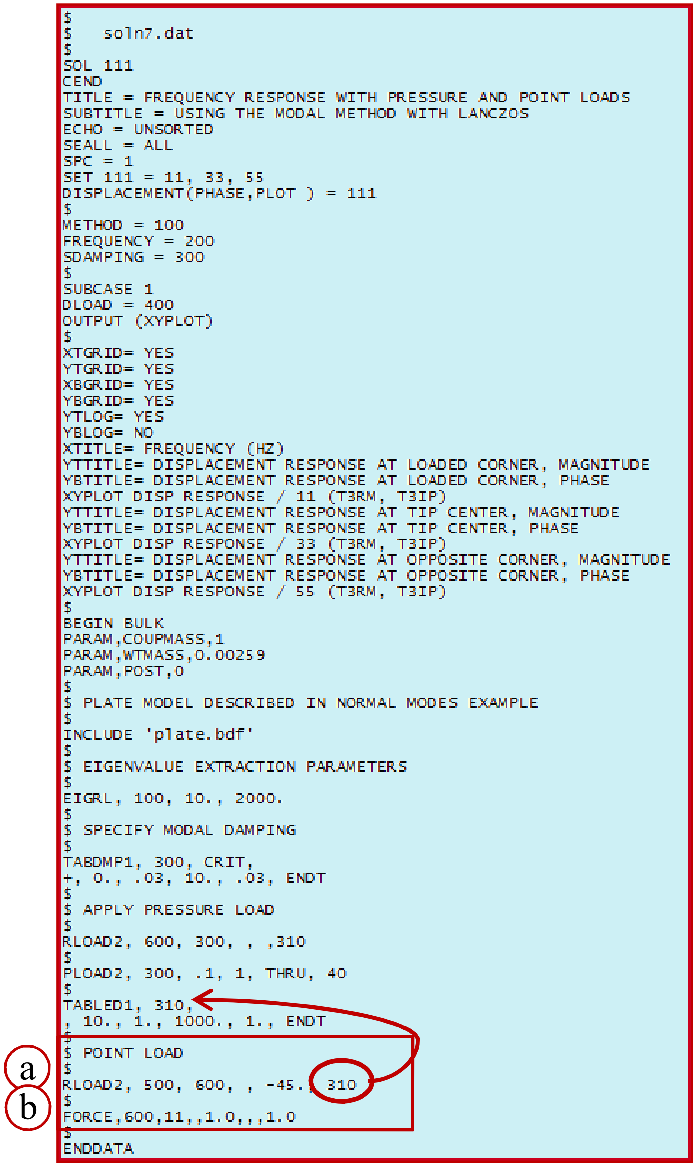


```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ APPLY PRESSURE LOAD
$
RLOAD2, 600, 300, , ,310
$
PLOAD2, 300, .1, 1, THRU, 40
$
TABLED1, 310,
, 10., 1., 1000., 1., ENDT
$
ENDDATA
```

Step 8. Add the Point Load

Apply the 1 lb point load at the corner of the tip of the plate at grid point 11, lagging 45º.

a. Use the **RLOAD2** entry in combination with the **FORCE** entry, and the **TABLED1** entry already defined from previous step.
b. For the **FORCE** entry, note that the **1 lb** force is applied at grid point **11** in the **Z** direction.

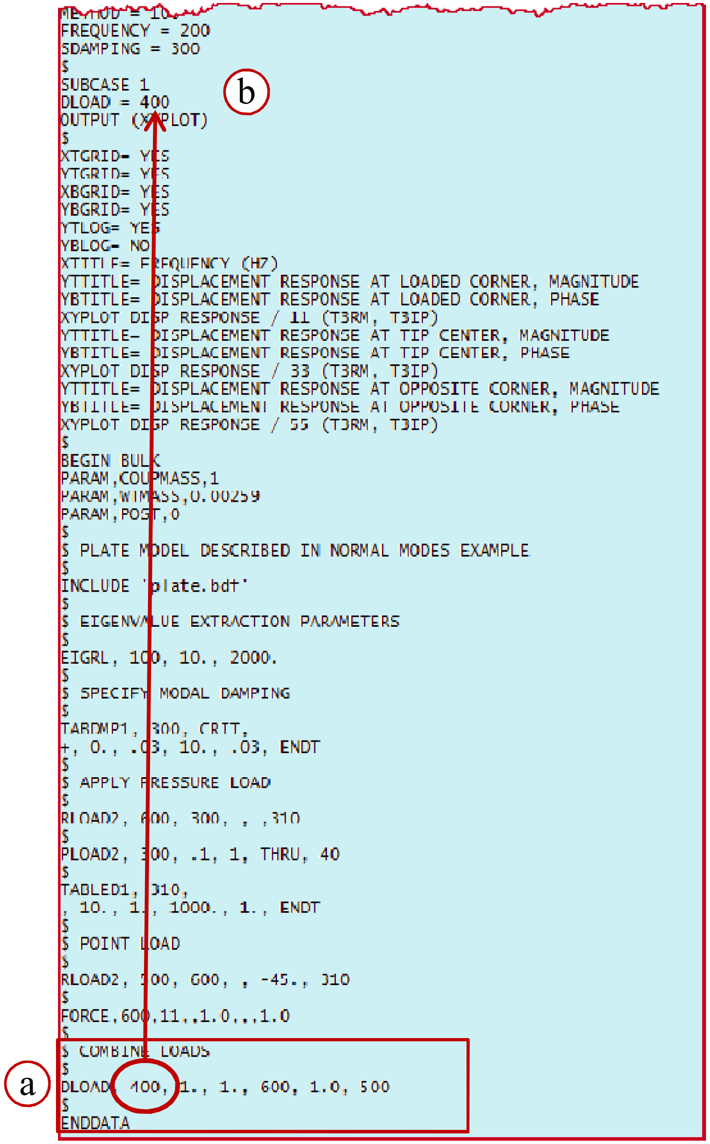


```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ APPLY PRESSURE LOAD
$
RLOAD2, 600, 300, , ,310
$
PLOAD2, 300, .1, 1, THRU, 40
$
TABLED1, 310,
, 10., 1., 1000., 1., ENDT
$
$ POINT LOAD
$
RLOAD2, 500, 600, , -45., 310
$
FORCE,600,11,,1.0,,,1.0
$
ENDDATA
```

Step 9. Add the Combined Loads

Combine the pressure and point loads using a DLOAD entry.

a. For the **DLOAD** entry, define the scale as **1.0** for both loads.
b. Make sure the **DLOAD** Case Control command indentification matches the SID for the **DLOAD** entry in the Bulk Data section.



```
METHOD = 10
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
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
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
PARAM,POST,0
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdt'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ APPLY PRESSURE LOAD
$
RLOAD2, 600, 300, , ,310
$
PLOAD2, 300, .1, 1, THRU, 40
$
TABLED1, 310,
, 10., 1., 1000., 1., ENDT
$
$ POINT LOAD
$
RLOAD2, 500, 600, , -45., 310
$
FORCE,600,11,,1.0,,,1.0
$
$ COMBINE LOADS
$
DLOAD, 400, 1., 1., 600, 1.0, 500
$
ENDDATA
```

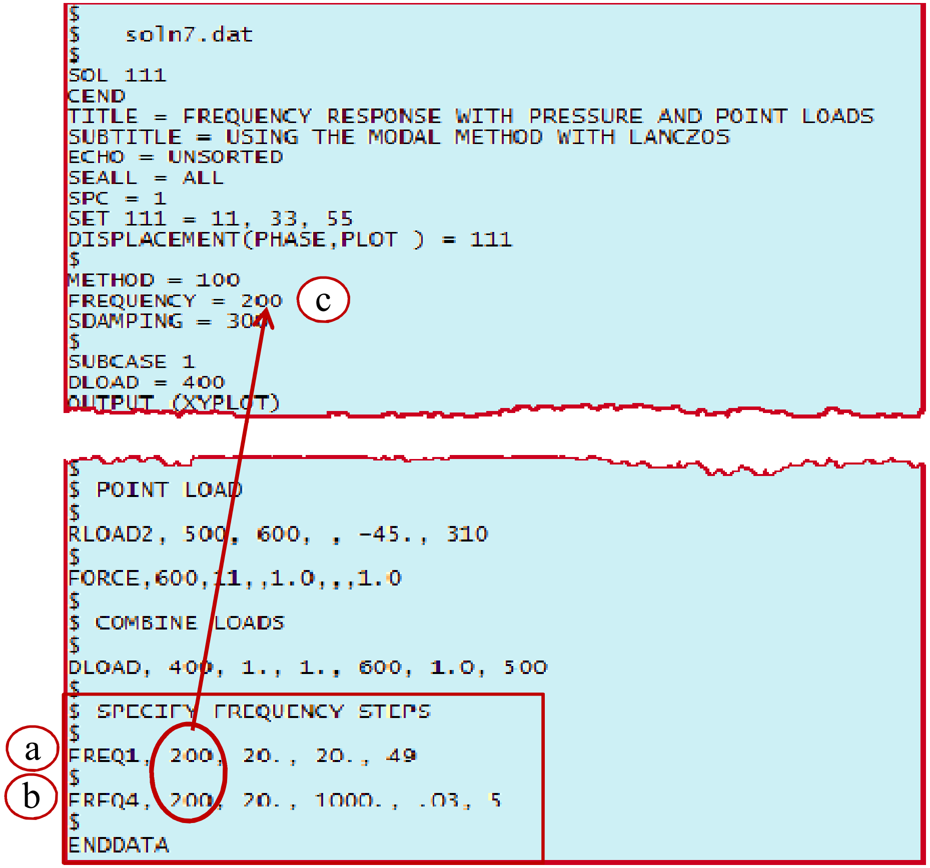
Step 10. Add Frequency of Load Application

To add the frequency of the applied load use the FREQ1 and FREQ4 entries.

a. For **FREQ1** entry, from the given information you can obtain:
   - First freq. = **20.0**
   - Frequency incr = **20.0**
   - Number of freq. increments = **49**

b. For **FREQ4** entry, from the given information you can obtain
   - Lower bound freq. = **20.0**
   - Upper bound freq = **1000.0**
   - Frequency spread (in this case it is defined as the half power point so it is equal to the damping ratio) = **.03**
   - Number of equally spaced frequencies = **5**

c. Make sure the **FREQUENCY** Case Control command indentification matches the SID for the **FREQ1** and **FREQ4** entries in the Bulk Data section.



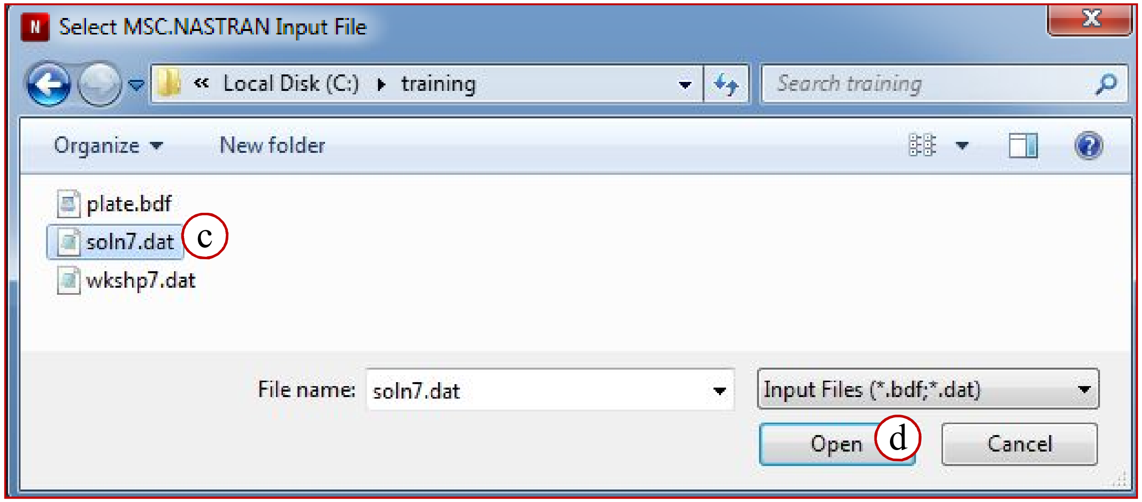
```
$
$   soln7.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE = USING THE MODAL METHOD WITH LANCZOS
ECHO = UNSORTED
SEALL = ALL
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE,PLOT ) = 111
$
METHOD = 100
FREQUENCY = 200
SDAMPING = 300
$
SUBCASE 1
DLOAD = 400
OUTPUT (XYPLOT)
```

```
$
$  POINT LOAD
$
RLOAD2, 500, 600, , -45., 310
$
FORCE,600,11,,1.0,,,1.0
$
$  COMBINE LOADS
$
DLOAD, 400, 1., 1., 600, 1.0, 500
$
$  SPECIFY FREQUENCY STEPS
$
FREQ1, 200, 20., 20., 49
$
FREQ4, 200, 20., 1000., .03, 5
$
ENDDATA
```

Step 11. Save and Run the New Input File

Save and run the modified file in Nastran.

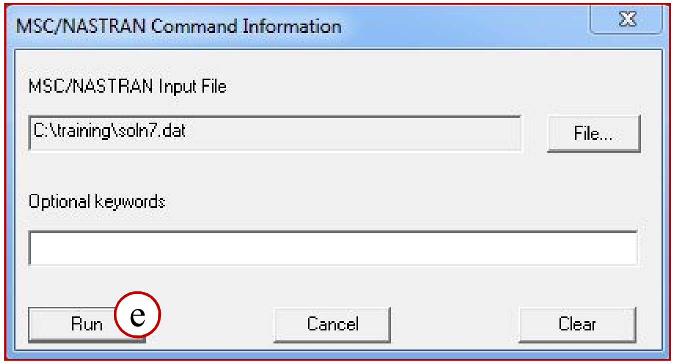
a. Save the modified file as **soln7.dat**.
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln7.dat**.
d. Click **Open**.
e. Click **Run**.



« Local Disk (C:) ▸ training

File name: soln7.dat

Input Files (*.bdf;*.dat)



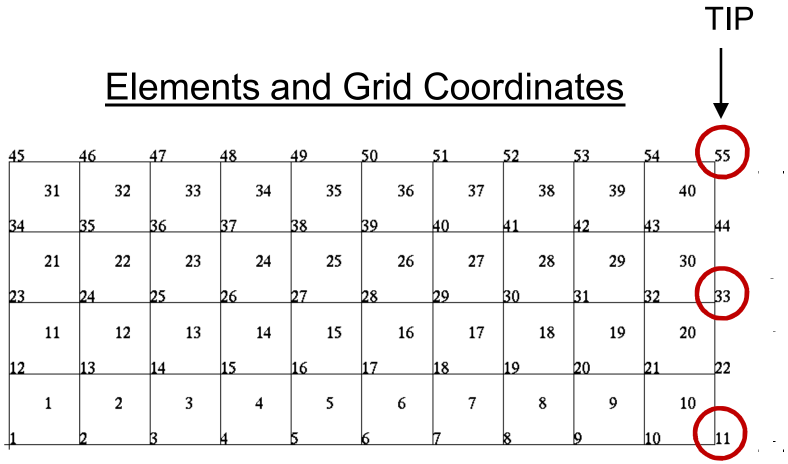
MSC/NASTRAN Input File: C:\training\soln7.dat

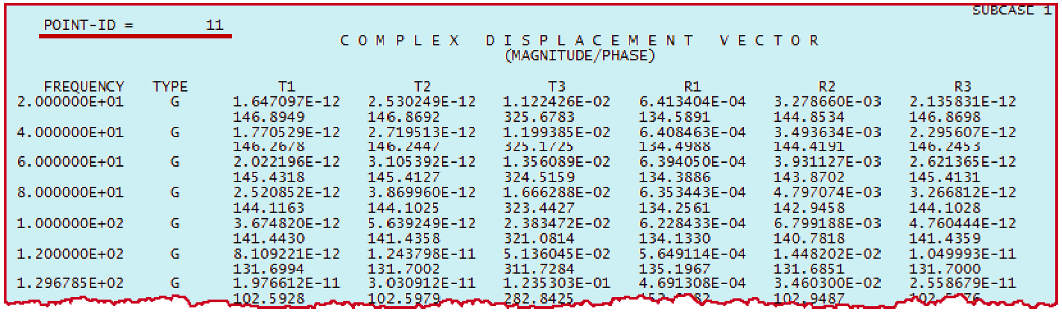
Optional keywords

Step 12. Review the Results in the Solution File

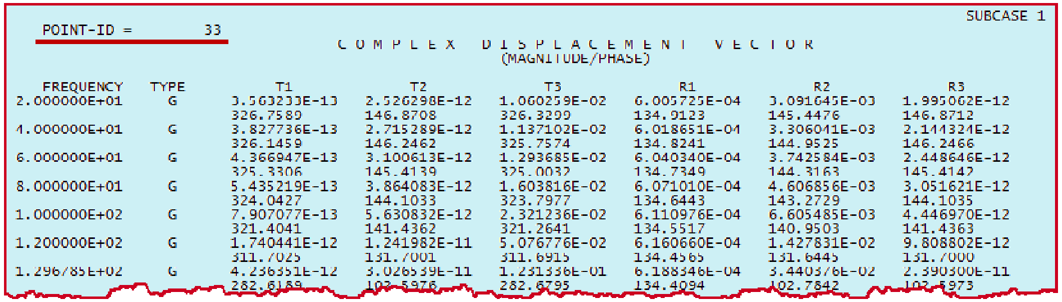
To see the results open the soln7.f06 file. The three grid points of interest lie along the tip of the plate, grid points 11, 33, 55.

Elements and Grid Coordinates

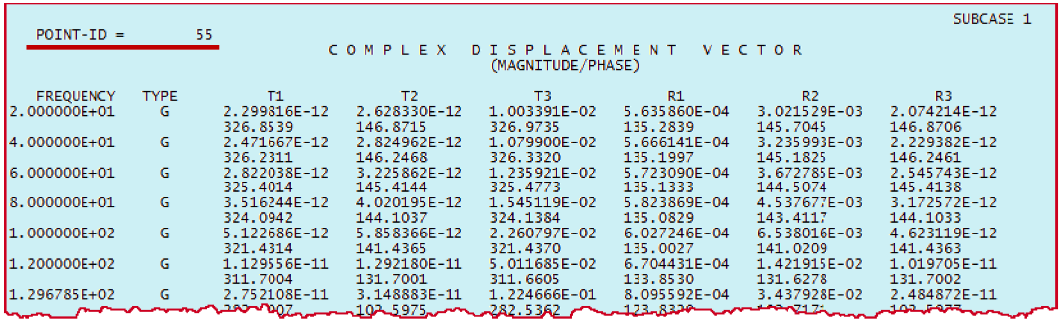




```
                                                                                                  SUBCASE 1
    POINT-ID =         11
                                        C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                            (MAGNITUDE/PHASE)

    FREQUENCY    TYPE          T1             T2             T3             R1             R2             R3
 2.000000E+01     G      1.647097E-12   2.530249E-12   1.122426E-02   6.413404E-04   3.278660E-03   2.135831E-12
                         146.8949       146.8692       325.6783       134.5891       144.8534       146.8698
 4.000000E+01     G      1.770529E-12   2.719513E-12   1.199385E-02   6.408463E-04   3.493634E-03   2.295607E-12
                         146.2678       146.2447       325.1725       134.4988       144.4191       146.2453
 6.000000E+01     G      2.022196E-12   3.105392E-12   1.356089E-02   6.394050E-04   3.931127E-03   2.621365E-12
                         145.4318       145.4127       324.5159       134.3886       143.8702       145.4131
 8.000000E+01     G      2.520852E-12   3.869960E-12   1.666288E-02   6.353443E-04   4.797074E-03   3.266812E-12
                         144.1163       144.1025       323.4427       134.2561       142.9458       144.1028
 1.000000E+02     G      3.674820E-12   5.639249E-12   2.383472E-02   6.228433E-04   6.799188E-03   4.760444E-12
                         141.4430       141.4358       321.0814       134.1330       140.7818       141.4359
 1.200000E+02     G      8.109221E-12   1.243798E-11   5.136045E-02   5.649114E-04   1.448202E-02   1.049993E-11
                         131.6994       131.7002       311.7284       135.1967       131.6851       131.7000
 1.296785E+02     G      1.976612E-11   3.030912E-11   1.235303E-01   4.691308E-04   3.460300E-02   2.558679E-11
                         102.5928       102.5979       282.8425                      102.9487
```



```
                                                                                                  SUBCASE 1
    POINT-ID =         33
                                        C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                            (MAGNITUDE/PHASE)

    FREQUENCY    TYPE          T1             T2             T3             R1             R2             R3
 2.000000E+01     G      3.563233E-13   2.526298E-12   1.060259E-02   6.005725E-04   3.091645E-03   1.995062E-12
                         326.7589       146.8708       326.3299       134.9123       145.4476       146.8712
 4.000000E+01     G      3.827736E-13   2.715289E-12   1.137102E-02   6.018651E-04   3.306041E-03   2.144324E-12
                         326.1459       146.2462       325.7574       134.8241       144.9525       146.2466
 6.000000E+01     G      4.366947E-13   3.100613E-12   1.293685E-02   6.040340E-04   3.742584E-03   2.448646E-12
                         325.3306       145.4139       325.0032       134.7349       144.3163       145.4142
 8.000000E+01     G      5.435219E-13   3.864083E-12   1.603816E-02   6.071010E-04   4.606856E-03   3.051621E-12
                         324.0427       144.1033       323.7977       134.6443       143.2729       144.1035
 1.000000E+02     G      7.907077E-13   5.630832E-12   2.321236E-02   6.110976E-04   6.605485E-03   4.446970E-12
                         321.4041       141.4362       321.2641       134.5517       140.9503       141.4363
 1.200000E+02     G      1.740441E-12   1.241982E-11   5.076776E-02   6.160660E-04   1.427831E-02   9.808802E-12
                         311.7025       131.7001       311.6915       134.4565       131.6445       131.7000
 1.296785E+02     G      4.236351E-12   3.026539E-11   1.231336E-01   6.188346E-04   3.440376E-02   2.390300E-11
                         282.6189       102.5976       282.6795       134.4094       102.7842       102.5973
```

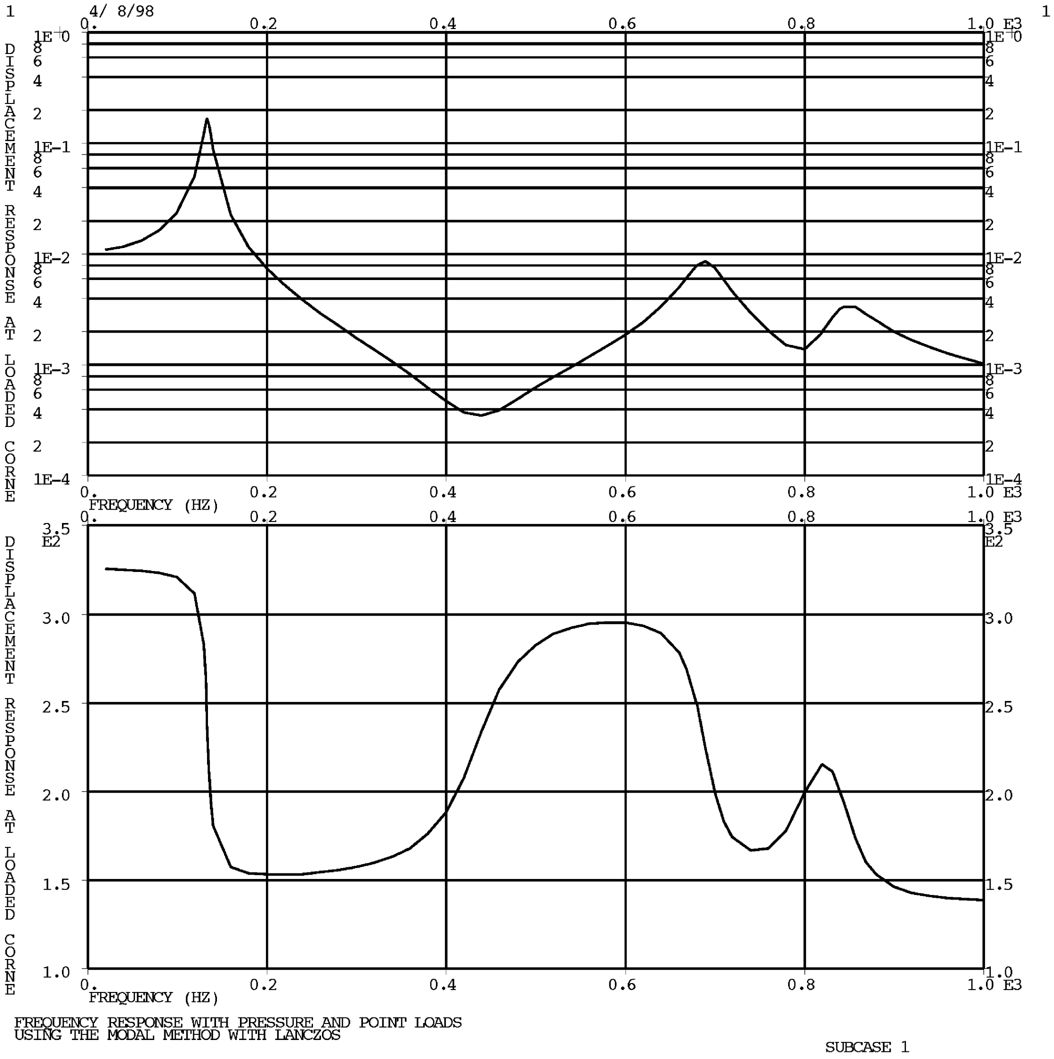


```
                                                                                                  SUBCASE 1
    POINT-ID =         55
                                        C O M P L E X   D I S P L A C E M E N T   V E C T O R
                                                            (MAGNITUDE/PHASE)

    FREQUENCY    TYPE          T1             T2             T3             R1             R2             R3
 2.000000E+01     G      2.299816E-12   2.628330E-12   1.003391E-02   5.635860E-04   3.021529E-03   2.074214E-12
                         326.8539       146.8715       326.9735       135.2839       145.7045       146.8706
 4.000000E+01     G      2.471667E-12   2.824962E-12   1.079900E-02   5.666141E-04   3.235993E-03   2.229382E-12
                         326.2311       146.2468       326.3320       135.1997       145.1825       146.2461
 6.000000E+01     G      2.822038E-12   3.225862E-12   1.235921E-02   5.723090E-04   3.672785E-03   2.545743E-12
                         325.4014       145.4144       325.4773       135.1333       144.5074       145.4138
 8.000000E+01     G      3.516244E-12   4.020195E-12   1.545119E-02   5.823869E-04   4.537677E-03   3.172572E-12
                         324.0942       144.1037       324.1384       135.0829       143.4117       144.1033
 1.000000E+02     G      5.122686E-12   5.858366E-12   2.260797E-02   6.027246E-04   6.538016E-03   4.623119E-12
                         321.4314       141.4365       321.4370       135.0027       141.0209       141.4363
 1.200000E+02     G      1.129556E-11   1.292180E-11   5.011685E-02   6.704431E-04   1.421915E-02   1.019705E-11
                         311.7004       131.7001       311.6605       133.8530       131.6278       131.7002
 1.296785E+02     G      2.752108E-11   3.148883E-11   1.224666E-01   8.095592E-04   3.437928E-02   2.484872E-11
                                        102.5975       282.5362
```

Step 13. Review the Graph Results

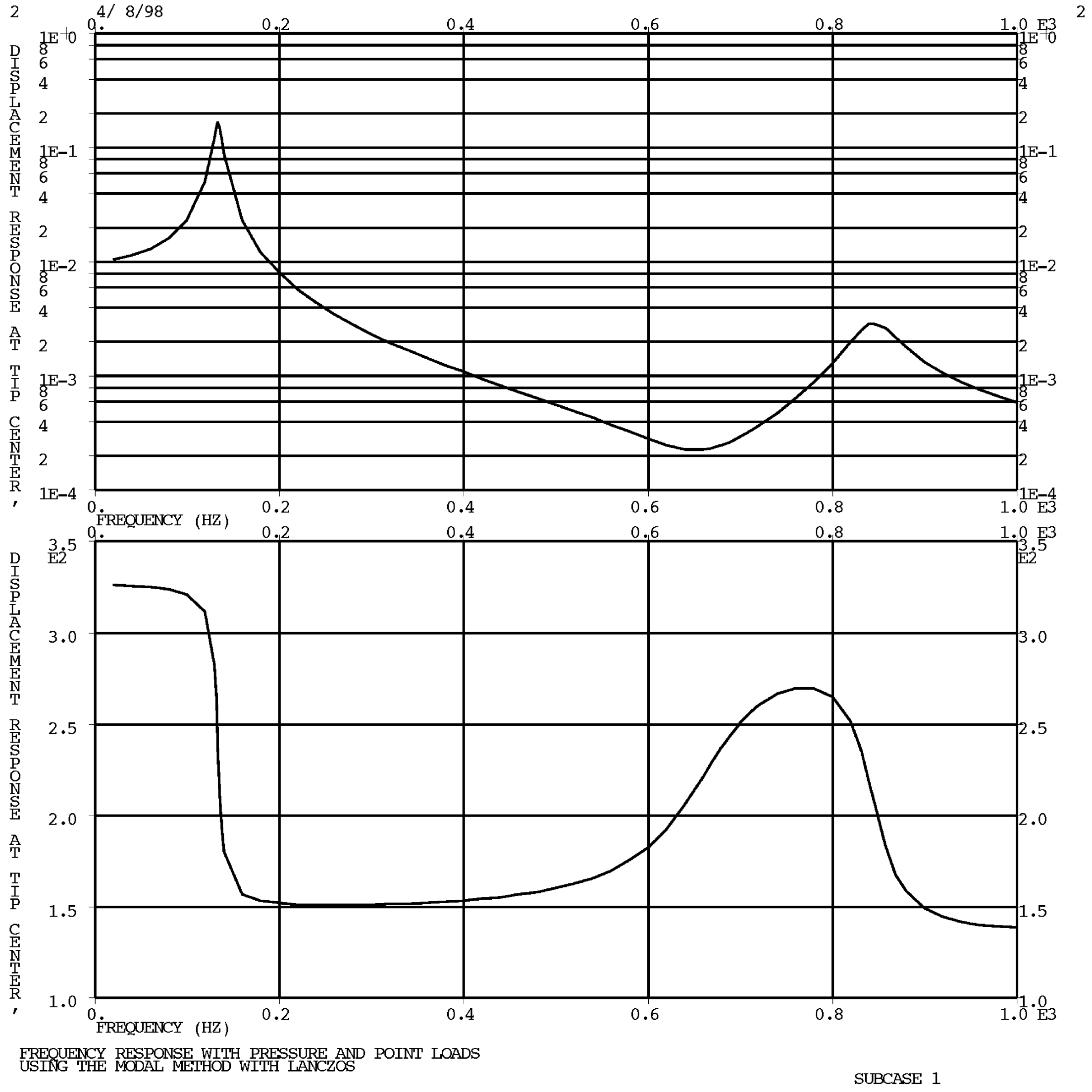
Recall that to obtain the graphs you will need to convert the .plt file to a .ps file, if needed, use the directions given in workshop 4, step 9

Review the displacement response graph at the loaded corner. (grid point 11)



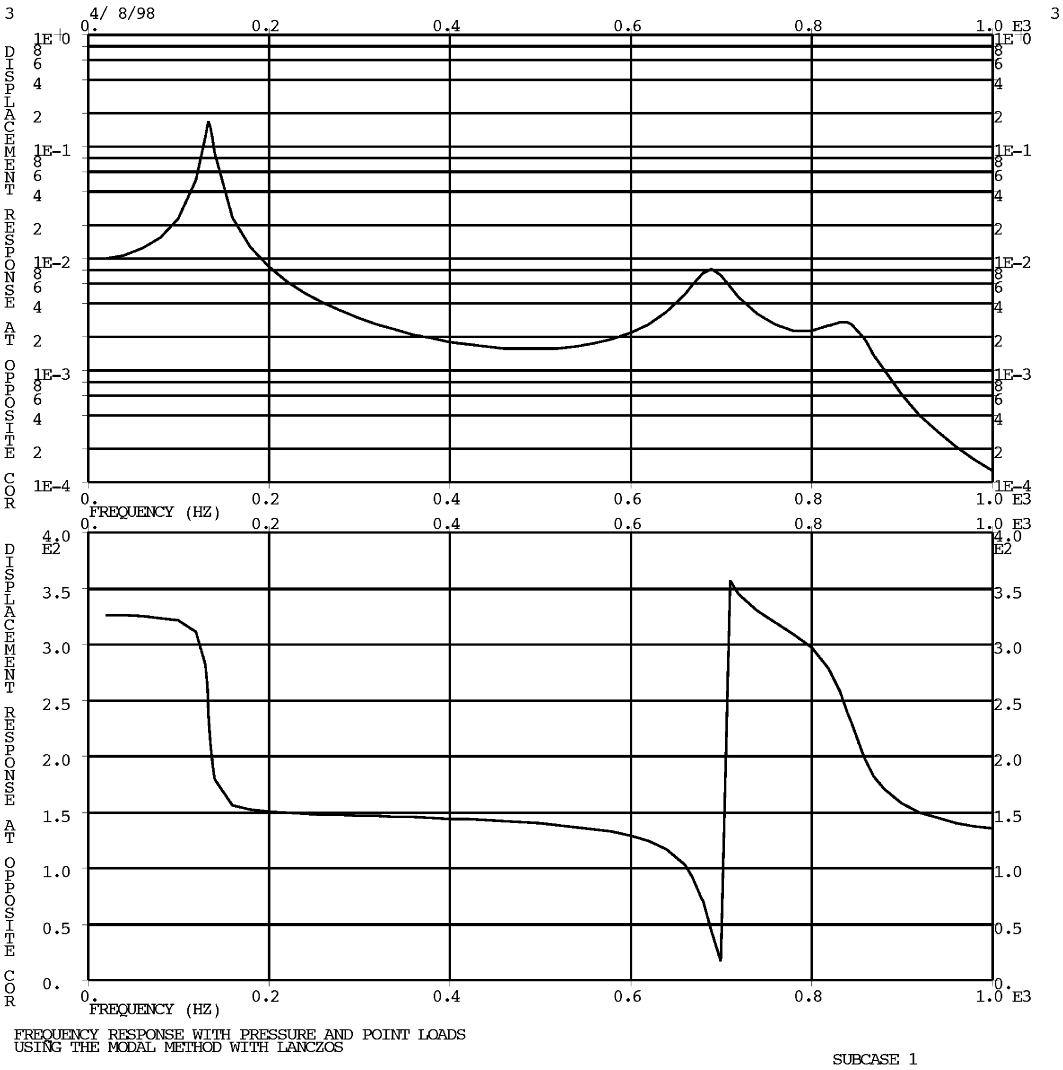
Step 13. Review the Graph Results (Cont.)

Review the displacement response graph at the center of the tip of the plate. (grid 33)



Step 13. Review the Graph Results (Cont.)

Review the displacement response graph at the opposite corner of the point load. (grid point 55)



WORKSHOP 8A
DIRECT TRANSIENT RESPONSE WITH ENFORCED ACCELERATION

- **Workshop Objective**
  - Using the direct method, determine the transient response of the flat plate (from workshop 1) due to the acceleration sine pulse described below.

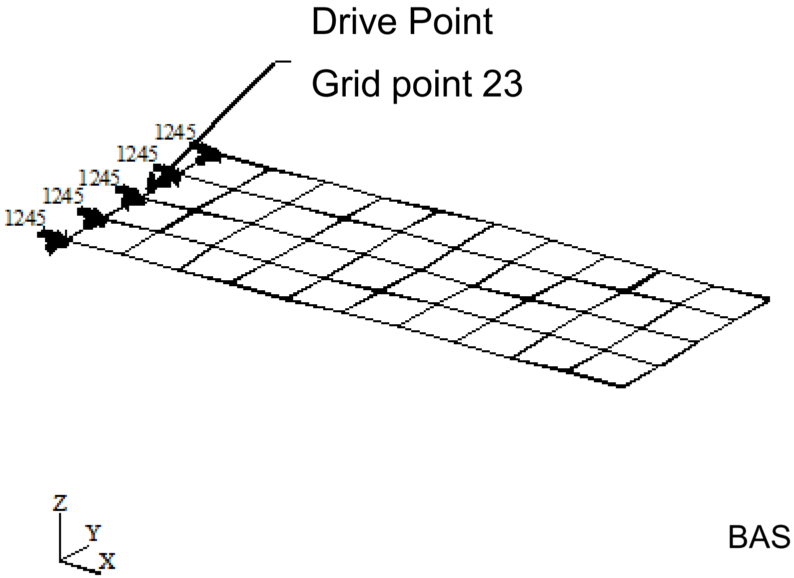
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - Plate.bdf
  - Wkshp8a.dat

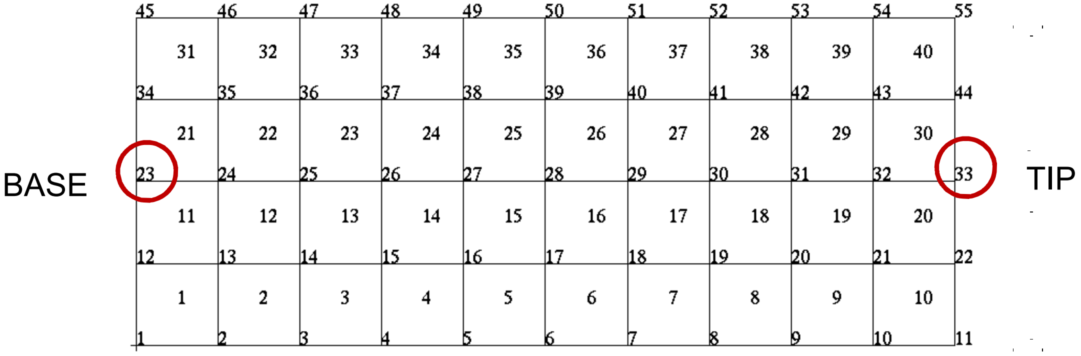
- **Problem Description**
  - The unit acceleration sine pulse of 250 Hz is applied at the base in the z-direction for .004 seconds. Use a structural damping coefficient of g = 0.06 and convert this damping to equivalent viscous damping at 250 Hz.

- **Problem Description Continued:**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition

Load and Boundary Condition



Elements and Grid Coordinates



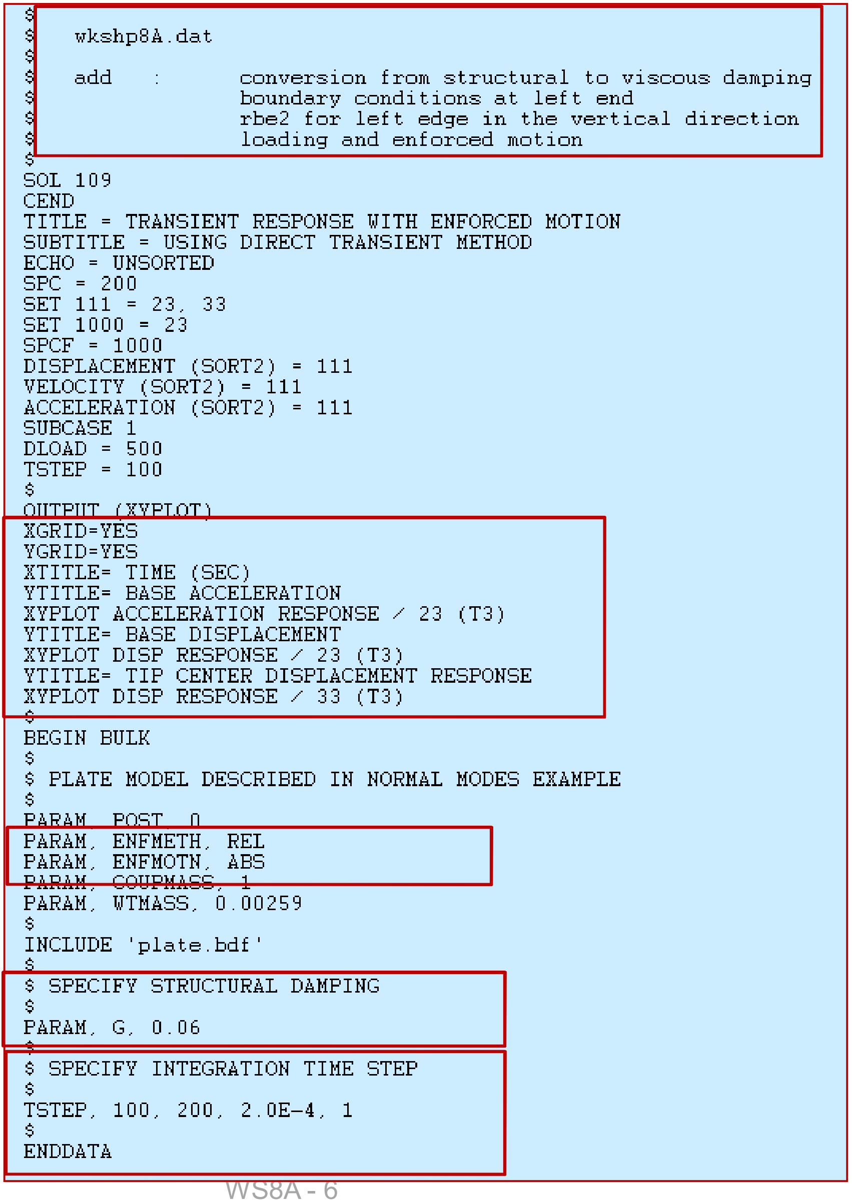
- **Suggested Steps**
  1. Open and review the input file wkshp8A.dat
  2. Add conversion to viscous damping.
  3. Add boundary condition.
  4. Add the sinusoidal acceleration.
  5. Apply enforced motion to the base of plate.
  6. Save and run the new input file in MSC Nastran.
  7. Review the MSC Nastran result using the solution file soln8a.f06.
  8. Review the graph results.

Step 1. Open and Review Input File wkshp8A.dat

The file wkshp8A.dat is the starting input file to be modified.

The following information is already included in the input file.

- Output acceleration graph at grid point 23, and output displacement graphs at points 23 and 33.
- Parameters
  - ENFMETH – sets solution to REL
  - ENFMOTN – sets the output to ABS
- Structural damping
- Integration time step



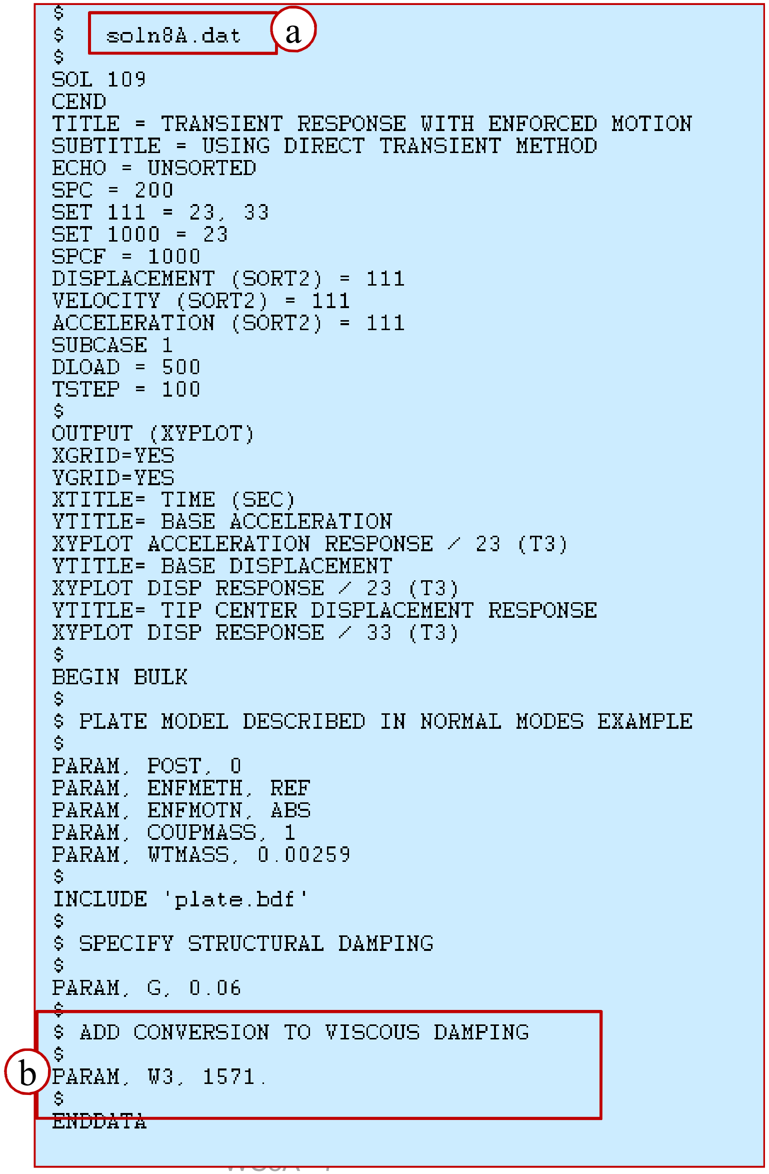
```
$
$   wkshp8A.dat
$
$   add   :      conversion from structural to viscous damping
$                boundary conditions at left end
$                rbe2 for left edge in the vertical direction
$                loading and enforced motion
$
SOL 109
CEND
TITLE = TRANSIENT RESPONSE WITH ENFORCED MOTION
SUBTITLE = USING DIRECT TRANSIENT METHOD
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
SET 1000 = 23
SPCF = 1000
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
SUBCASE 1
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ SPECIFY INTEGRATION TIME STEP
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 2. Add damping Conversion

Add the appropriate parameter in the Bulk Data section for converting to viscous damping.

a. First rename the input file as **soln8A.dat**..

b. Use **PARAM W3**, for the value of this parameter, convert 250 Hz to radians/sec.



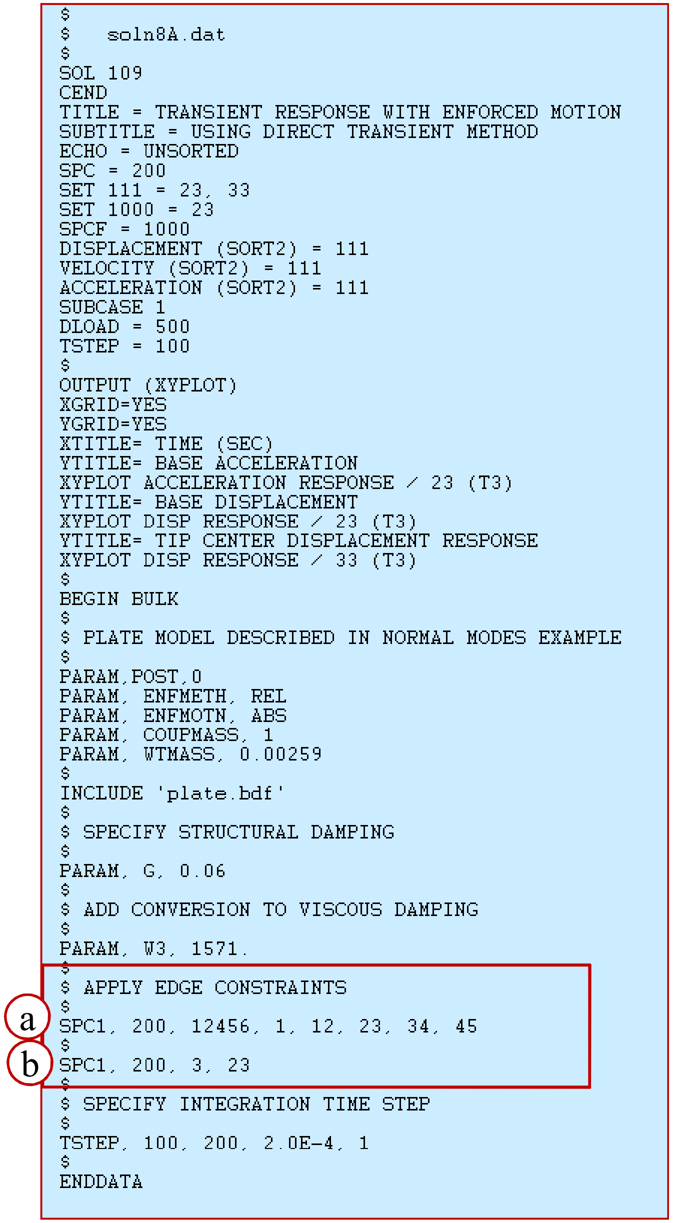
```
$
$  soln8A.dat
$
SOL 109
CEND
TITLE = TRANSIENT RESPONSE WITH ENFORCED MOTION
SUBTITLE = USING DIRECT TRANSIENT METHOD
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
SET 1000 = 23
SPCF = 1000
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
SUBCASE 1
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REF
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
ENDDATA
```

Step 3. Add Boundary Condition

To apply the base constraint:

a. Use **SPC1** to constrain the base of the plate in the X, Y directions and all rotations. Apply constraint at grid points **1, 12, 23, 34, 45**

b. Use **SPC1** to constrain grid point **23** in the Z (**3**) direction.



```
$
$   soln8A.dat
$
SOL 109
CEND
TITLE = TRANSIENT RESPONSE WITH ENFORCED MOTION
SUBTITLE = USING DIRECT TRANSIENT METHOD
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
SET 1000 = 23
SPCF = 1000
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
SUBCASE 1
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM,POST,0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ SPECIFY INTEGRATION TIME STEP
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

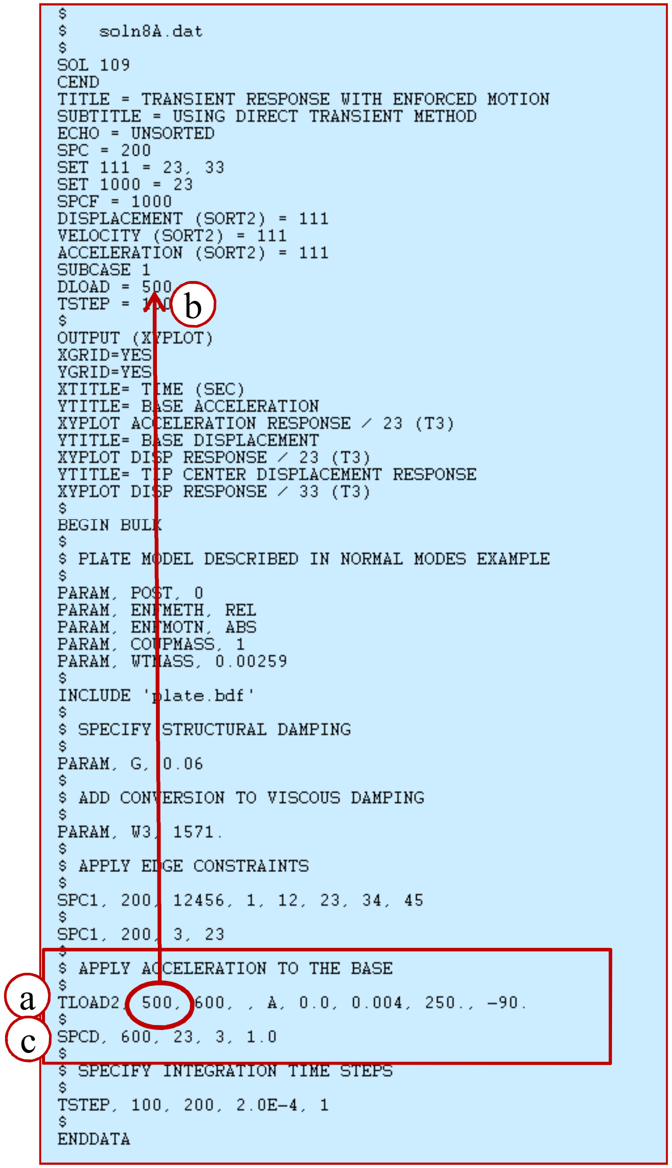
Step 4. Add the Sinusoidal Acceleration

Apply the unit acceleration sine pulse of 250 Hz at the base (grid point 23) of the plate in the z-direction for .004 seconds.

a. Use a **TLOAD2** entry in combination with a **SPCD** entry and the given information obtain:
    - Type = **A,** Enforced acceleration using a large mass.
    - Time = **0 to .004 secs**
    - Frequency = **250 HZ**
    - Phase angle = **-90**

b. Make sure that the **DLOAD** Case Command identification number matches the SID for the **TLOAD2**

c. For the **SPCD**, apply the unit acceleration pulse at grid point **23**, in the Z (**3**) direction.

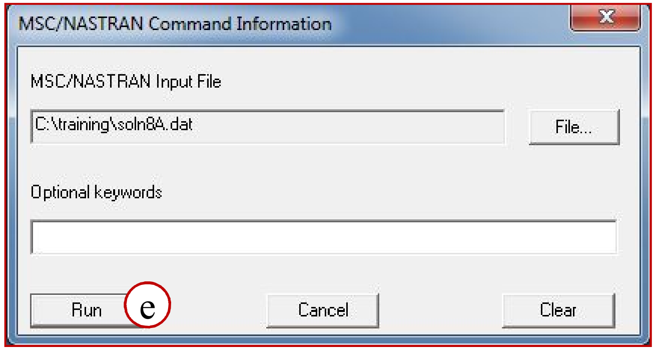


```
$
$   soln8A.dat
$
SOL 109
CEND
TITLE = TRANSIENT RESPONSE WITH ENFORCED MOTION
SUBTITLE = USING DIRECT TRANSIENT METHOD
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
SET 1000 = 23
SPCF = 1000
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
SUBCASE 1
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ APPLY ACCELERATION TO THE BASE
$
TLOAD2, 500, 600, , A, 0.0, 0.004, 250., -90.
$
SPCD, 600, 23, 3, 1.0
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 6. Save and Run the New Input File

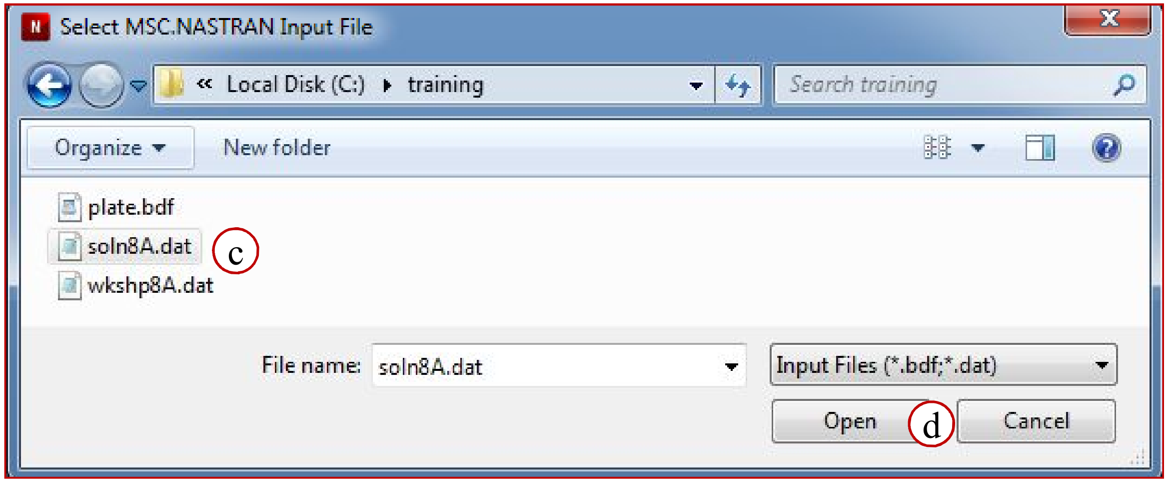
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln8A.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln8A.dat**.
d. Click **Open**.
e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln8A.dat

Optional keywords

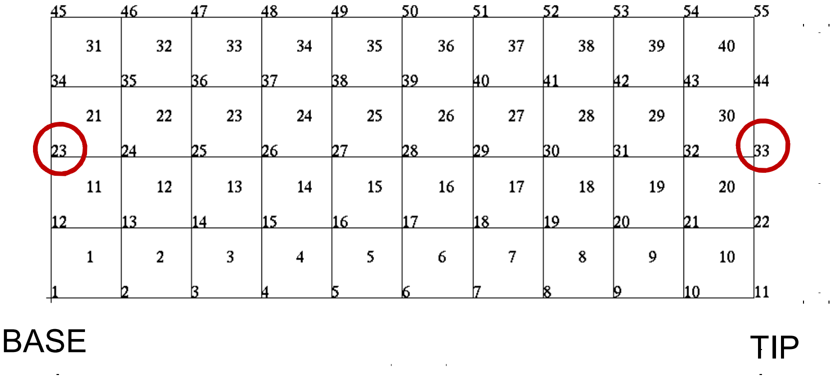


File name: soln8A.dat

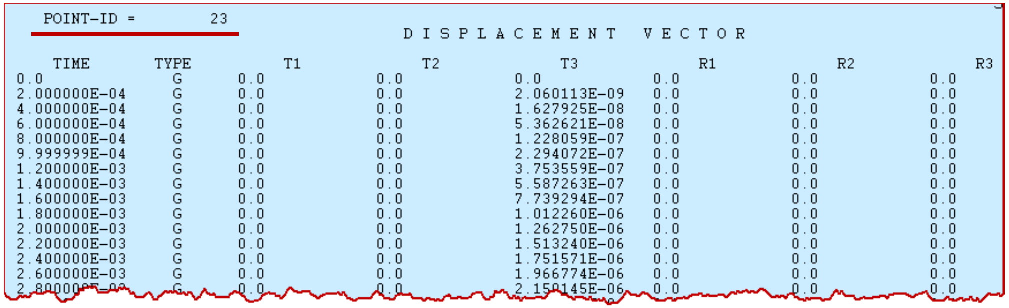
Input Files (*.bdf;*.dat)

Step 7. Review the Results in the Solution File

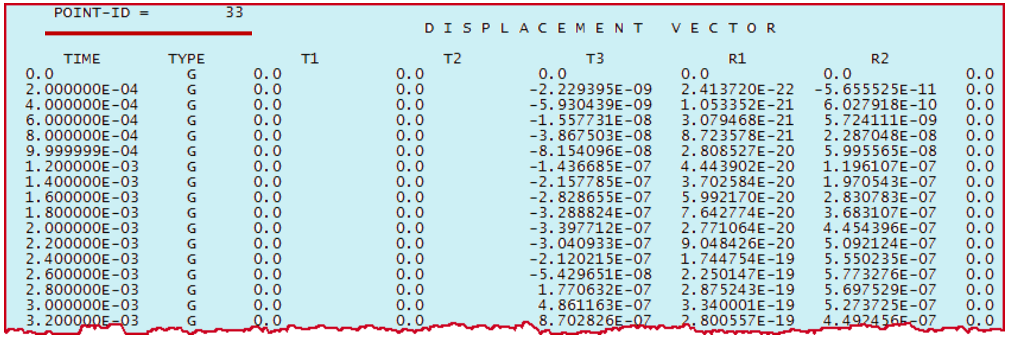
Elements and Grid Coordinates



Displacement



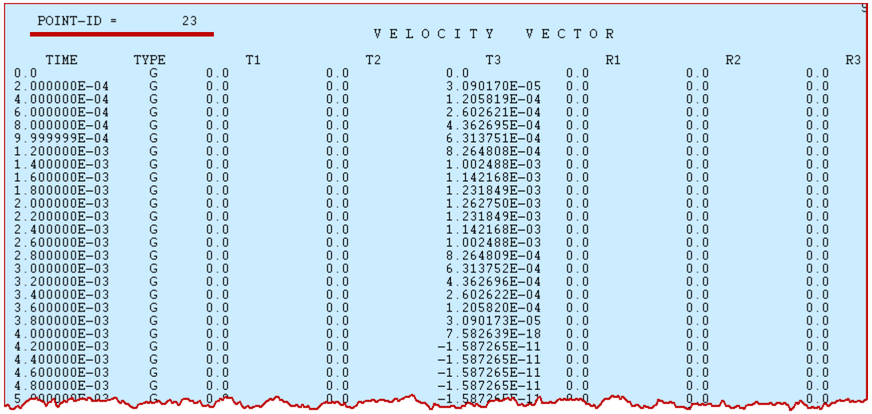
```
   POINT-ID =         23
                                              D I S P L A C E M E N T   V E C T O R

     TIME         TYPE          T1              T2              T3              R1              R2              R3
0.0                G       0.0             0.0             0.0             0.0             0.0             0.0
2.000000E-04       G       0.0             0.0             2.060113E-09    0.0             0.0             0.0
4.000000E-04       G       0.0             0.0             1.627925E-08    0.0             0.0             0.0
6.000000E-04       G       0.0             0.0             5.362621E-08    0.0             0.0             0.0
8.000000E-04       G       0.0             0.0             1.228059E-07    0.0             0.0             0.0
9.999999E-04       G       0.0             0.0             2.294072E-07    0.0             0.0             0.0
1.200000E-03       G       0.0             0.0             3.753559E-07    0.0             0.0             0.0
1.400000E-03       G       0.0             0.0             5.587263E-07    0.0             0.0             0.0
1.600000E-03       G       0.0             0.0             7.739294E-07    0.0             0.0             0.0
1.800000E-03       G       0.0             0.0             1.012260E-06    0.0             0.0             0.0
2.000000E-03       G       0.0             0.0             1.262750E-06    0.0             0.0             0.0
2.200000E-03       G       0.0             0.0             1.513240E-06    0.0             0.0             0.0
2.400000E-03       G       0.0             0.0             1.751571E-06    0.0             0.0             0.0
2.600000E-03       G       0.0             0.0             1.966774E-06    0.0             0.0             0.0
2.800000E-03       G       0.0             0.0             2.150145E-06    0.0             0.0             0.0
```



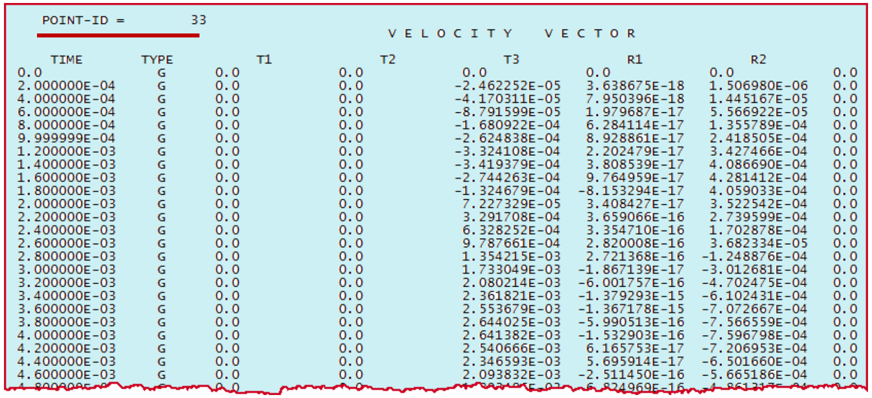
```
    POINT-ID =         33
                                              D I S P L A C E M E N T   V E C T O R

      TIME          TYPE           T1              T2              T3              R1              R2
 0.0                 G       0.0             0.0              0.0             0.0             0.0             0.0
 2.000000E-04        G       0.0             0.0            -2.229395E-09    2.413720E-22   -5.655525E-11    0.0
 4.000000E-04        G       0.0             0.0            -5.930439E-09    1.053352E-21    6.027918E-10    0.0
 6.000000E-04        G       0.0             0.0            -1.557731E-08    3.079468E-21    5.724111E-09    0.0
 8.000000E-04        G       0.0             0.0            -3.867503E-08    8.723578E-21    2.287048E-08    0.0
 9.999999E-04        G       0.0             0.0            -8.154096E-08    2.808527E-20    5.995565E-08    0.0
 1.200000E-03        G       0.0             0.0            -1.436685E-07    4.443902E-20    1.196107E-07    0.0
 1.400000E-03        G       0.0             0.0            -2.157785E-07    3.702584E-20    1.970543E-07    0.0
 1.600000E-03        G       0.0             0.0            -2.828655E-07    5.992170E-20    2.830783E-07    0.0
 1.800000E-03        G       0.0             0.0            -3.288824E-07    7.642774E-20    3.683107E-07    0.0
 2.000000E-03        G       0.0             0.0            -3.397712E-07    2.771064E-20    4.454396E-07    0.0
 2.200000E-03        G       0.0             0.0            -3.040933E-07    9.048426E-20    5.092124E-07    0.0
 2.400000E-03        G       0.0             0.0            -2.120215E-07    1.744754E-19    5.550235E-07    0.0
 2.600000E-03        G       0.0             0.0            -5.429651E-08    2.250147E-19    5.773276E-07    0.0
 2.800000E-03        G       0.0             0.0             1.770632E-07    2.875243E-19    5.697529E-07    0.0
 3.000000E-03        G       0.0             0.0             4.861163E-07    3.340001E-19    5.273725E-07    0.0
 3.200000E-03        G       0.0             0.0             8.702826E-07    2.800557E-19    4.492456E-07    0.0
```

Step 7. Review the Results in the Solution File (Cont.)

Velocity

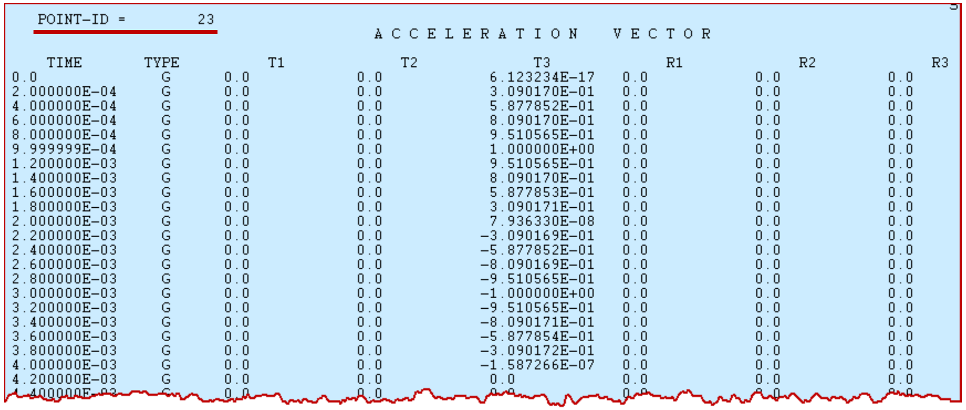


```
   POINT-ID =         23
                                  V E L O C I T Y   V E C T O R

    TIME        TYPE          T1             T2             T3             R1             R2             R3
0.0              G      0.0            0.0            0.0            0.0            0.0            0.0
2.000000E-04     G      0.0            0.0            3.090170E-05   0.0            0.0            0.0
4.000000E-04     G      0.0            0.0            1.205819E-04   0.0            0.0            0.0
6.000000E-04     G      0.0            0.0            2.602621E-04   0.0            0.0            0.0
8.000000E-04     G      0.0            0.0            4.362695E-04   0.0            0.0            0.0
9.999999E-04     G      0.0            0.0            6.313751E-04   0.0            0.0            0.0
1.200000E-03     G      0.0            0.0            8.264808E-04   0.0            0.0            0.0
1.400000E-03     G      0.0            0.0            1.002488E-03   0.0            0.0            0.0
1.600000E-03     G      0.0            0.0            1.142168E-03   0.0            0.0            0.0
1.800000E-03     G      0.0            0.0            1.231849E-03   0.0            0.0            0.0
2.000000E-03     G      0.0            0.0            1.262750E-03   0.0            0.0            0.0
2.200000E-03     G      0.0            0.0            1.231849E-03   0.0            0.0            0.0
2.400000E-03     G      0.0            0.0            1.142168E-03   0.0            0.0            0.0
2.600000E-03     G      0.0            0.0            1.002488E-03   0.0            0.0            0.0
2.800000E-03     G      0.0            0.0            8.264809E-04   0.0            0.0            0.0
3.000000E-03     G      0.0            0.0            6.313752E-04   0.0            0.0            0.0
3.200000E-03     G      0.0            0.0            4.362696E-04   0.0            0.0            0.0
3.400000E-03     G      0.0            0.0            2.602622E-04   0.0            0.0            0.0
3.600000E-03     G      0.0            0.0            1.205820E-04   0.0            0.0            0.0
3.800000E-03     G      0.0            0.0            3.090173E-05   0.0            0.0            0.0
4.000000E-03     G      0.0            0.0            7.582639E-18   0.0            0.0            0.0
4.200000E-03     G      0.0            0.0           -1.587265E-11   0.0            0.0            0.0
4.400000E-03     G      0.0            0.0           -1.587265E-11   0.0            0.0            0.0
4.600000E-03     G      0.0            0.0           -1.587265E-11   0.0            0.0            0.0
4.800000E-03     G      0.0            0.0           -1.587265E-11   0.0            0.0            0.0
```

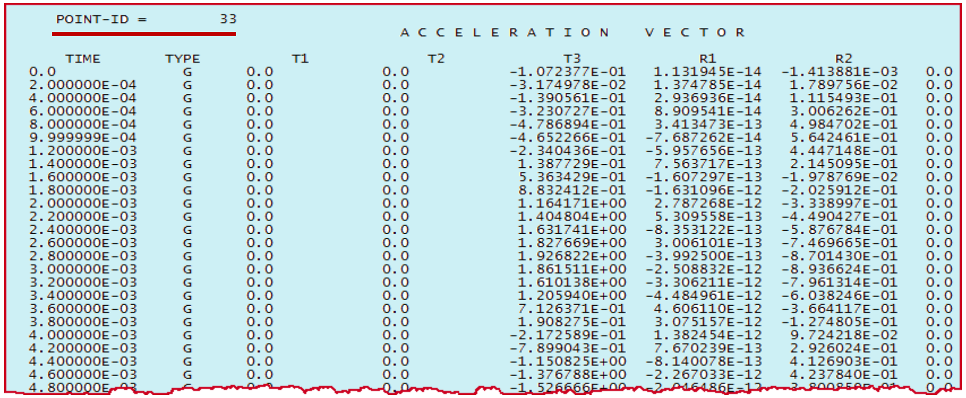


```
   POINT-ID =         33
                                  V E L O C I T Y   V E C T O R

    TIME        TYPE          T1             T2             T3             R1             R2
0.0              G      0.0            0.0            0.0            0.0            0.0            0.0
2.000000E-04     G      0.0            0.0           -2.462252E-05   3.638675E-18   1.506980E-06   0.0
4.000000E-04     G      0.0            0.0           -4.170311E-05   7.950396E-18   1.445167E-05   0.0
6.000000E-04     G      0.0            0.0           -8.791599E-05   1.979687E-17   5.566922E-05   0.0
8.000000E-04     G      0.0            0.0           -1.680922E-04   6.284114E-17   1.355789E-04   0.0
9.999999E-04     G      0.0            0.0           -2.624838E-04   8.928861E-17   2.418505E-04   0.0
1.200000E-03     G      0.0            0.0           -3.324108E-04   2.202479E-17   3.427466E-04   0.0
1.400000E-03     G      0.0            0.0           -3.419379E-04   3.808539E-17   4.086690E-04   0.0
1.600000E-03     G      0.0            0.0           -2.744263E-04   9.764959E-17   4.281412E-04   0.0
1.800000E-03     G      0.0            0.0           -1.324679E-04  -8.153294E-17   4.059033E-04   0.0
2.000000E-03     G      0.0            0.0            7.227329E-05   3.408427E-17   3.522542E-04   0.0
2.200000E-03     G      0.0            0.0            3.291708E-04   3.659066E-16   2.739599E-04   0.0
2.400000E-03     G      0.0            0.0            6.328252E-04   3.354710E-16   1.702878E-04   0.0
2.600000E-03     G      0.0            0.0            9.787661E-04   2.820008E-16   3.682334E-05   0.0
2.800000E-03     G      0.0            0.0            1.354215E-03   2.721368E-16  -1.248876E-04   0.0
3.000000E-03     G      0.0            0.0            1.733049E-03  -1.867139E-17  -3.012681E-04   0.0
3.200000E-03     G      0.0            0.0            2.080214E-03  -6.001757E-16  -4.702475E-04   0.0
3.400000E-03     G      0.0            0.0            2.361821E-03  -1.379293E-15  -6.102431E-04   0.0
3.600000E-03     G      0.0            0.0            2.553679E-03  -1.367178E-15  -7.072667E-04   0.0
3.800000E-03     G      0.0            0.0            2.644025E-03  -5.990513E-16  -7.566559E-04   0.0
4.000000E-03     G      0.0            0.0            2.641382E-03  -1.532903E-16  -7.596798E-04   0.0
4.200000E-03     G      0.0            0.0            2.540666E-03   6.165753E-17  -7.206953E-04   0.0
4.400000E-03     G      0.0            0.0            2.346593E-03   5.695914E-17  -6.501660E-04   0.0
4.600000E-03     G      0.0            0.0            2.093832E-03  -2.511450E-16  -5.665186E-04   0.0
```

Acceleration



```
   POINT-ID =         23
                                  A C C E L E R A T I O N   V E C T O R

    TIME        TYPE          T1             T2             T3             R1             R2             R3
0.0              G      0.0            0.0            6.123234E-17   0.0            0.0            0.0
2.000000E-04     G      0.0            0.0            3.090170E-01   0.0            0.0            0.0
4.000000E-04     G      0.0            0.0            5.877852E-01   0.0            0.0            0.0
6.000000E-04     G      0.0            0.0            8.090170E-01   0.0            0.0            0.0
8.000000E-04     G      0.0            0.0            9.510565E-01   0.0            0.0            0.0
9.999999E-04     G      0.0            0.0            1.000000E+00   0.0            0.0            0.0
1.200000E-03     G      0.0            0.0            9.510565E-01   0.0            0.0            0.0
1.400000E-03     G      0.0            0.0            8.090170E-01   0.0            0.0            0.0
1.600000E-03     G      0.0            0.0            5.877853E-01   0.0            0.0            0.0
1.800000E-03     G      0.0            0.0            3.090171E-01   0.0            0.0            0.0
2.000000E-03     G      0.0            0.0            7.936330E-08   0.0            0.0            0.0
2.200000E-03     G      0.0            0.0           -3.090169E-01   0.0            0.0            0.0
2.400000E-03     G      0.0            0.0           -5.877852E-01   0.0            0.0            0.0
2.600000E-03     G      0.0            0.0           -8.090169E-01   0.0            0.0            0.0
2.800000E-03     G      0.0            0.0           -9.510565E-01   0.0            0.0            0.0
3.000000E-03     G      0.0            0.0           -1.000000E+00   0.0            0.0            0.0
3.200000E-03     G      0.0            0.0           -9.510565E-01   0.0            0.0            0.0
3.400000E-03     G      0.0            0.0           -8.090171E-01   0.0            0.0            0.0
3.600000E-03     G      0.0            0.0           -5.877854E-01   0.0            0.0            0.0
3.800000E-03     G      0.0            0.0           -3.090172E-01   0.0            0.0            0.0
4.000000E-03     G      0.0            0.0           -1.587266E-07   0.0            0.0            0.0
4.200000E-03     G      0.0            0.0            0.0            0.0            0.0            0.0
```

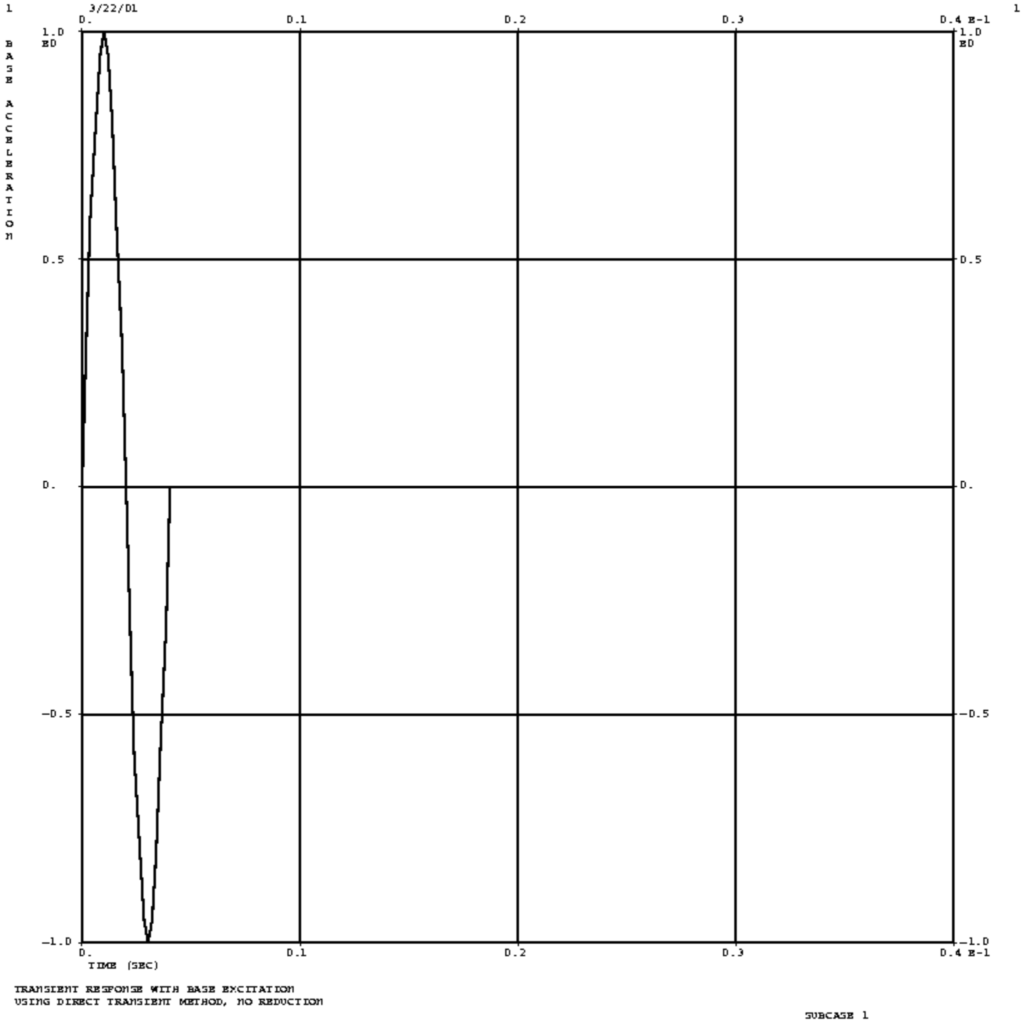


```
   POINT-ID =         33
                                  A C C E L E R A T I O N   V E C T O R

    TIME        TYPE          T1             T2             T3             R1             R2
0.0              G      0.0            0.0           -1.072377E-01   1.131945E-14  -1.413881E-03   0.0
2.000000E-04     G      0.0            0.0           -3.174978E-02   1.374785E-14   1.789756E-02   0.0
4.000000E-04     G      0.0            0.0           -1.390561E-01   2.936936E-14   1.115493E-01   0.0
6.000000E-04     G      0.0            0.0           -3.230727E-01   8.909541E-14   3.006262E-01   0.0
8.000000E-04     G      0.0            0.0           -4.786894E-01   3.413473E-13   4.984702E-01   0.0
9.999999E-04     G      0.0            0.0           -4.652266E-01  -7.687262E-14   5.642461E-01   0.0
1.200000E-03     G      0.0            0.0           -2.340436E-01  -5.957656E-13   4.447148E-01   0.0
1.400000E-03     G      0.0            0.0            1.387729E-01   7.563717E-13   2.145095E-01   0.0
1.600000E-03     G      0.0            0.0            5.363429E-01  -1.607297E-13  -1.978769E-02   0.0
1.800000E-03     G      0.0            0.0            8.832412E-01  -1.631096E-12  -2.025912E-01   0.0
2.000000E-03     G      0.0            0.0            1.164171E+00   2.787268E-12  -3.338997E-01   0.0
2.200000E-03     G      0.0            0.0            1.404804E+00   5.309558E-13  -4.490427E-01   0.0
2.400000E-03     G      0.0            0.0            1.631741E+00  -8.353122E-13  -5.876784E-01   0.0
2.600000E-03     G      0.0            0.0            1.827669E+00   3.006101E-13  -7.469665E-01   0.0
2.800000E-03     G      0.0            0.0            1.926822E+00  -3.992500E-13  -8.701430E-01   0.0
3.000000E-03     G      0.0            0.0            1.861511E+00  -2.508832E-12  -8.936624E-01   0.0
3.200000E-03     G      0.0            0.0            1.610138E+00  -3.306211E-12  -7.961314E-01   0.0
3.400000E-03     G      0.0            0.0            1.205940E+00  -4.484961E-12  -6.038246E-01   0.0
3.600000E-03     G      0.0            0.0            7.126371E-01   4.606110E-12  -3.664117E-01   0.0
3.800000E-03     G      0.0            0.0            1.908275E-01   3.075157E-12  -1.274805E-01   0.0
4.000000E-03     G      0.0            0.0           -2.172589E-01   1.382454E-12   9.724218E-02   0.0
4.200000E-03     G      0.0            0.0           -7.899043E-01   7.670239E-13   2.926024E-01   0.0
4.400000E-03     G      0.0            0.0           -1.150825E+00  -8.140078E-13   4.126903E-01   0.0
4.600000E-03     G      0.0            0.0           -1.376788E+00  -2.267033E-12   4.237840E-01   0.0
```

Step 8. Review the Graph Results

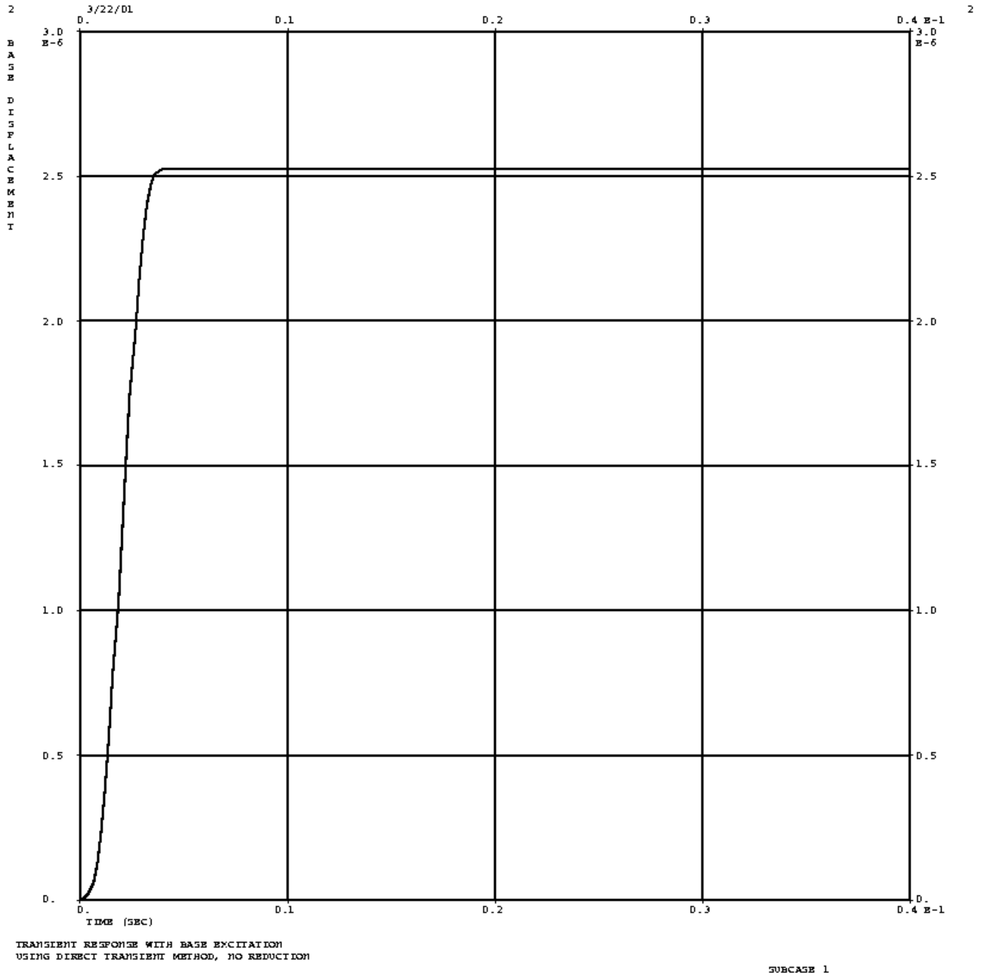
Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions in workshop 4, step 9.

Base acceleration at Grid Point 23



Step 8. Review the Graph Results (Cont.)

Base displacement at Grid Point 23

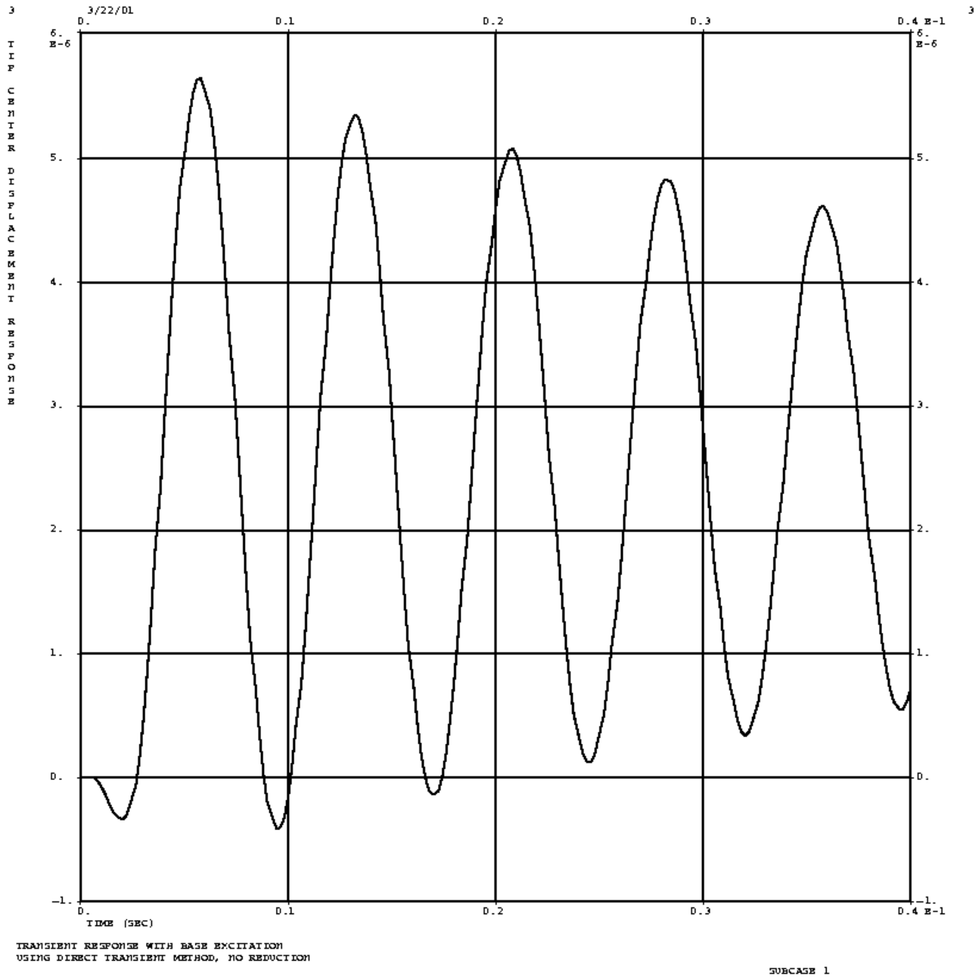


TRANSIENT RESPONSE WITH BASE EXCITATION
USING DIRECT TRANSIENT METHOD, NO REDUCTION

SUBCASE 1

Step 8. Review the Graph Results (Cont.)

Tip displacement at Grid Point 33



WORKSHOP 8B
MODAL TRANSIENT RESPONSE WITH ENFORCED ACCELERATION

- **Workshop Objective**
  - Using the modal method, determine the transient response of the flat plate (from workshop 1) due to the acceleration sine pulse described below.

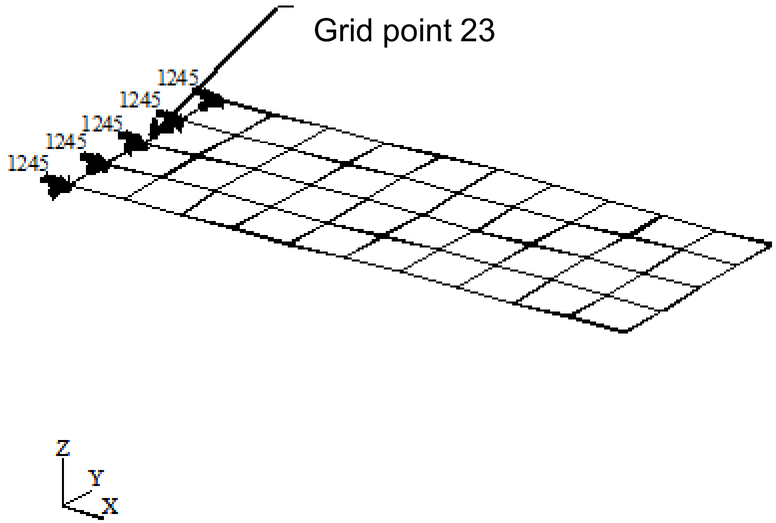
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - Plate.bdf
  - Wkshp8b.dat

- **Problem Description**
  - The unit acceleration sine pulse of 250 Hz is applied at the base in the z-direction for .004 seconds. Use a structural damping coefficient of g = 0.06 and convert this damping to equivalent viscous damping at 250 Hz. Be sure to include residual vectors.

- **Problem Description Continued:**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

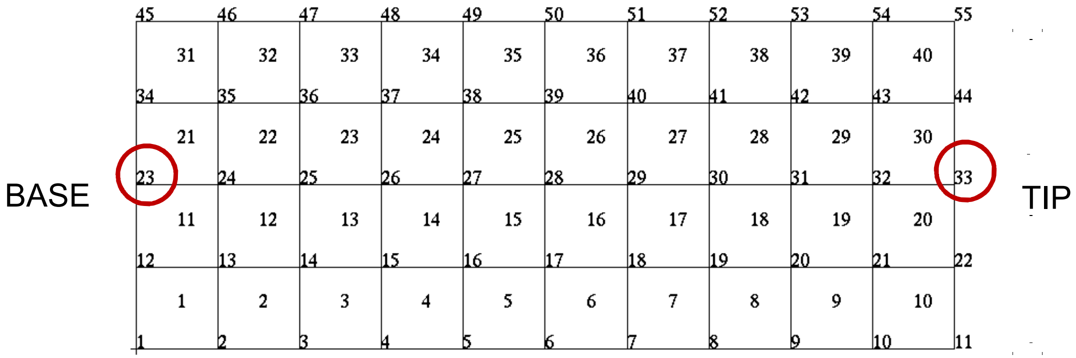
Load and Boundary Condition



Drive Point

Grid point 23

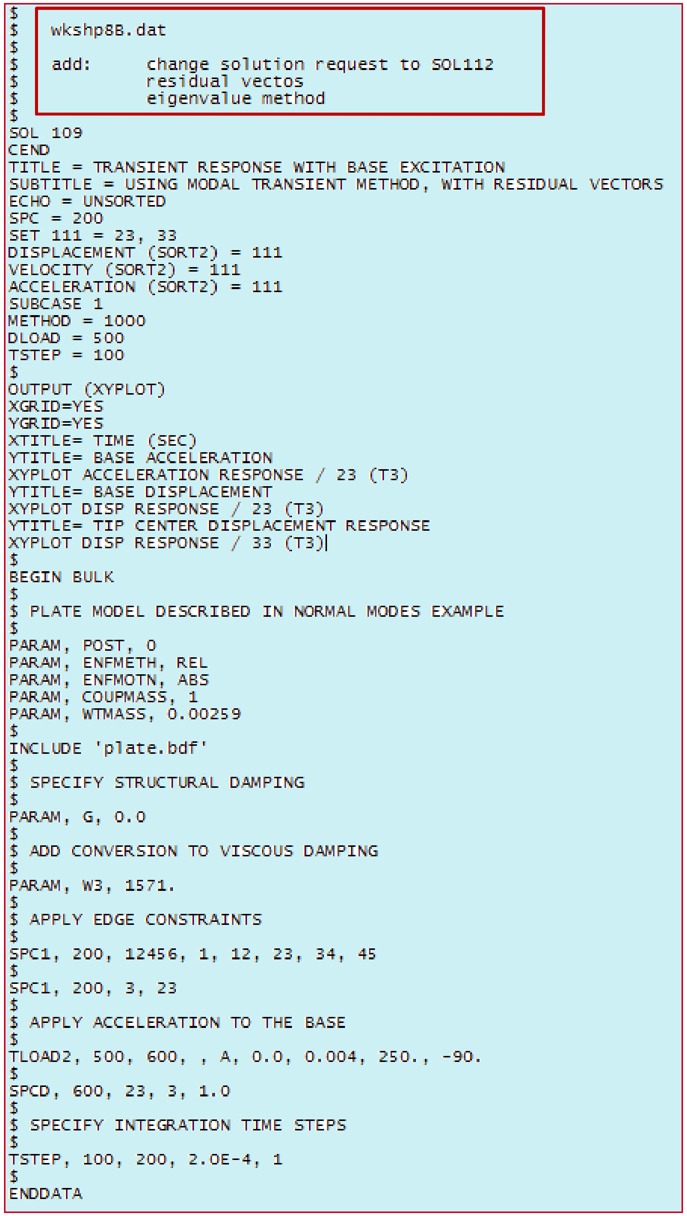
Elements and Grid Coordinates



- **Suggested Steps**
  1. Open and review the input file wkshp8B.dat
  2. Change the solution to modal transient response, SOL 112.
  3. Add option to include residual vectors.
  4. Add eigenvalue method.
  5. Save and run the new input file in MSC Nastran.
  6. Review the MSC Nastran result using the solution file soln8b.f06.
  7. Review the graph results.

Step 1. Open and Review Input File wkshp8B.dat

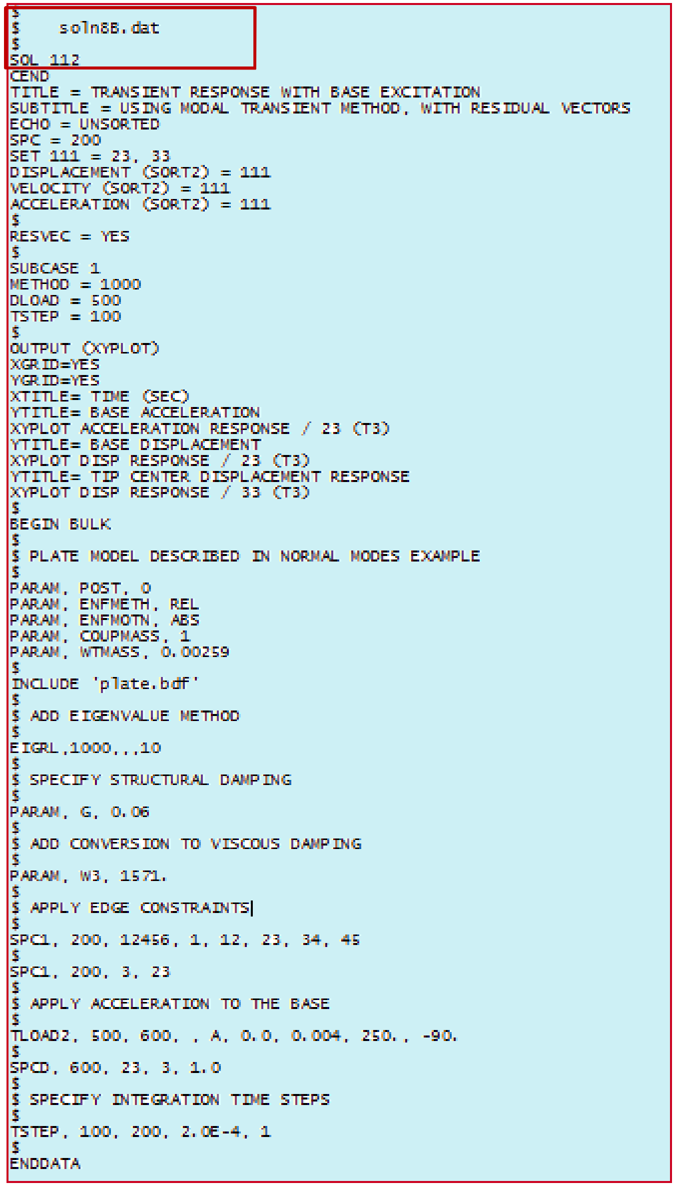
The file wkshp8b.dat is the starting input file. This is the final input file from workshop 8a. All that is necessary is to change from a direct method to a modal one and to add a case control command for the residual vector option.



```
$
$   wkshp8B.dat
$
$   add:     change solution request to SOL112
$            residual vectos
$            eigenvalue method
$
SOL 109
CEND
TITLE = TRANSIENT RESPONSE WITH BASE EXCITATION
SUBTITLE = USING MODAL TRANSIENT METHOD, WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
SUBCASE 1
METHOD = 1000
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.0
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ APPLY ACCELERATION TO THE BASE
$
TLOAD2, 500, 600, , A, 0.0, 0.004, 250., -90.
$
SPCD, 600, 23, 3, 1.0
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 2. Change Solution Request

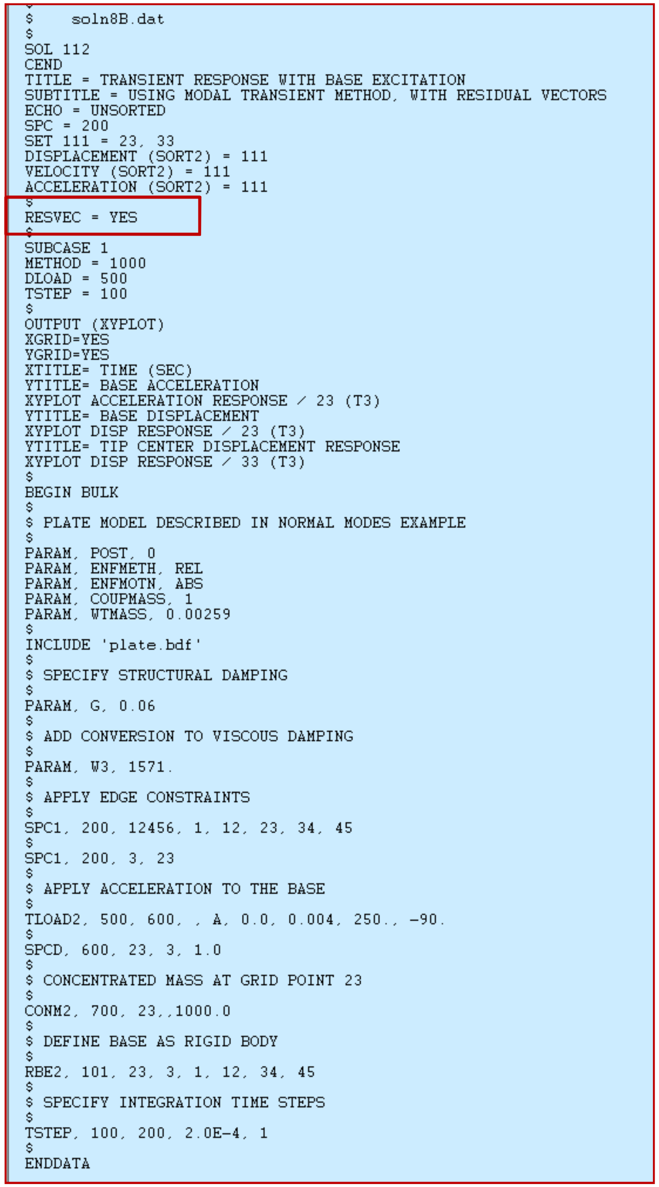
First change the file name to **soln8B.dat**. The solution request for a modal transient response is SOL 112, so change the SOL 109 to **SOL112**.



```
$
$    soln8B.dat
$
SOL 112
CEND
TITLE = TRANSIENT RESPONSE WITH BASE EXCITATION
SUBTITLE = USING MODAL TRANSIENT METHOD, WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
$
RESVEC = YES
$
SUBCASE 1
METHOD = 1000
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ ADD EIGENVALUE METHOD
$
EIGRL,1000,,,10
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ APPLY ACCELERATION TO THE BASE
$
TLOAD2, 500, 600, , A, 0.0, 0.004, 250., , -90.
$
SPCD, 600, 23, 3, 1.0
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 3. Add Option for Residual Vectors

Use the Case Control command **RESVEC** to specify the option for residual vectors.



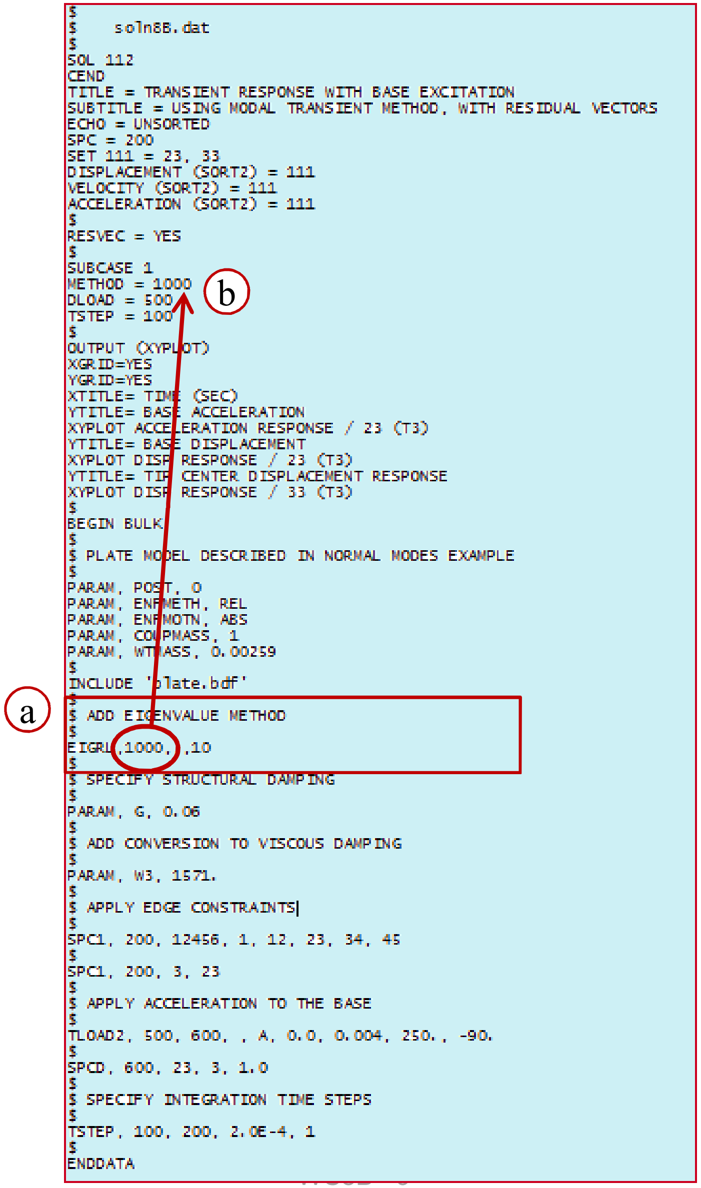
```
$    soln8B.dat
$
SOL 112
CEND
TITLE = TRANSIENT RESPONSE WITH BASE EXCITATION
SUBTITLE = USING MODAL TRANSIENT METHOD, WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
$
RESVEC = YES
$
SUBCASE 1
METHOD = 1000
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ APPLY ACCELERATION TO THE BASE
$
TLOAD2, 500, 600, , A, 0.0, 0.004, 250., -90.
$
SPCD, 600, 23, 3, 1.0
$
$ CONCENTRATED MASS AT GRID POINT 23
$
CONM2, 700, 23,,1000.0
$
$ DEFINE BASE AS RIGID BODY
$
RBE2, 101, 23, 3, 1, 12, 34, 45
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 4. Add the Eigenvalue Method

To add the eigenvalue Method:

a. Use the **EIGRL** entry specifying **10** roots.

b. Make sure that the **METHOD** Case Control command identification number matches the **EIGRL** SID.

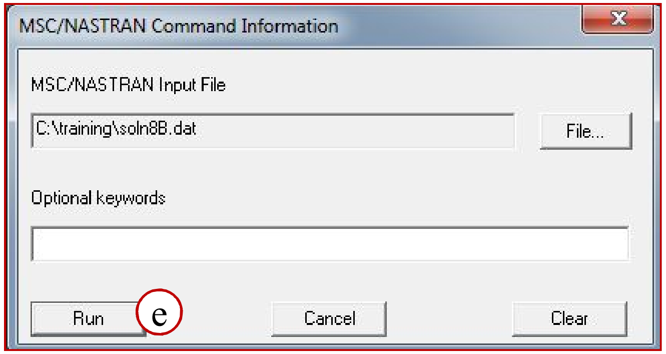


```
$
$    soln8B.dat
$
SOL 112
CEND
TITLE = TRANSIENT RESPONSE WITH BASE EXCITATION
SUBTITLE = USING MODAL TRANSIENT METHOD, WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 200
SET 111 = 23, 33
DISPLACEMENT (SORT2) = 111
VELOCITY (SORT2) = 111
ACCELERATION (SORT2) = 111
$
RESVEC = YES
$
SUBCASE 1
METHOD = 1000
DLOAD = 500
TSTEP = 100
$
OUTPUT (XYPLOT)
XGRID=YES
YGRID=YES
XTITLE= TIME (SEC)
YTITLE= BASE ACCELERATION
XYPLOT ACCELERATION RESPONSE / 23 (T3)
YTITLE= BASE DISPLACEMENT
XYPLOT DISP RESPONSE / 23 (T3)
YTITLE= TIP CENTER DISPLACEMENT RESPONSE
XYPLOT DISP RESPONSE / 33 (T3)
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ ADD EIGENVALUE METHOD
$
EIGRL,1000, ,10
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ ADD CONVERSION TO VISCOUS DAMPING
$
PARAM, W3, 1571.
$
$ APPLY EDGE CONSTRAINTS
$
SPC1, 200, 12456, 1, 12, 23, 34, 45
$
SPC1, 200, 3, 23
$
$ APPLY ACCELERATION TO THE BASE
$
TLOAD2, 500, 600, , A, 0.0, 0.004, 250., -90.
$
SPCD, 600, 23, 3, 1.0
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 200, 2.0E-4, 1
$
ENDDATA
```

Step 5. Save and Run the New Input File

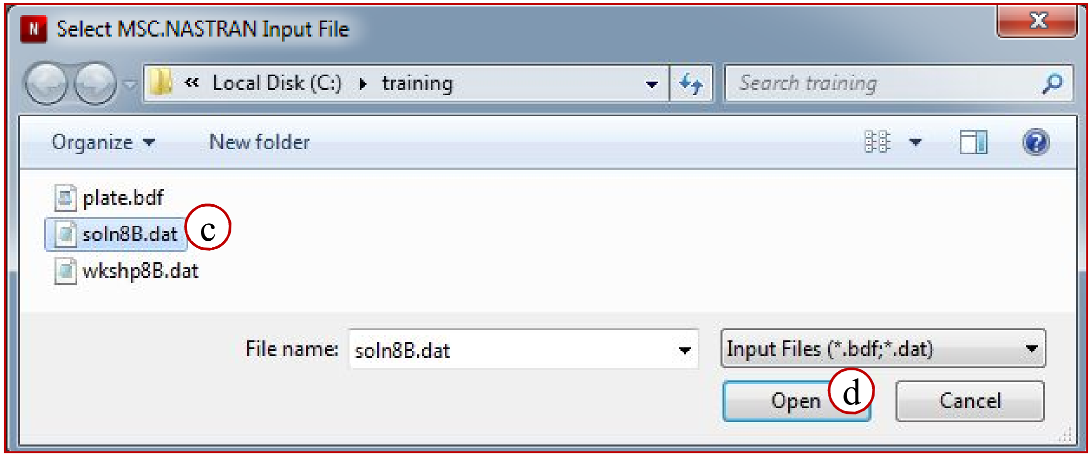
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln8B.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln8B.dat**.
d. Click **Open**.
e. Click **Run**.


MSC/NASTRAN Command Information

MSC/NASTRAN Input File: C:\training\soln8B.dat

Optional keywords:


Select MSC.NASTRAN Input File

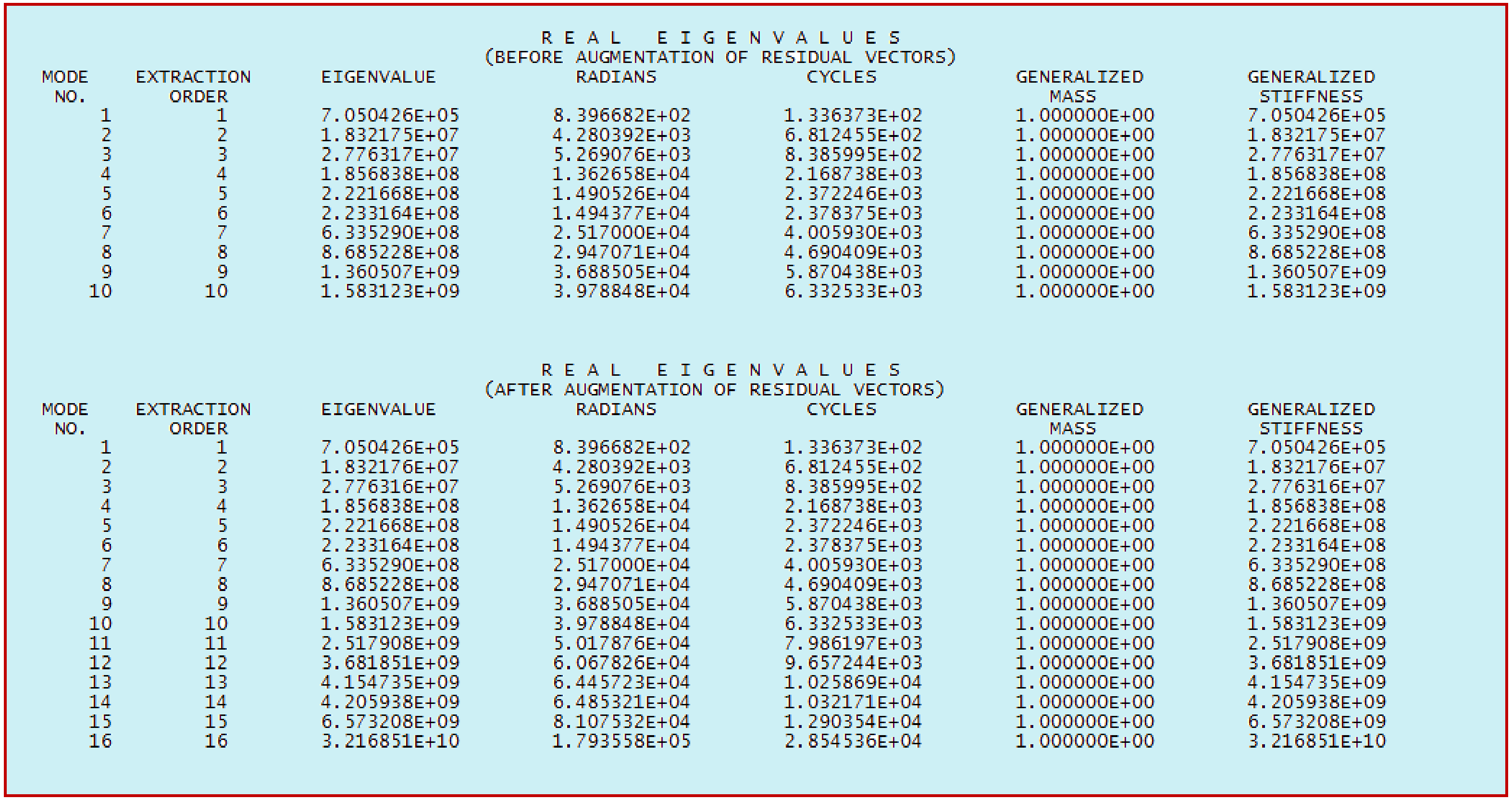
« Local Disk (C:) ▸ training

plate.bdf
soln8B.dat
wkshp8B.dat

File name: soln8B.dat

Input Files (*.bdf;*.dat)

Step 6. Review the Results in the Solution File

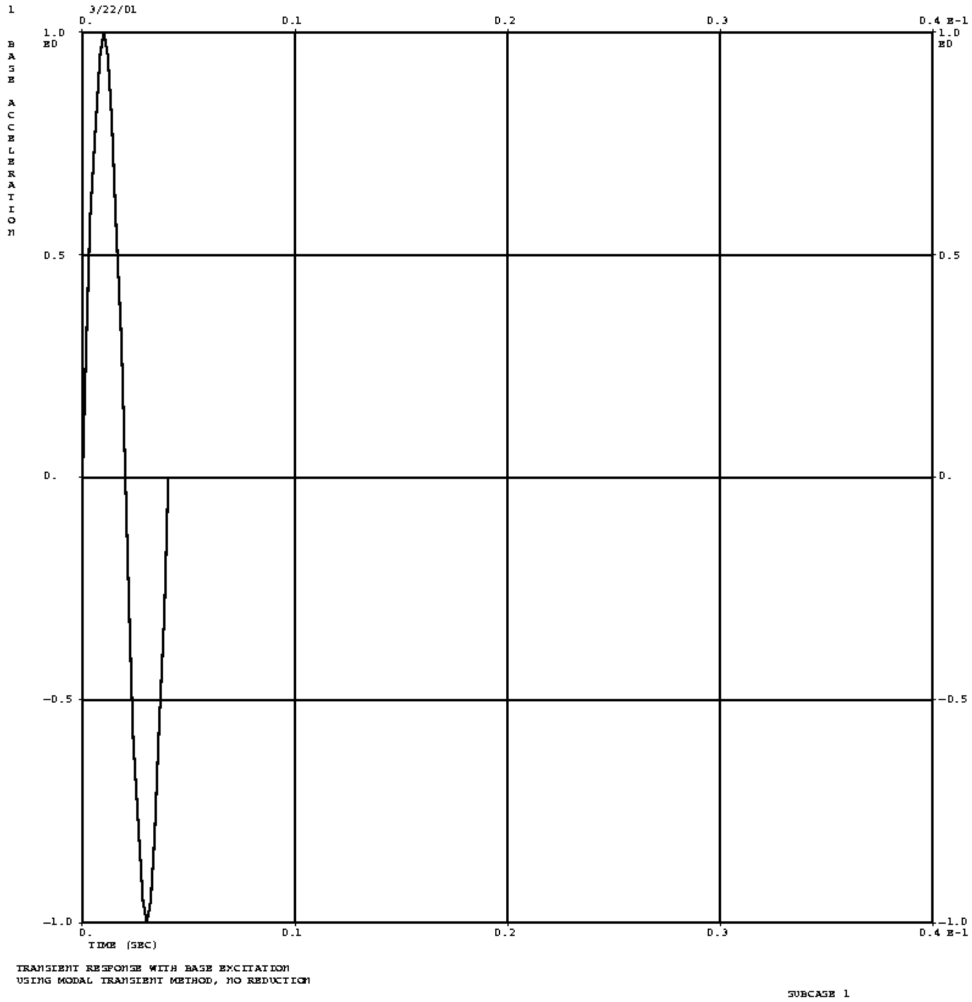


```
                                          R E A L   E I G E N V A L U E S
                                   (BEFORE AUGMENTATION OF RESIDUAL VECTORS)
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        7.050426E+05        8.396682E+02        1.336373E+02        1.000000E+00        7.050426E+05
        2         2        1.832175E+07        4.280392E+03        6.812455E+02        1.000000E+00        1.832175E+07
        3         3        2.776317E+07        5.269076E+03        8.385995E+02        1.000000E+00        2.776317E+07
        4         4        1.856838E+08        1.362658E+04        2.168738E+03        1.000000E+00        1.856838E+08
        5         5        2.221668E+08        1.490526E+04        2.372246E+03        1.000000E+00        2.221668E+08
        6         6        2.233164E+08        1.494377E+04        2.378375E+03        1.000000E+00        2.233164E+08
        7         7        6.335290E+08        2.517000E+04        4.005930E+03        1.000000E+00        6.335290E+08
        8         8        8.685228E+08        2.947071E+04        4.690409E+03        1.000000E+00        8.685228E+08
        9         9        1.360507E+09        3.688505E+04        5.870438E+03        1.000000E+00        1.360507E+09
       10        10        1.583123E+09        3.978848E+04        6.332533E+03        1.000000E+00        1.583123E+09


                                          R E A L   E I G E N V A L U E S
                                   (AFTER AUGMENTATION OF RESIDUAL VECTORS)
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        7.050426E+05        8.396682E+02        1.336373E+02        1.000000E+00        7.050426E+05
        2         2        1.832176E+07        4.280392E+03        6.812455E+02        1.000000E+00        1.832176E+07
        3         3        2.776316E+07        5.269076E+03        8.385995E+02        1.000000E+00        2.776316E+07
        4         4        1.856838E+08        1.362658E+04        2.168738E+03        1.000000E+00        1.856838E+08
        5         5        2.221668E+08        1.490526E+04        2.372246E+03        1.000000E+00        2.221668E+08
        6         6        2.233164E+08        1.494377E+04        2.378375E+03        1.000000E+00        2.233164E+08
        7         7        6.335290E+08        2.517000E+04        4.005930E+03        1.000000E+00        6.335290E+08
        8         8        8.685228E+08        2.947071E+04        4.690409E+03        1.000000E+00        8.685228E+08
        9         9        1.360507E+09        3.688505E+04        5.870438E+03        1.000000E+00        1.360507E+09
       10        10        1.583123E+09        3.978848E+04        6.332533E+03        1.000000E+00        1.583123E+09
       11        11        2.517908E+09        5.017876E+04        7.986197E+03        1.000000E+00        2.517908E+09
       12        12        3.681851E+09        6.067826E+04        9.657244E+03        1.000000E+00        3.681851E+09
       13        13        4.154735E+09        6.445723E+04        1.025869E+04        1.000000E+00        4.154735E+09
       14        14        4.205938E+09        6.485321E+04        1.032171E+04        1.000000E+00        4.205938E+09
       15        15        6.573208E+09        8.107532E+04        1.290354E+04        1.000000E+00        6.573208E+09
       16        16        3.216851E+10        1.793558E+05        2.854536E+04        1.000000E+00        3.216851E+10
```

Step 7. Review the Graph Results

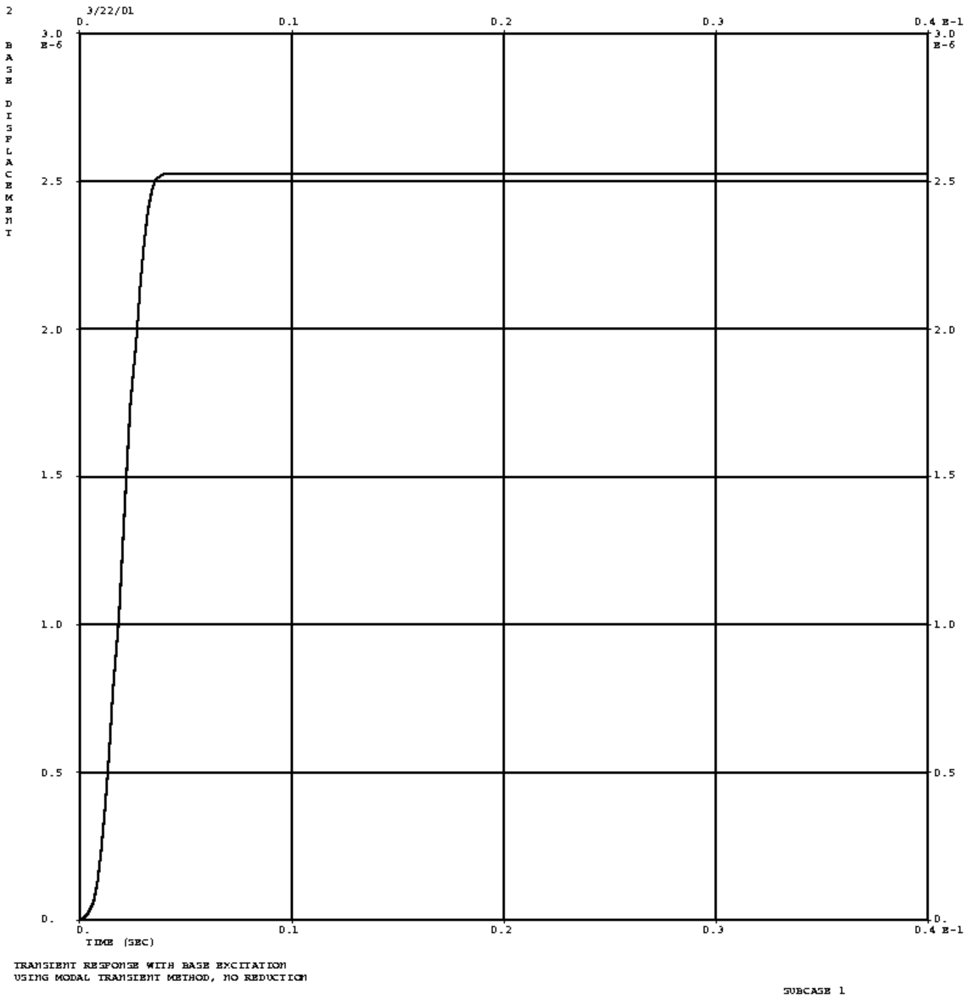
Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions given in workshop 4, step 9.

Base acceleration at Grid Point 23



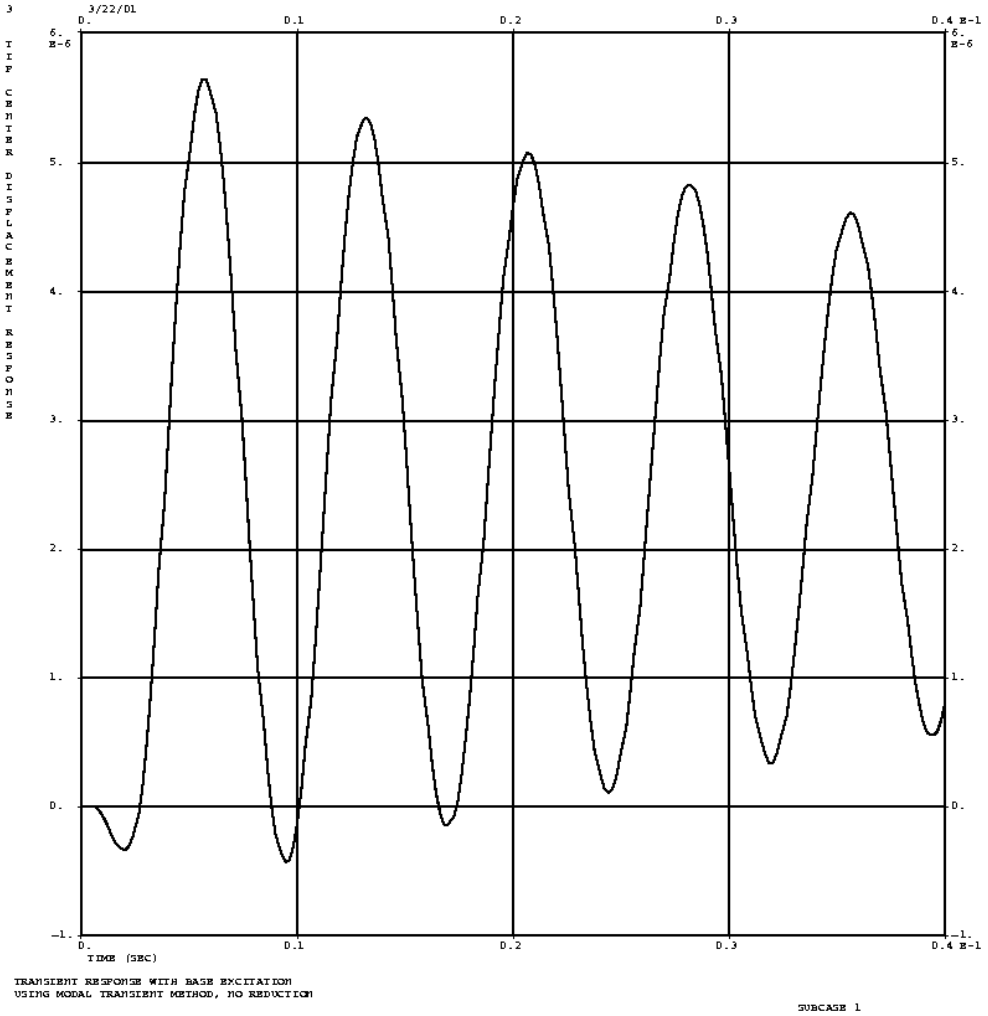
Step 7. Review the Graph Results (Cont.)

Base displacement at Grid Point 23



Step 7. Review the Graph Results (Cont.)

Tip displacement at Grid Point 33



WORKSHOP 9A
DIRECT FREQUENCY RESPONSE WITH ENFORCED DISPLACEMENT

- **Workshop Objective**
  - Using the direct method, determine the frequency response of the flat rectangular plate (from workshop1) subject to an enforced displacement as described below.

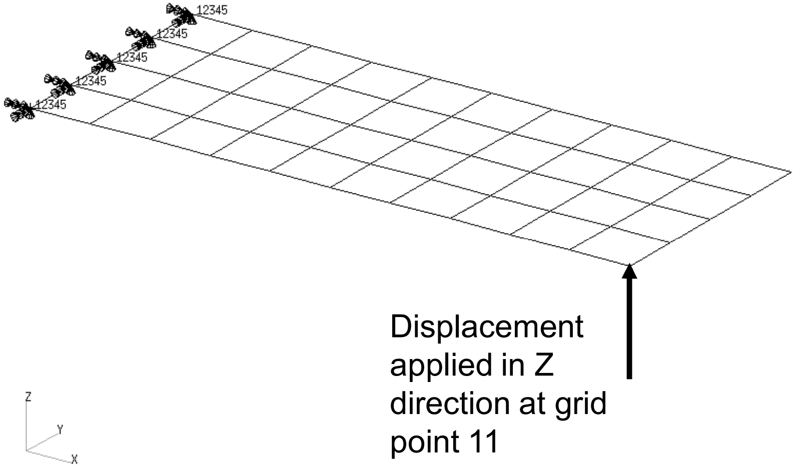
- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp9A.dat

- **Problem Description**
  - The structure is subject to a 0.1 inch enforced displacement at the 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.

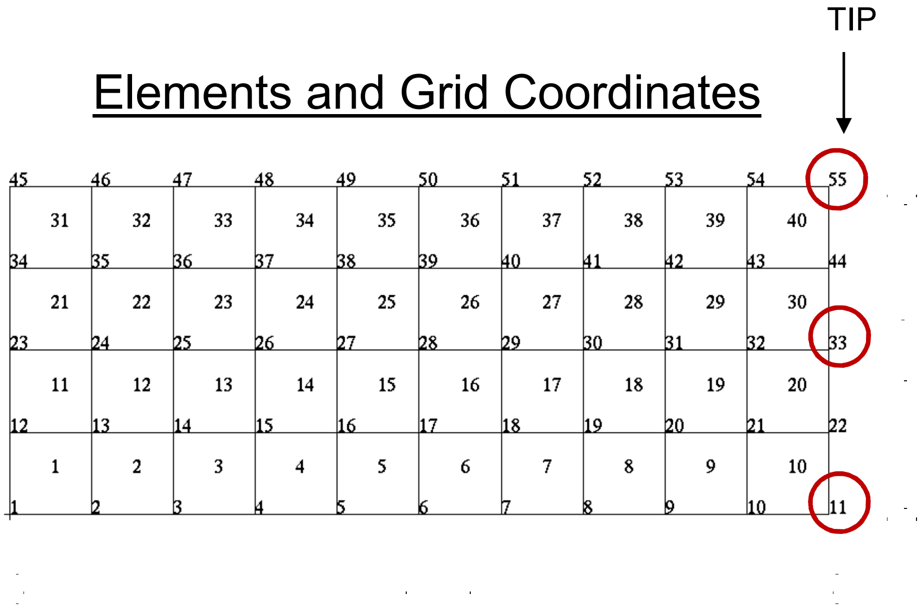
- **Problem Description Continued:**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

Load and Boundary Condition



Displacement applied in Z direction at grid point 11

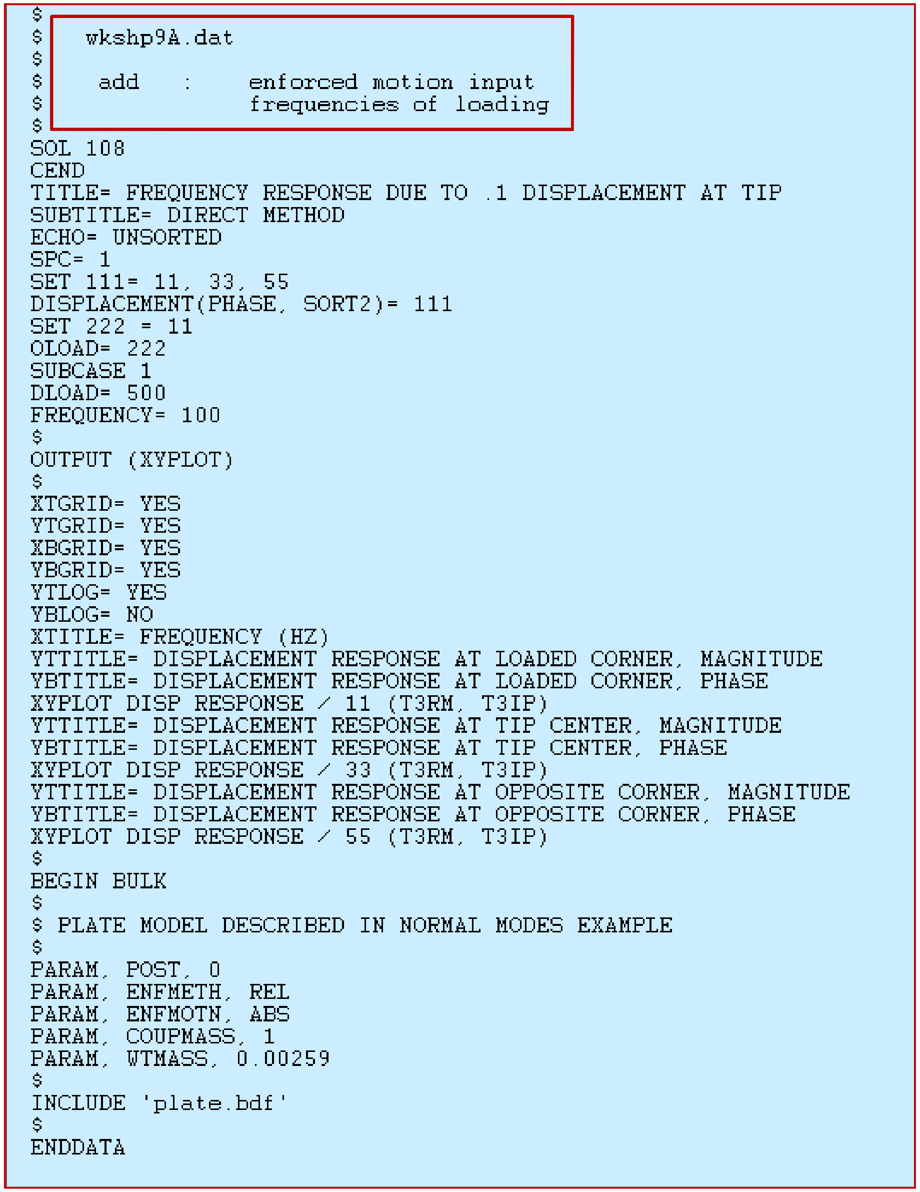
Elements and Grid Coordinates



- **Suggested Step**
  1. Open and review the input file wkshp9A.dat.
  2. Add structural damping.
  3. Add enforced motion input.
  4. Add frequency steps.
  5. Save and run the new input file in MSC Nastran
  6. Review the MSC Nastran results using the soln9A.f06 file.
  7. Review the graph results

Step 1. Open and Review Input File wkshp9A.dat

The file wkshp9A is the starting input file to be modified.

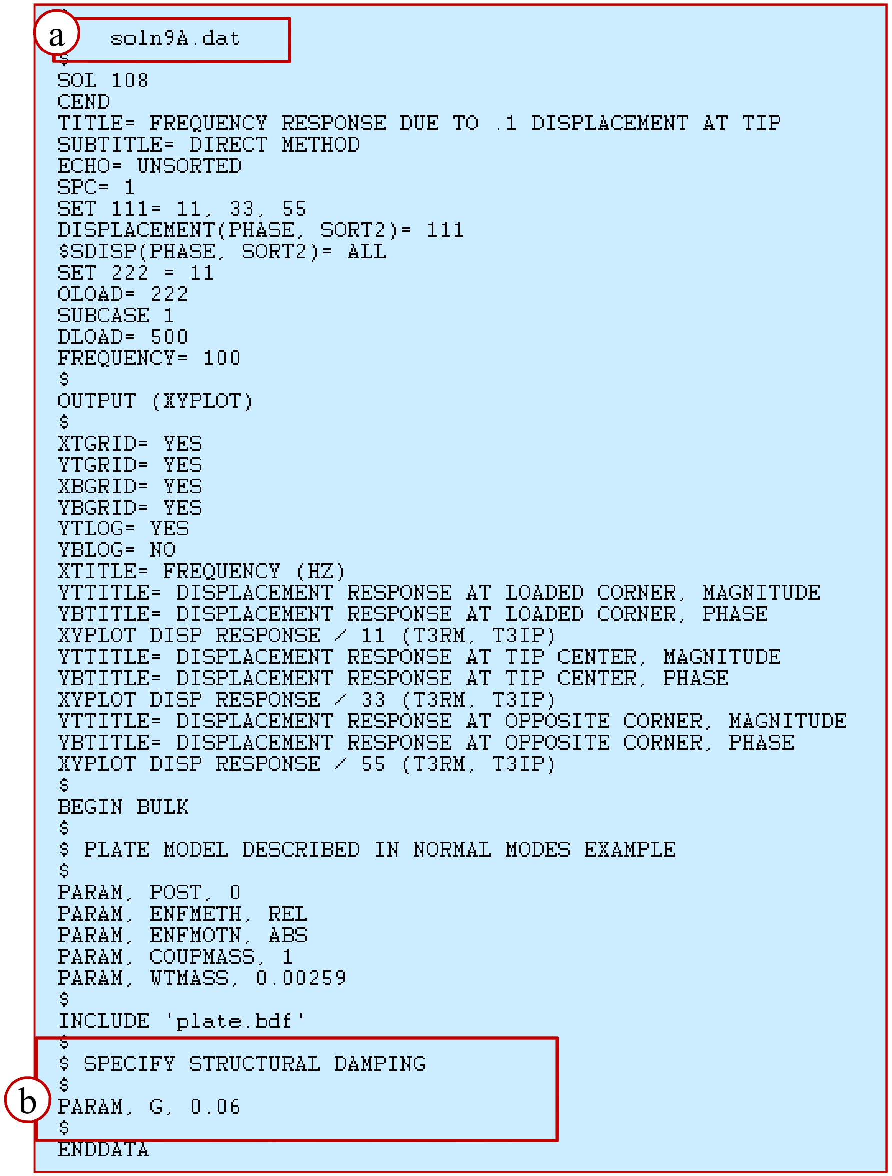


```
$
$   wkshp9A.dat
$
$    add     :     enforced motion input
$                  frequencies of loading
$
SOL 108
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= DIRECT METHOD
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD= 222
SUBCASE 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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
ENDDATA
```

Step 2. Add structural Damping

Add the appropriate parameters in the Bulk Data section for damping.

a. First rename the input file as **soln9A.dat**.
b. Use **PARAM G** with a value of **.06**.

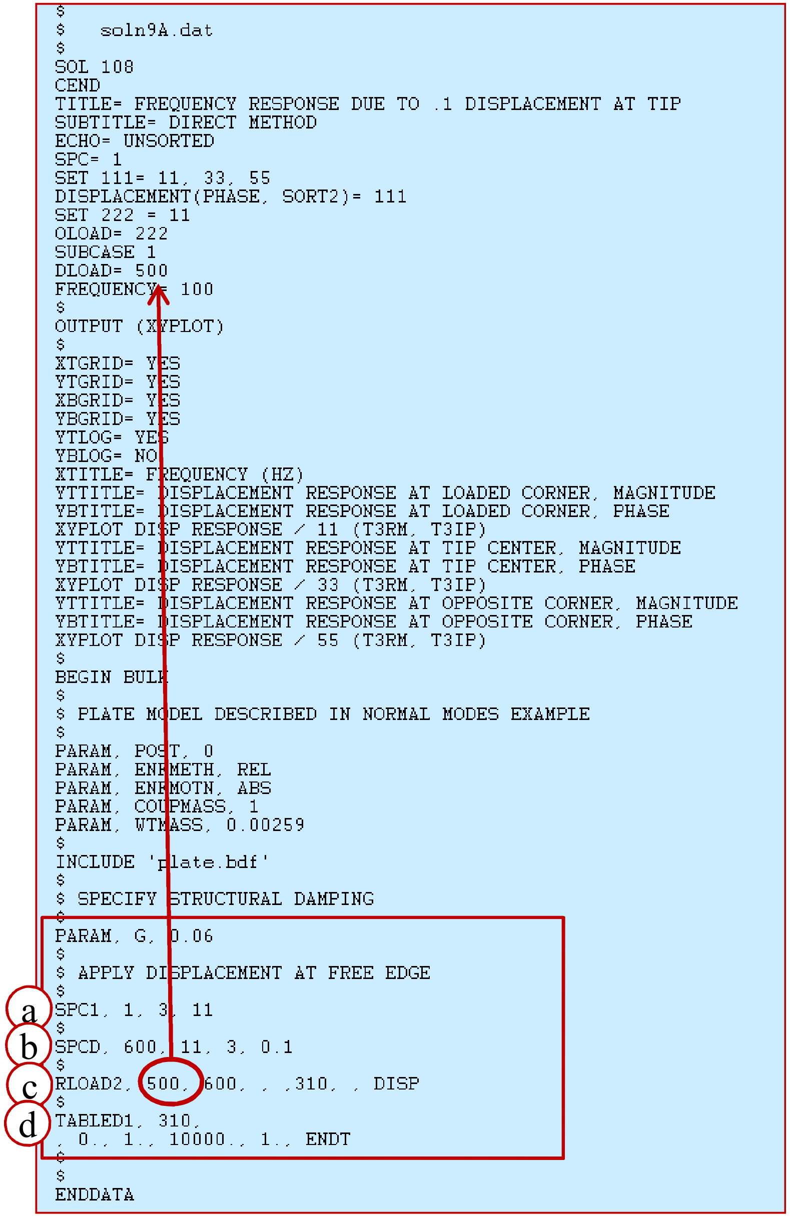


```
$
    soln9A.dat
$
SOL 108
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= DIRECT METHOD
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
$SDISP(PHASE, SORT2)= ALL
SET 222 = 11
OLOAD= 222
SUBCASE 1
DLOAD= 500
FREQUENCY= 100
$
OUTPUT (XYPLOT)
$
XTGRID= 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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
ENDDATA
```

Step 3. Add Enforced Motion Input

Add 0.1 displacement at the corner of the tip (grid point 11) of the plate, with a frequency step of 20 Hz in the range of 20 to 1000 Hz. Use the following entries:

a. **SPC1** – grid point **11**, Z (**3**) direction
b. **SPCD** - apply the **.1** displacement in the Z (**3**) direction at grid point **11**.
c. **RLOAD2** - define the excitation as displacement and point to the **SPCD** and **TABLED1**. Make sure the SID for the **RLOAD2** entry matches the identification number for the **DLOAD** in the Case Control section.
d. **TABLED1** – add frequencies for loading.



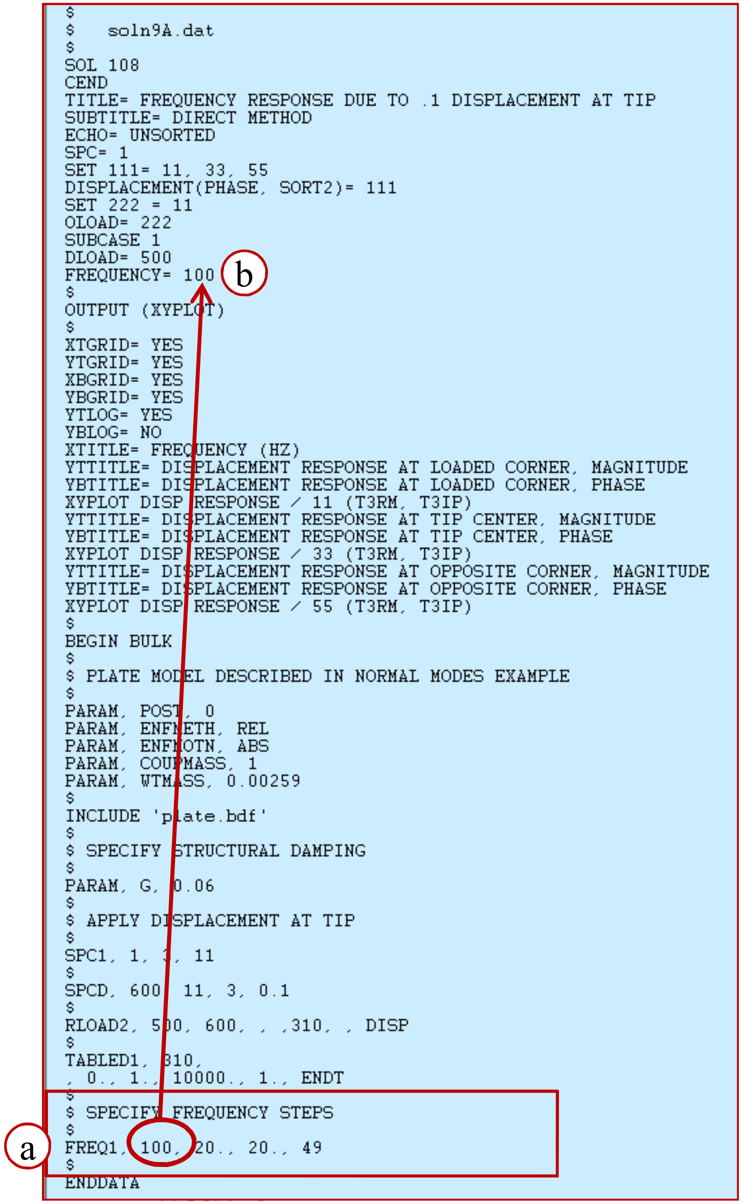
```
$
$   soln9A.dat
$
SOL 108
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= DIRECT METHOD
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD= 222
SUBCASE 1
DLOAD= 500
FREQUENCY= 100
$
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= 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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT FREE EDGE
$
SPC1, 1, 3, 11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310, , DISP
$
TABLED1, 310,
, 0., 1., 10000., 1., ENDT
$
$
ENDDATA
```

Step 4. Add the frequency steps

To add the frequency steps use of the FREQ1 entry.

a. For **FREQ1** entry, from the given information you can obtain:
   - First freq. = **20**
   - Frequency incr = **20**
   - Number of freq. increments = **49**

b. Make sure that the SID for the **FREQ1** entry matches the identification number for the **FREQUENCY** in the Case Control section.

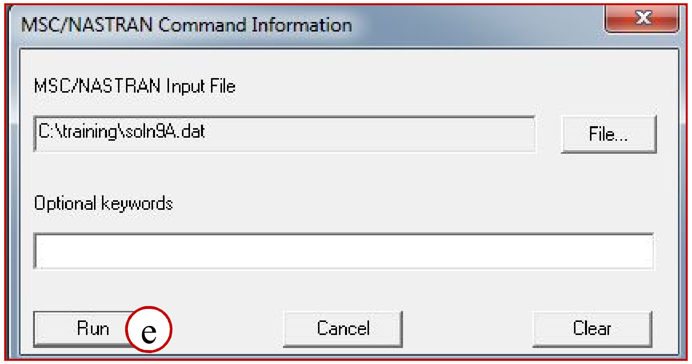


```
$
$   soln9A.dat
$
SOL 108
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= DIRECT METHOD
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD= 222
SUBCASE 1
DLOAD= 500
FREQUENCY= 100
$
OUTPUT (XYPLOT)
$
XTGRID= YES
YTGRID= YES
XBGRID= 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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT TIP
$
SPC1, 1, 3, 11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310, , DISP
$
TABLED1, 310,
, 0., 1., 10000., 1., ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 5. Save and Run the New Input File

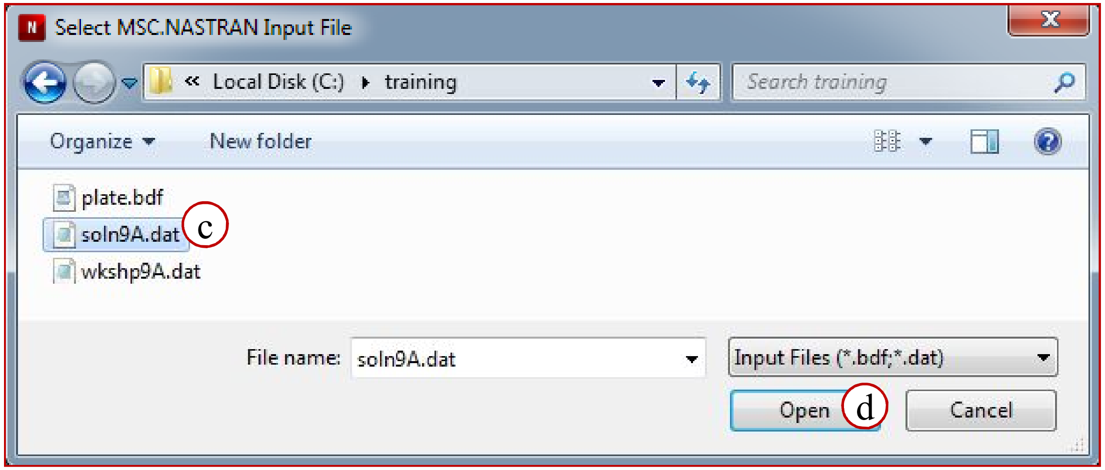
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln9A.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln9A.dat**.
d. Click **Open**.
e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln9A.dat

Optional keywords:

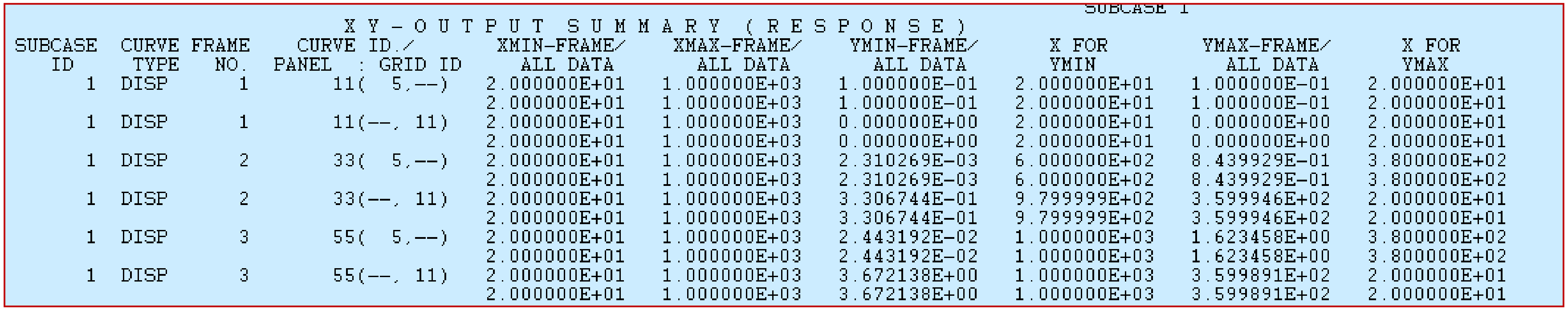


File name: soln9A.dat

Input Files (*.bdf;*.dat)

Step 6. Review the Results in the Solution File

To view the results open the soln9a.f06 file.

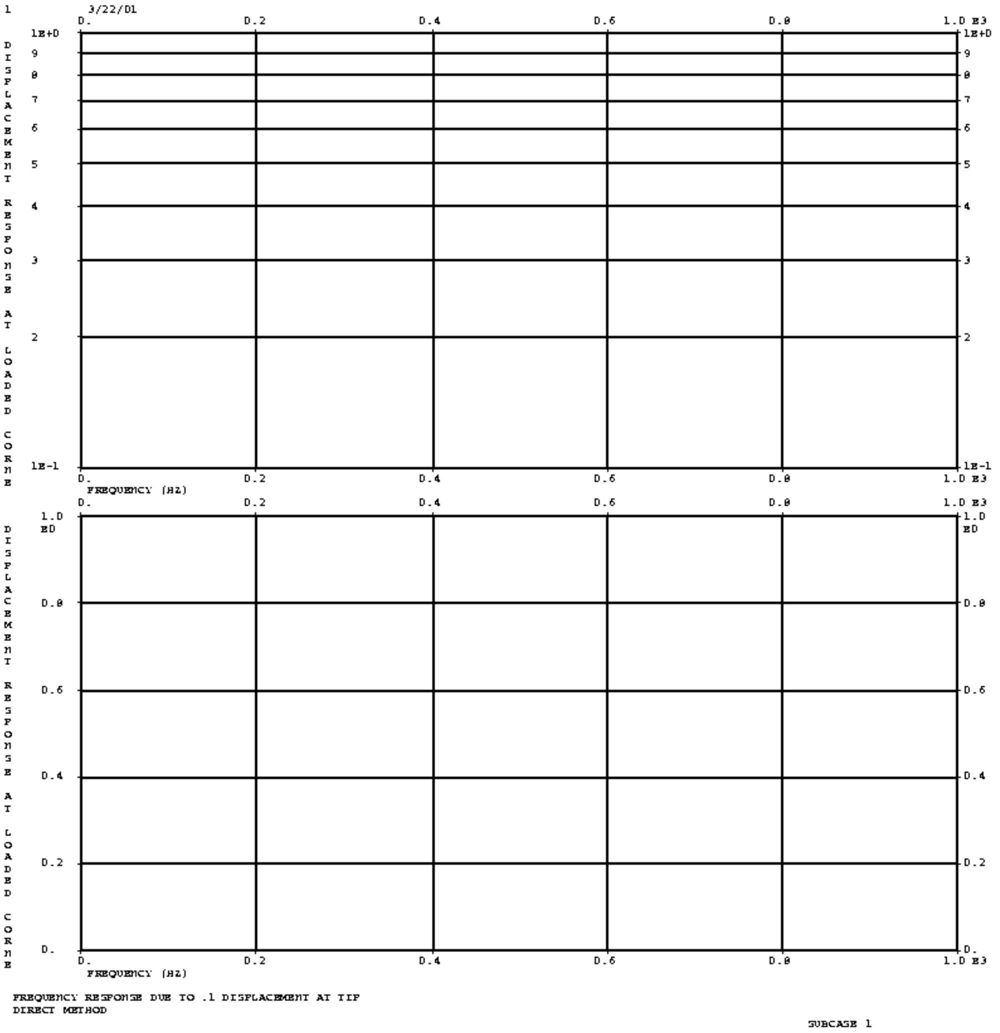


```
                                                                                           SUBCASE 1
                            X Y - O U T P U T   S U M M A R Y   ( R E S P O N S E )
SUBCASE  CURVE FRAME    CURVE ID./       XMIN-FRAME/    XMAX-FRAME/    YMIN-FRAME/      X FOR        YMAX-FRAME/      X FOR
   ID     TYPE   NO.  PANEL  : GRID ID     ALL DATA       ALL DATA       ALL DATA       YMIN           ALL DATA       YMAX
      1  DISP      1       11(  5,--)   2.000000E+01   1.000000E+03   1.000000E-01   2.000000E+01   1.000000E-01   2.000000E+01
                                        2.000000E+01   1.000000E+03   1.000000E-01   2.000000E+01   1.000000E-01   2.000000E+01
      1  DISP      1       11(--, 11)   2.000000E+01   1.000000E+03   0.000000E+00   2.000000E+01   0.000000E+00   2.000000E+01
                                        2.000000E+01   1.000000E+03   0.000000E+00   2.000000E+01   0.000000E+00   2.000000E+01
      1  DISP      2       33(  5,--)   2.000000E+01   1.000000E+03   2.310269E-03   6.000000E+02   8.439929E-01   3.800000E+02
                                        2.000000E+01   1.000000E+03   2.310269E-03   6.000000E+02   8.439929E-01   3.800000E+02
      1  DISP      2       33(--, 11)   2.000000E+01   1.000000E+03   3.306744E-01   9.799999E+02   3.599946E+02   2.000000E+01
                                        2.000000E+01   1.000000E+03   3.306744E-01   9.799999E+02   3.599946E+02   2.000000E+01
      1  DISP      3       55(  5,--)   2.000000E+01   1.000000E+03   2.443192E-02   1.000000E+03   1.623458E+00   3.800000E+02
                                        2.000000E+01   1.000000E+03   2.443192E-02   1.000000E+03   1.623458E+00   3.800000E+02
      1  DISP      3       55(--, 11)   2.000000E+01   1.000000E+03   3.672138E+00   1.000000E+03   3.599891E+02   2.000000E+01
                                        2.000000E+01   1.000000E+03   3.672138E+00   1.000000E+03   3.599891E+02   2.000000E+01
```

Step 7. Review the Graph Results

Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions given in workshop 4, step 9.

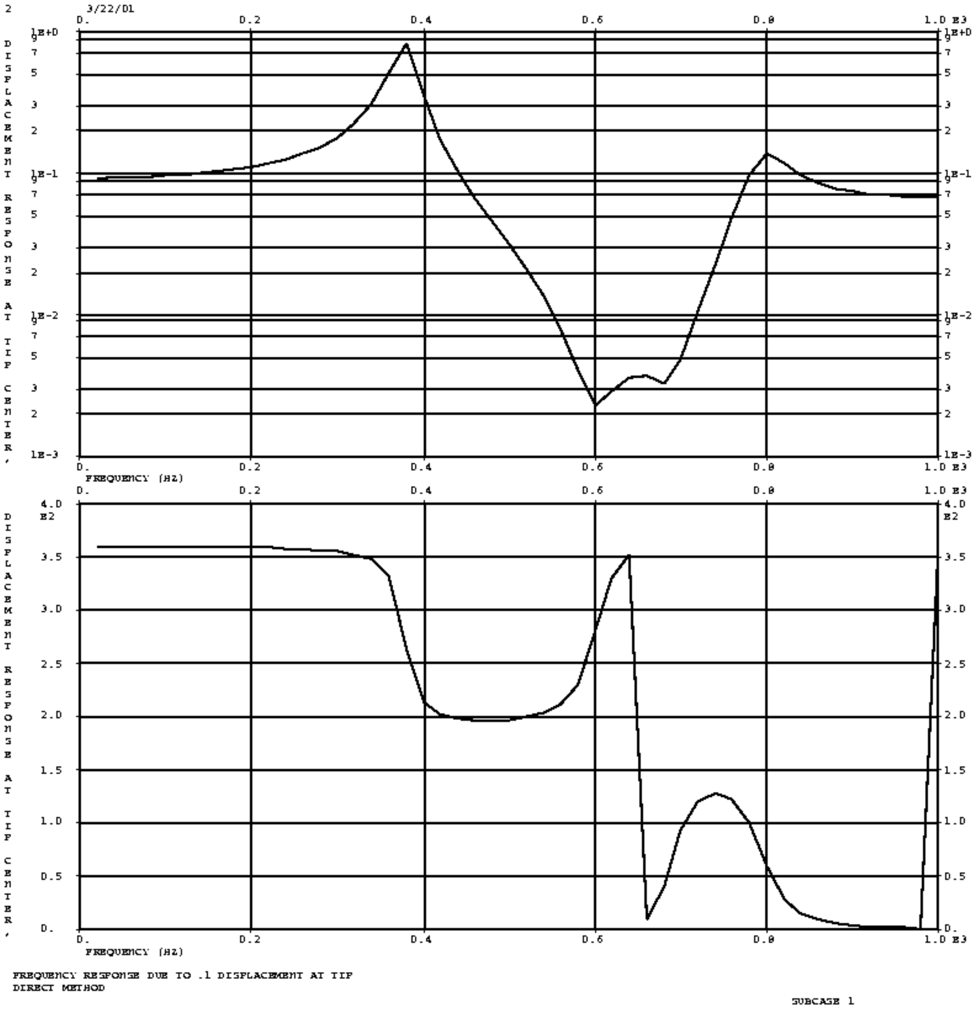
Displacement at loaded corner at Grid Point 11



FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
DIRECT METHOD

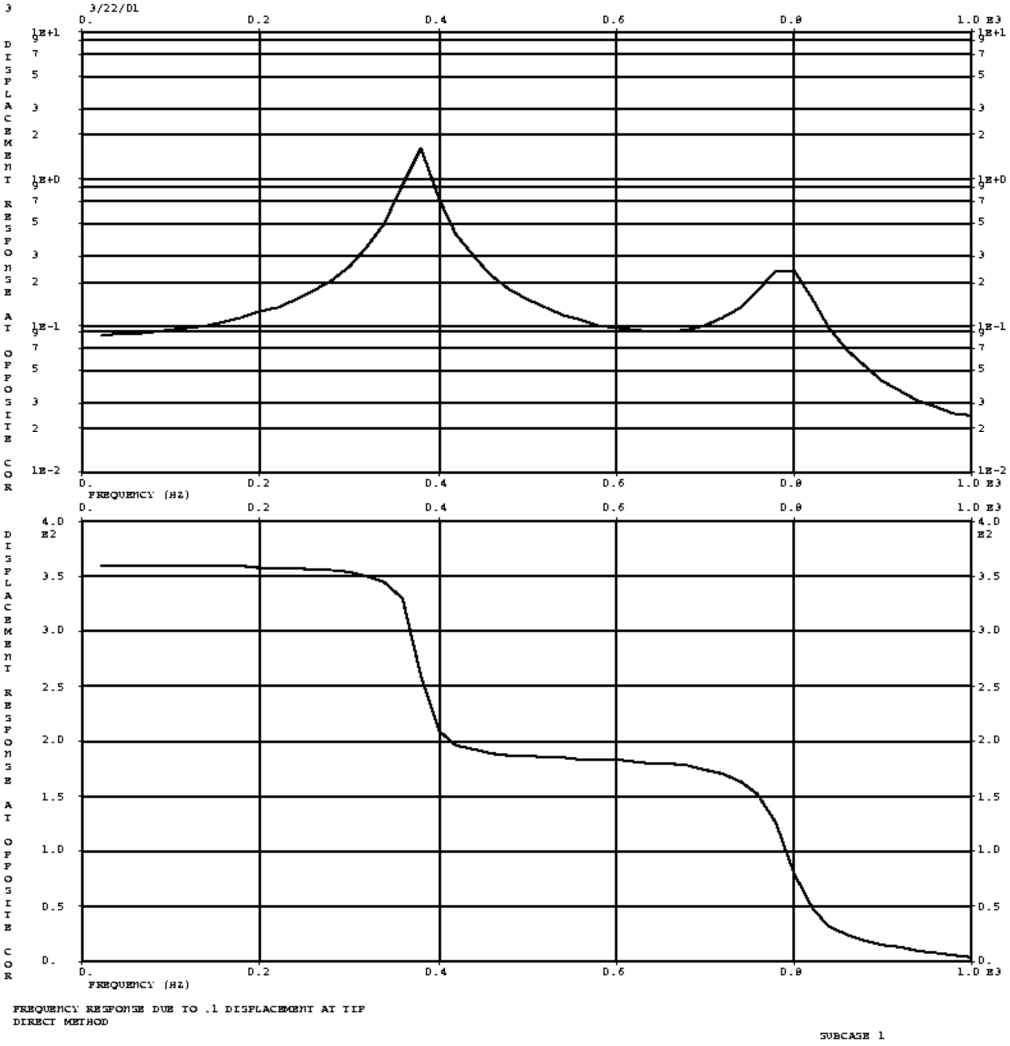
Step 7. Review the Graph Results (Cont.)

Displacement at center of the tip at Grid Point 33



Step 7. Review the Graph Results (Cont.)

Displacement at opposite corner from the load at Grid Point 55



WORKSHOP 9B
MODAL FREQUENCY RESPONSE WITH ENFORCED DISPLACEMENT

- **Workshop Objective**
  - Using the modal method, determine the frequency response of the flat rectangular plate, (from Workshop 1) subject to an enforced displacement described below.

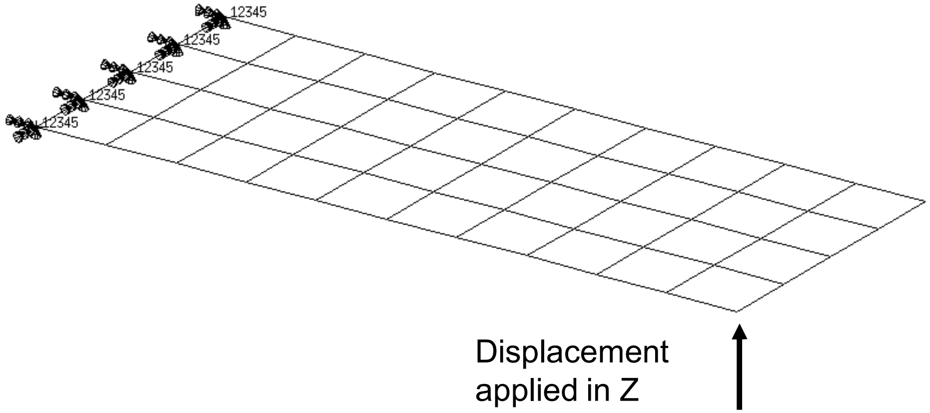
- **Software Version**
  - MSC Nastran

- **Files Required**
  - plate.bdf
  - wkshp9B.dat

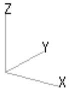
- **Problem Description**
  - The structure is subject to an 0.1 enforced displacement at the corner of the tip. Use a frequency step of 20 Hz in the range of 20 to 1000 Hz. Use a structural damping of g = 0.06. Be sure to include residual vectors.

- **Problem Description Continued:**
  - The figures below show the finite element representation of the flat plate and the loads and boundary condition.

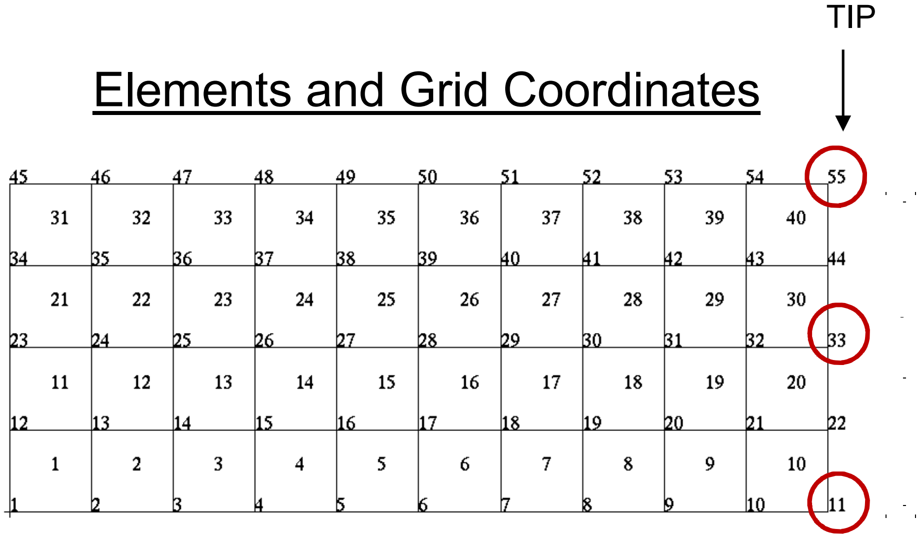
Load and Boundary Condition



Displacement applied in Z direction at grid point 11



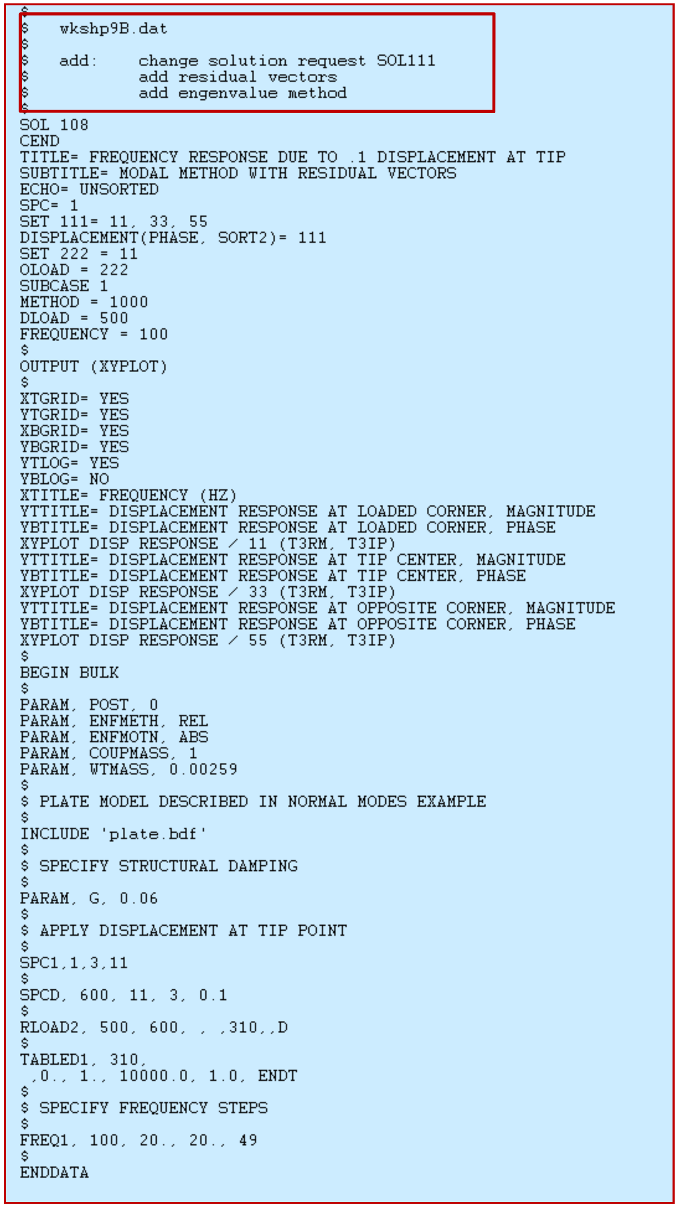
Elements and Grid Coordinates



- **Suggested Steps**
  1. Open and review the input file wkshp9B.dat.
  2. Change the solution request to SOL111.
  3. Add option to include residual vectors.
  4. Add eigenvalue method.
  5. Save and run the new input file in MSC Nastran.
  6. Review the MSC Nastran result using the soln9b.f06 file.
  7. Review the graph results.

Step 1. Open and Review Input File wkshp9B.dat

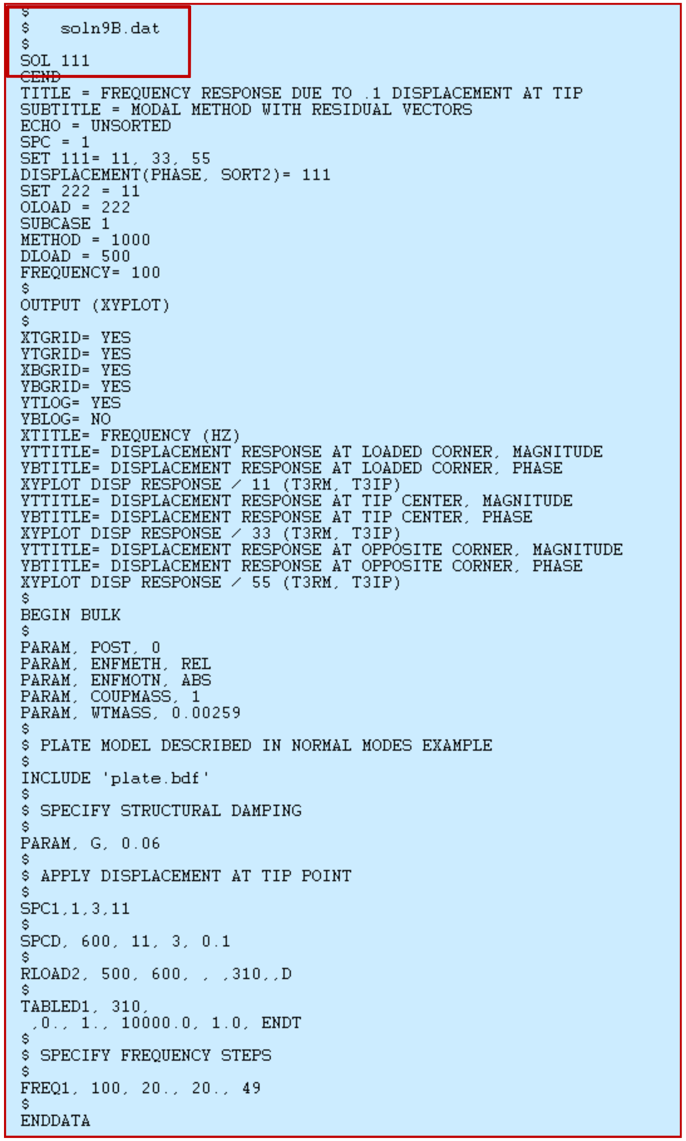
The file wkshp9B.dat is the starting input file. This is the final input file from workshop9A. All that is necessary is to change from a direct method to a modal one and to add a case control command for the residual vector option.



```
$
$   wkshp9B.dat
$
$   add:    change solution request SOL111
$           add residual vectors
$           add engenvalue method
$
SOL 108
CEND
TITLE= FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE= MODAL METHOD WITH RESIDUAL VECTORS
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD = 222
SUBCASE 1
METHOD = 1000
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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT TIP POINT
$
SPC1,1,3,11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310,,D
$
TABLED1, 310,
 ,0., 1., 10000.0, 1.0, ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 2. Change the Solution Request

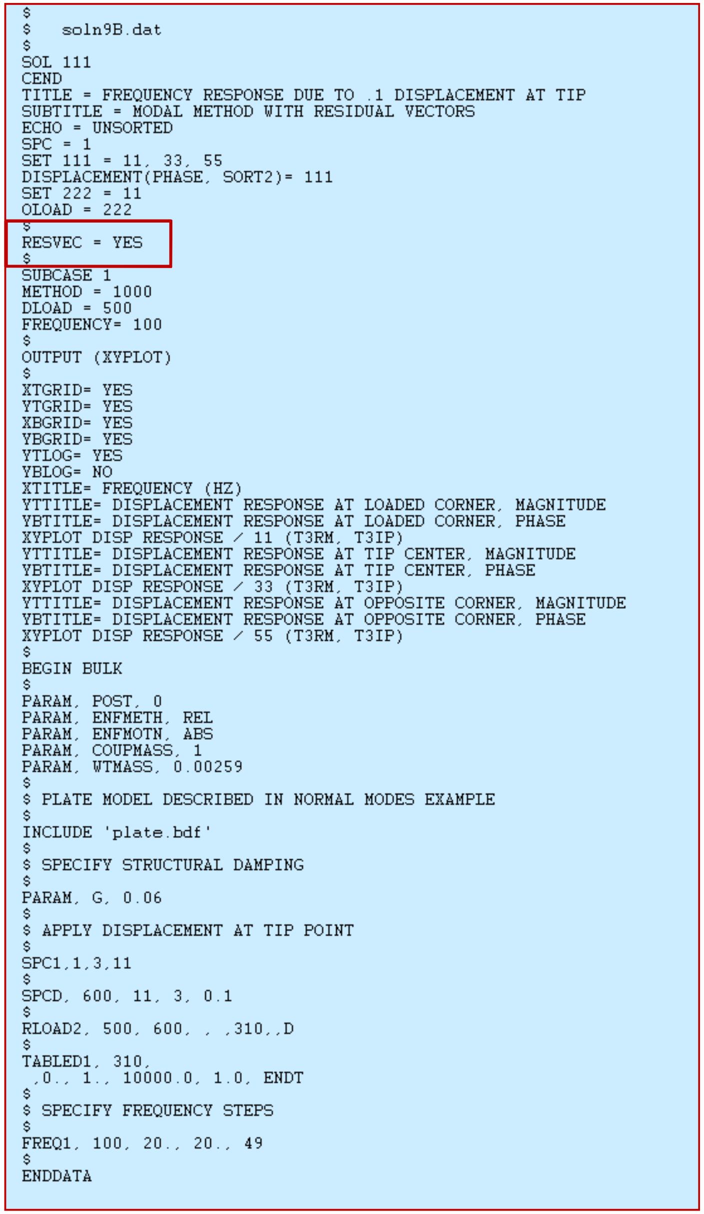
First change the file name to **soln9B.dat**. The solution request for a modal frequency response is SOL 111, so change the SOL 108 to **SOL111**.



```
$
$   soln9B.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE = MODAL METHOD WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 1
SET 111= 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD = 222
SUBCASE 1
METHOD = 1000
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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT TIP POINT
$
SPC1,1,3,11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310,,D
$
TABLED1, 310,
 ,0., 1., 10000.0, 1.0, ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 3. Add Option for Residual Vectors

Use the Case Control command **RESVEC** to specify the option for residual vectors.



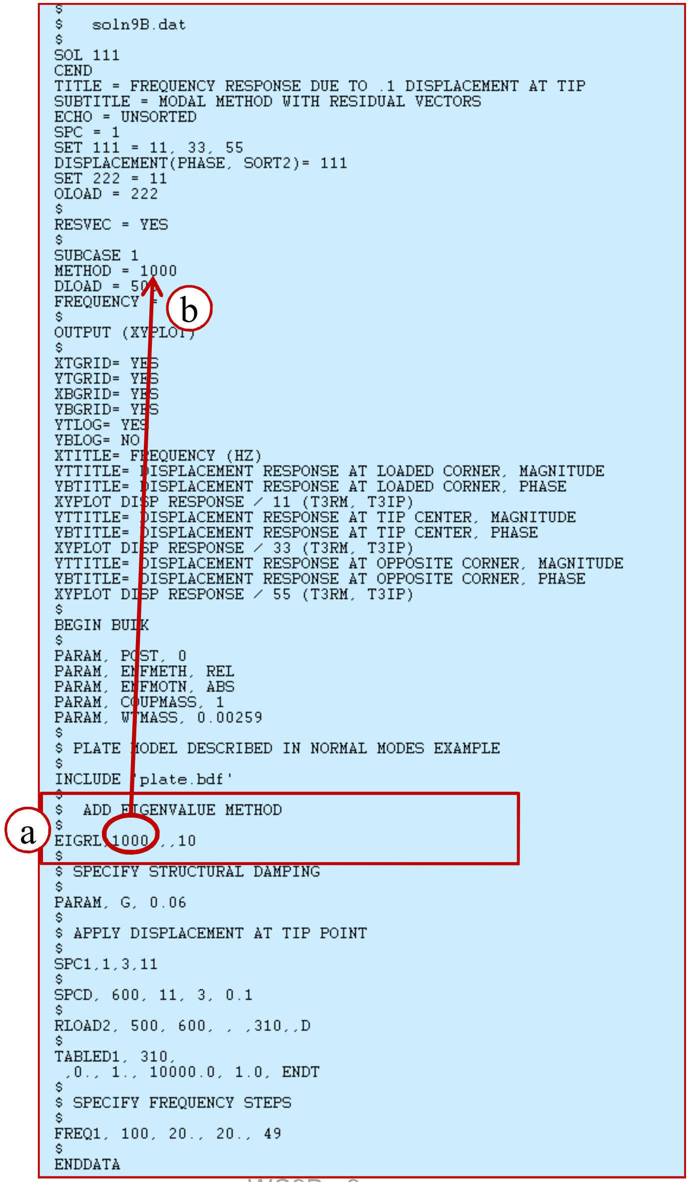
```
$
$   soln9B.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE = MODAL METHOD WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD = 222
$
RESVEC = YES
$
SUBCASE 1
METHOD = 1000
DLOAD = 500
FREQUENCY= 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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT TIP POINT
$
SPC1,1,3,11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310,,D
$
TABLED1, 310,
 ,0., 1., 10000.0, 1.0, ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 4. Add the Eigenvalue Method

Add the eigenvalue Method:

a. Use the **EIGRL** entry specifying **10** roots.

b. Make sure that the **METHOD** Case Control command identification number matches the **EIGRL** SID.

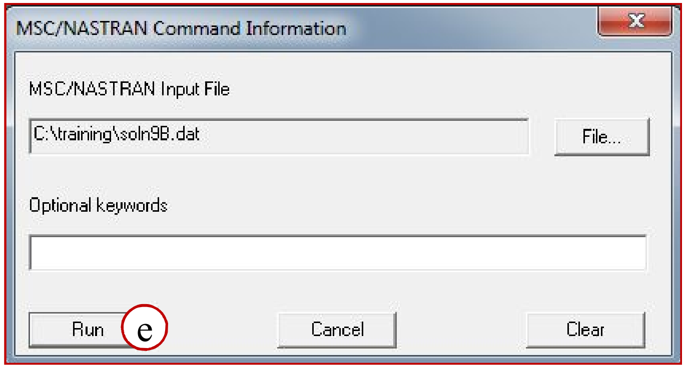


```
$
$   soln9B.dat
$
SOL 111
CEND
TITLE = FREQUENCY RESPONSE DUE TO .1 DISPLACEMENT AT TIP
SUBTITLE = MODAL METHOD WITH RESIDUAL VECTORS
ECHO = UNSORTED
SPC = 1
SET 111 = 11, 33, 55
DISPLACEMENT(PHASE, SORT2)= 111
SET 222 = 11
OLOAD = 222
$
RESVEC = YES
$
SUBCASE 1
METHOD = 1000
DLOAD = 50
FREQUENCY =
$
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
$
PARAM, POST, 0
PARAM, ENFMETH, REL
PARAM, ENFMOTN, ABS
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$  ADD EIGENVALUE METHOD
$
EIGRL,1000,,,10
$
$ SPECIFY STRUCTURAL DAMPING
$
PARAM, G, 0.06
$
$ APPLY DISPLACEMENT AT TIP POINT
$
SPC1,1,3,11
$
SPCD, 600, 11, 3, 0.1
$
RLOAD2, 500, 600, , ,310,,D
$
TABLED1, 310,
 ,0., 1., 10000.0, 1.0, ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 100, 20., 20., 49
$
ENDDATA
```

Step 5. Save and Run the New Input File

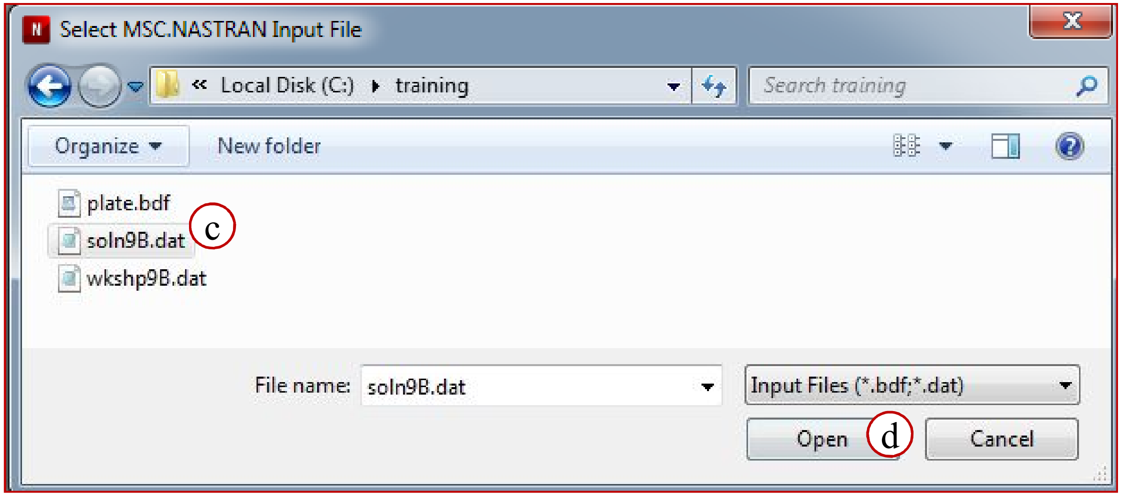
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln9B.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln9B.dat**.
d. Click **Open**.
e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln9B.dat

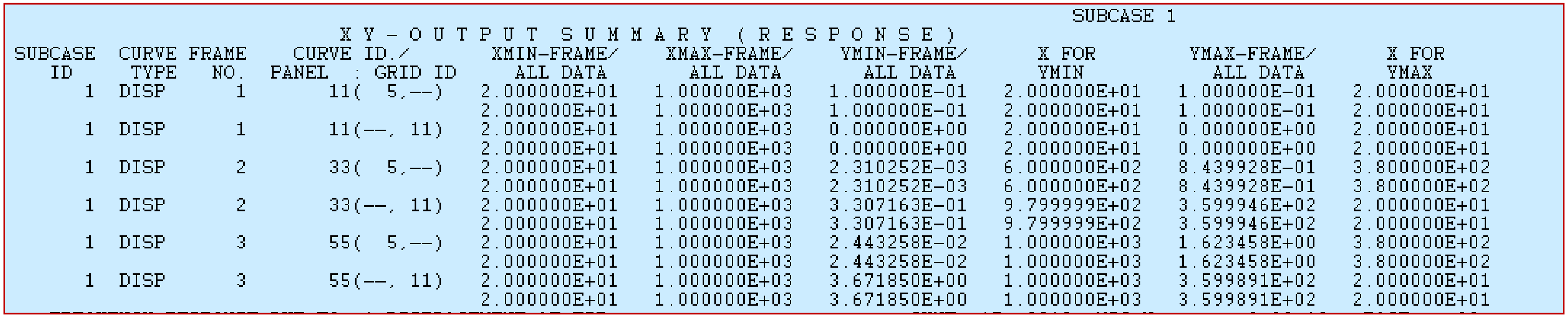
Optional keywords:



File name: soln9B.dat

Input Files (*.bdf;*.dat)

Step 6. Review the Results in the Solution File

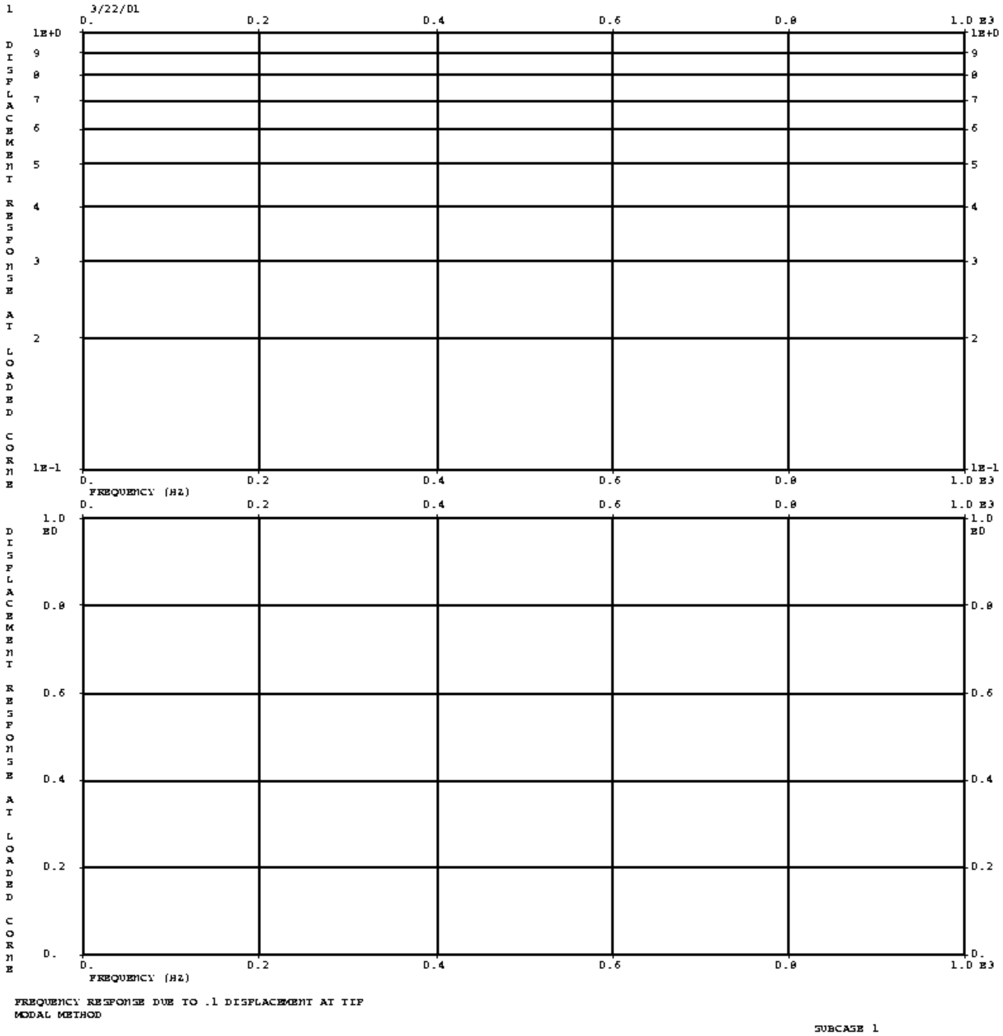


```
                                                                                              SUBCASE 1
                               X Y - O U T P U T   S U M M A R Y   ( R E S P O N S E )
SUBCASE  CURVE FRAME    CURVE ID./       XMIN-FRAME/     XMAX-FRAME/     YMIN-FRAME/      X FOR          YMAX-FRAME/      X FOR
   ID     TYPE    NO.  PANEL  : GRID ID   ALL DATA        ALL DATA        ALL DATA         YMIN           ALL DATA         YMAX
     1   DISP      1        11(   5,--)  2.000000E+01    1.000000E+03    1.000000E-01    2.000000E+01    1.000000E-01    2.000000E+01
                                         2.000000E+01    1.000000E+03    1.000000E-01    2.000000E+01    1.000000E-01    2.000000E+01
     1   DISP      1        11(--, 11)   2.000000E+01    1.000000E+03    0.000000E+00    2.000000E+01    0.000000E+00    2.000000E+01
                                         2.000000E+01    1.000000E+03    0.000000E+00    2.000000E+01    0.000000E+00    2.000000E+01
     1   DISP      2        33(   5,--)  2.000000E+01    1.000000E+03    2.310252E-03    6.000000E+02    8.439928E-01    3.800000E+02
                                         2.000000E+01    1.000000E+03    2.310252E-03    6.000000E+02    8.439928E-01    3.800000E+02
     1   DISP      2        33(--, 11)   2.000000E+01    1.000000E+03    3.307163E-01    9.799999E+02    3.599946E+02    2.000000E+01
                                         2.000000E+01    1.000000E+03    3.307163E-01    9.799999E+02    3.599946E+02    2.000000E+01
     1   DISP      3        55(   5,--)  2.000000E+01    1.000000E+03    2.443258E-02    1.000000E+03    1.623458E+00    3.800000E+02
                                         2.000000E+01    1.000000E+03    2.443258E-02    1.000000E+03    1.623458E+00    3.800000E+02
     1   DISP      3        55(--, 11)   2.000000E+01    1.000000E+03    3.671850E+00    1.000000E+03    3.599891E+02    2.000000E+01
                                         2.000000E+01    1.000000E+03    3.671850E+00    1.000000E+03    3.599891E+02    2.000000E+01
```

Step 7. Review the Graph Results

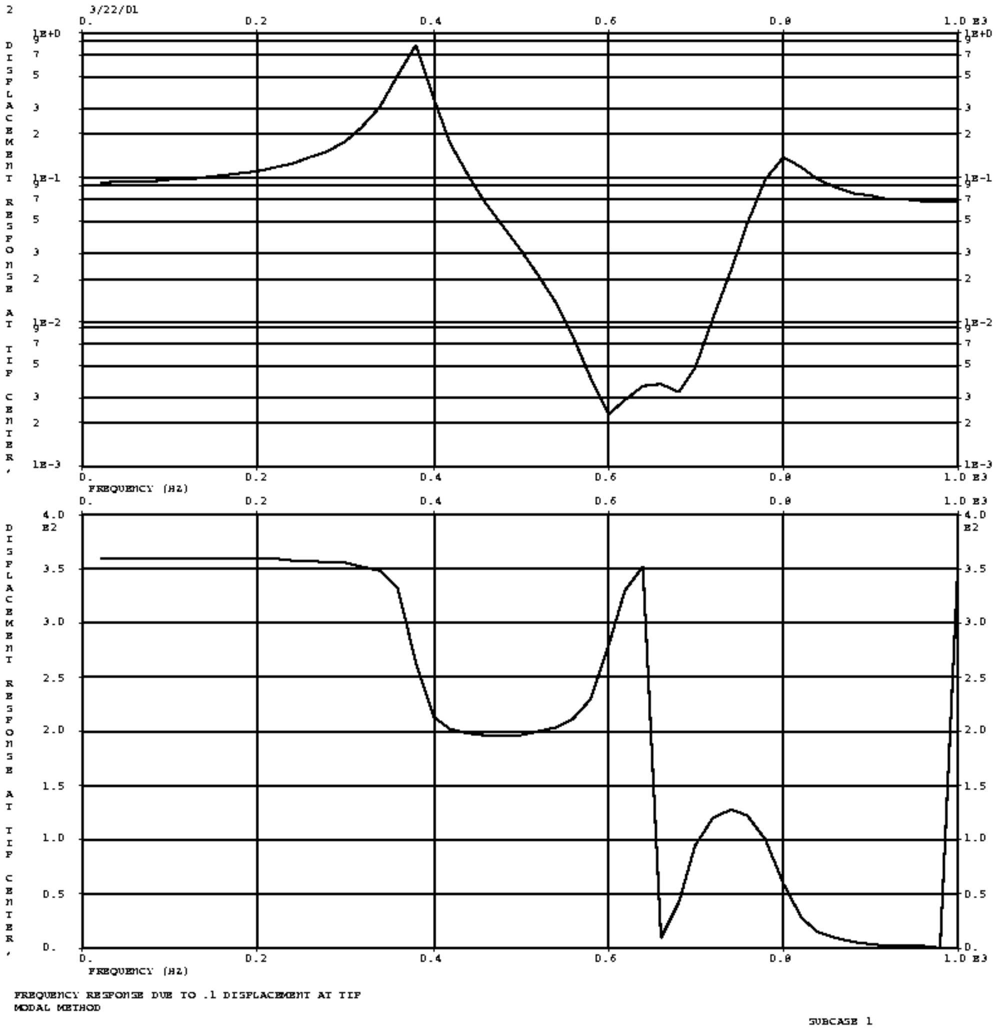
Recall that to obtain the graphs you will need to convert the .plt file to a .ps file, if needed, use the directions givin in workshop 4, step 9.

Displacement at loaded corner at Grid Point 11



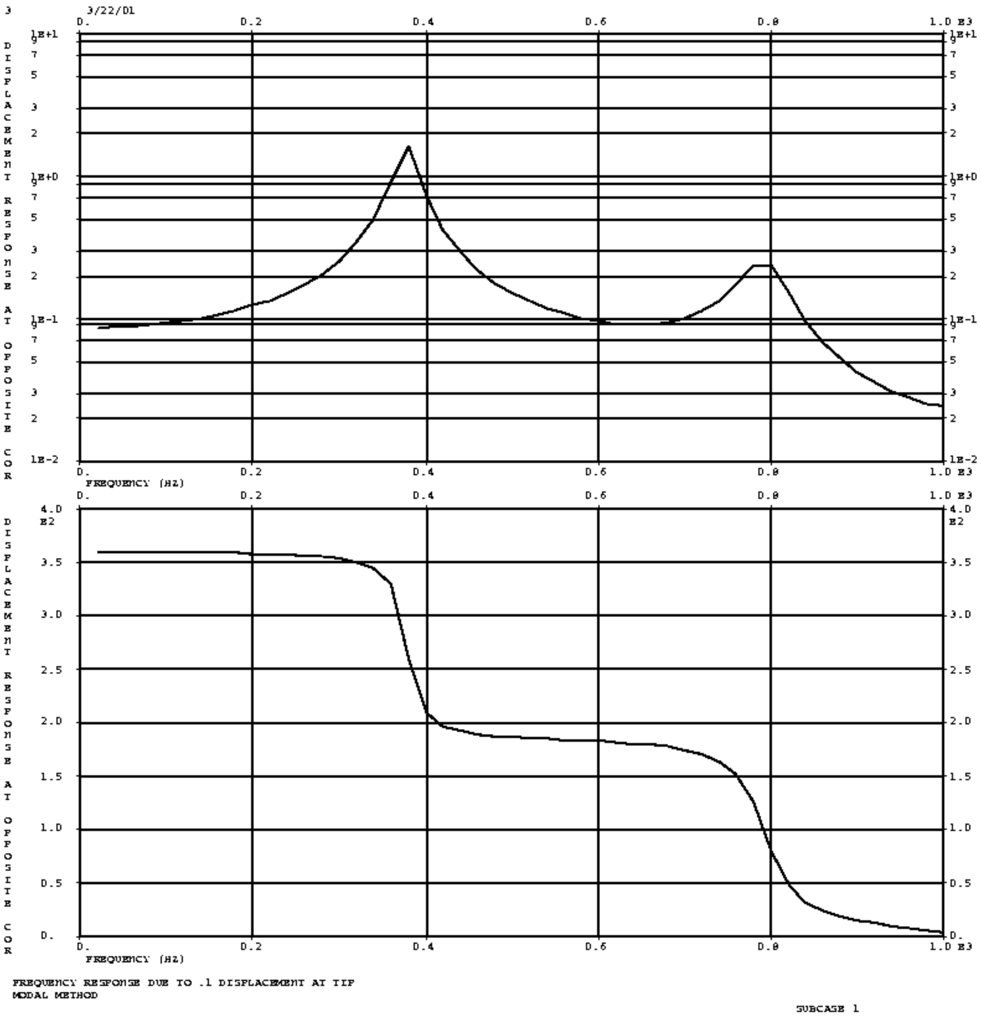
Step 7. Review the Graph Results (Cont.)

Displacement at center of the tip at Grid Point 33



Step 6. Review the Graph Results (Cont.)

Displacement at opposite corner from the load at Grid Point 55



WORKSHOP 10A
GENERATE A SHOCK SPECTRUM INPUT

- **Workshop Objectives:**
  - Generate a shock spectrum for the plate (from workshop 1) due to a 2.0 in/sec^2 sine pulse applied at the fixed edge. Compute spectra for 0, 2, and 4 percent damping.

- **Software Version**
  - MSC Nastran 2013

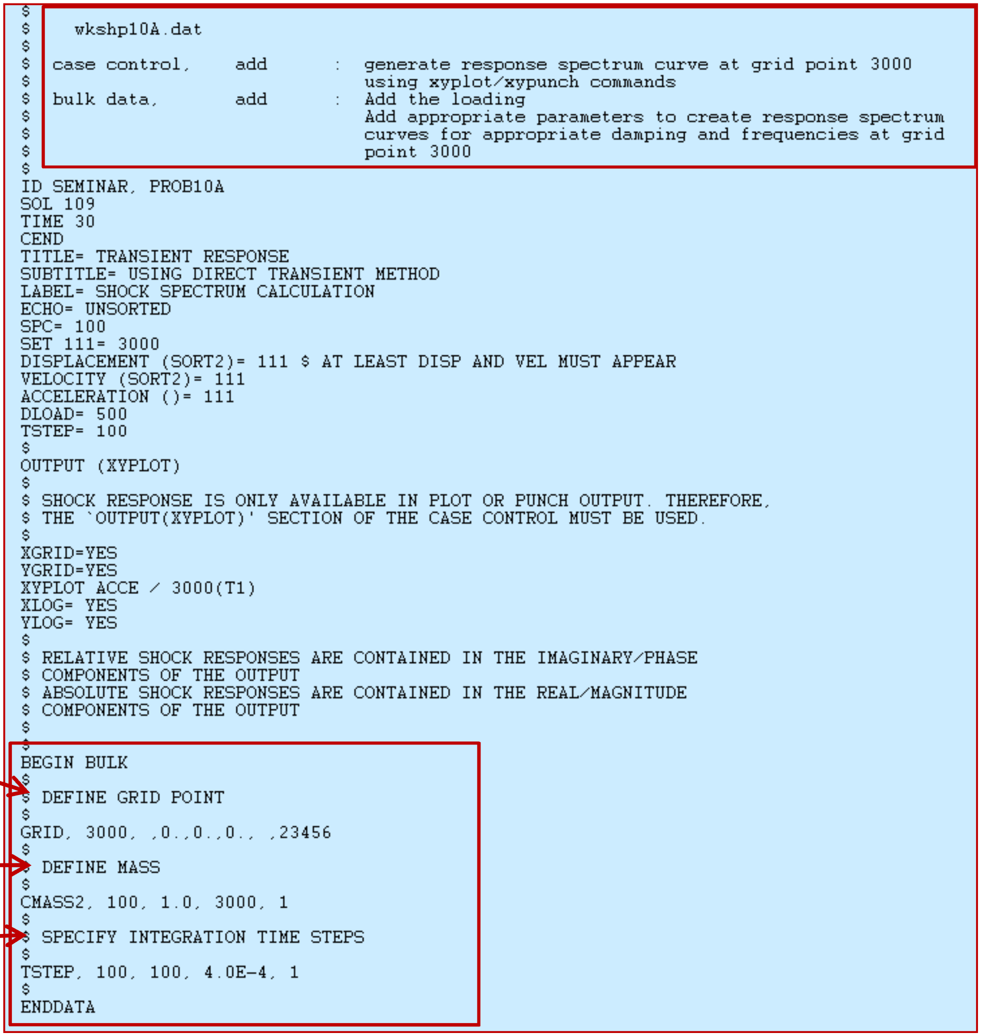
- **Files Required**
  - wkshp10A.dat

- **Problem Description**
  - This is the first part of a two part problem. This workshop is to generate the shock spectrum. In the next workshop, 10b we need to apply generated shock input.

- **Suggested Steps**
  1. Open and review the input file wkshp10A.dat
  2. Add the XYplot/XYpunch commands to generate a response spectrum at grid point 3000.
  3. Add the time dependent load.
  4. Add the request for calculation of spectra.
  5. Add entries to specify damping and natural frequencies for oscillator
  6. Add entry to correlate frequency and damping requests.
  7. Save and run the new input file in MSC Nastran.
  8. Review the tabular results of the acceleration spectra data using the file soln10a.pch.
  9. Review the graphical results.

Step 1. Open and Review Input File wkshp10A.dat

This is the starting input file, to be modified to add the shock spectrum.



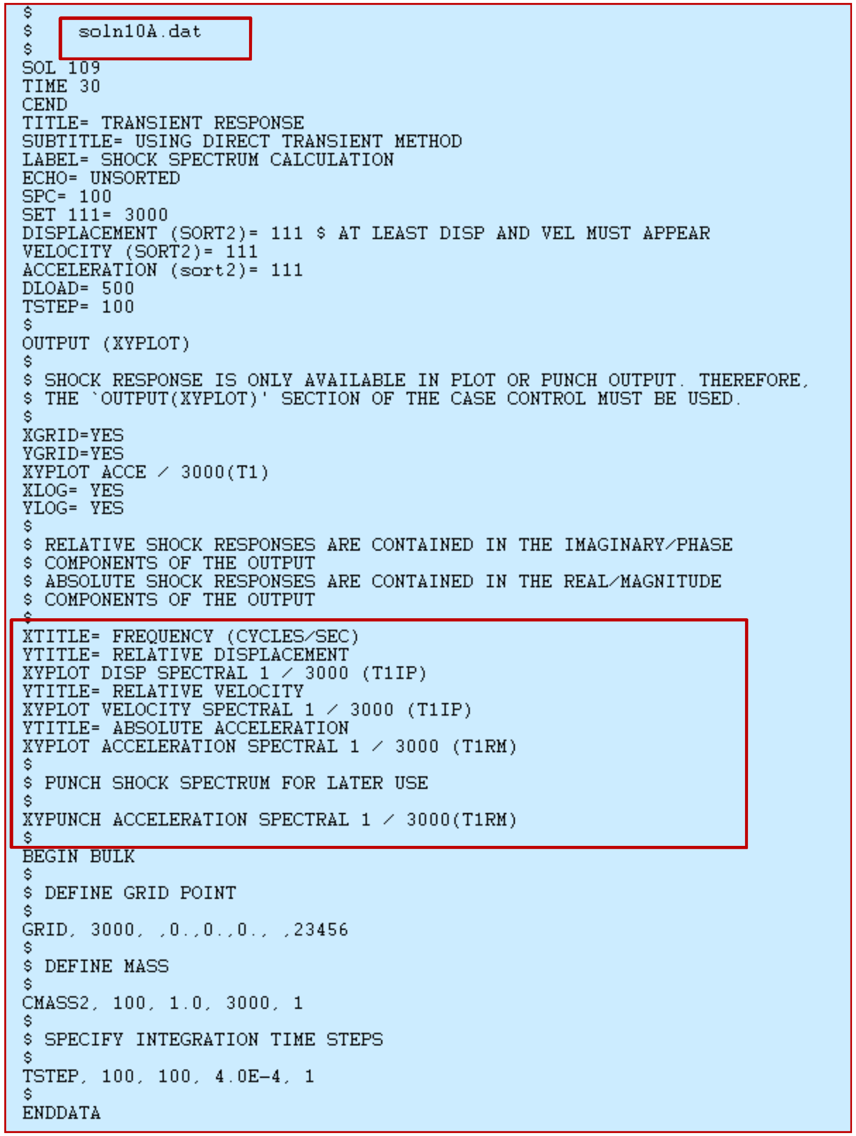
```
$
$   wkshp10A.dat
$
$ case control,     add       :  generate response spectrum curve at grid point 3000
$                                using xyplot/xypunch commands
$ bulk data,        add       :  Add the loading
$                                Add appropriate parameters to create response spectrum
$                                curves for appropriate damping and frequencies at grid
$                                point 3000
$
ID SEMINAR, PROB10A
SOL 109
TIME 30
CEND
TITLE= TRANSIENT RESPONSE
SUBTITLE= USING DIRECT TRANSIENT METHOD
LABEL= SHOCK SPECTRUM CALCULATION
ECHO= UNSORTED
SPC= 100
SET 111= 3000
DISPLACEMENT (SORT2)= 111 $ AT LEAST DISP AND VEL MUST APPEAR
VELOCITY (SORT2)= 111
ACCELERATION ()= 111
DLOAD= 500
TSTEP= 100
$
OUTPUT (XYPLOT)
$
$ SHOCK RESPONSE IS ONLY AVAILABLE IN PLOT OR PUNCH OUTPUT. THEREFORE,
$ THE `OUTPUT(XYPLOT)' SECTION OF THE CASE CONTROL MUST BE USED.
$
XGRID=YES
YGRID=YES
XYPLOT ACCE / 3000(T1)
XLOG= YES
YLOG= YES
$
$ RELATIVE SHOCK RESPONSES ARE CONTAINED IN THE IMAGINARY/PHASE
$ COMPONENTS OF THE OUTPUT
$ ABSOLUTE SHOCK RESPONSES ARE CONTAINED IN THE REAL/MAGNITUDE
$ COMPONENTS OF THE OUTPUT
$
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
ENDDATA
```

The following information is already included in the input file.

- Grid point 3000 at location (0,0,0) and fixed in every direction and rotation except the X direction.
- Mass as a unit mass at grid point 3000
- Integration time step

Step 2. Add the XYplot/XYpunch Commands

Change file name to **soln10A.dat** and add the **XYPLOT/XYPUNCH** commands to graph and save in tabular form the response spectrum (in a pch file) at grid point **3000**, as shown to the right.

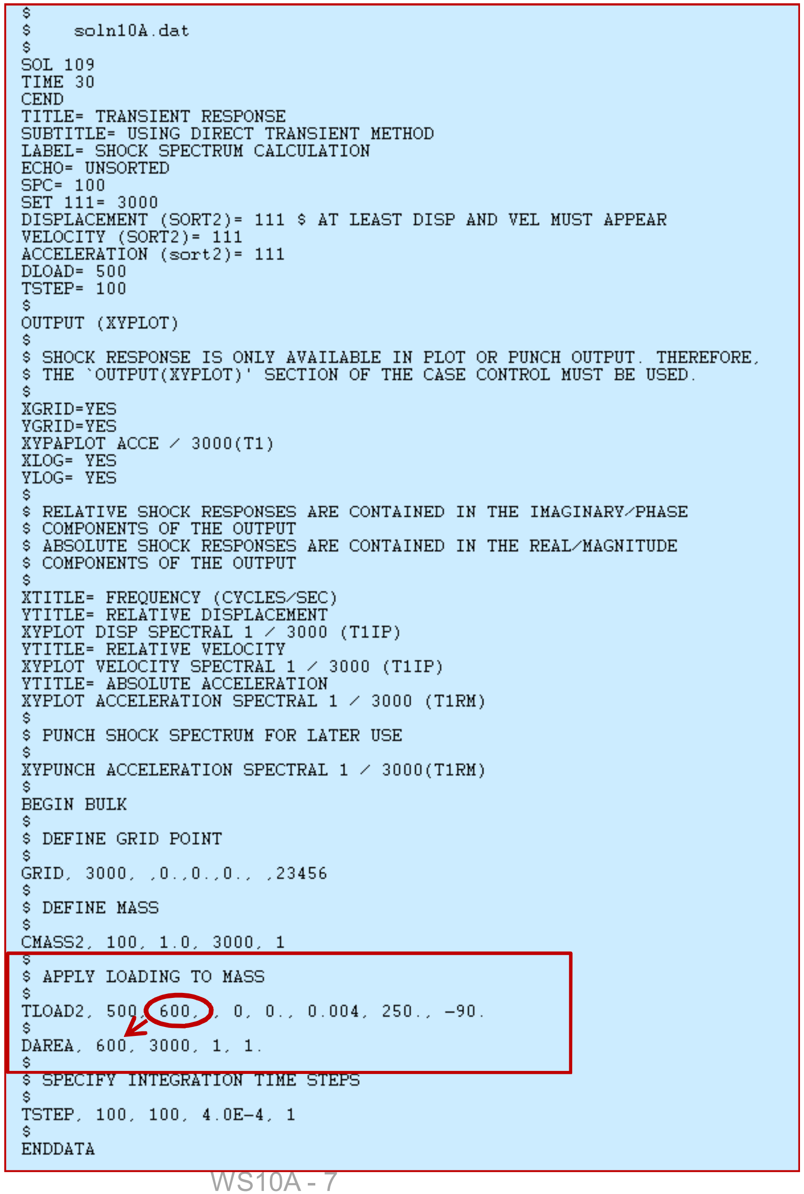


```
$
$    soln10A.dat
$
SOL 109
TIME 30
CEND
TITLE= TRANSIENT RESPONSE
SUBTITLE= USING DIRECT TRANSIENT METHOD
LABEL= SHOCK SPECTRUM CALCULATION
ECHO= UNSORTED
SPC= 100
SET 111= 3000
DISPLACEMENT (SORT2)= 111 $ AT LEAST DISP AND VEL MUST APPEAR
VELOCITY (SORT2)= 111
ACCELERATION (sort2)= 111
DLOAD= 500
TSTEP= 100
$
OUTPUT (XYPLOT)
$
$ SHOCK RESPONSE IS ONLY AVAILABLE IN PLOT OR PUNCH OUTPUT. THEREFORE,
$ THE `OUTPUT(XYPLOT)' SECTION OF THE CASE CONTROL MUST BE USED.
$
XGRID=YES
YGRID=YES
XYPLOT ACCE / 3000(T1)
XLOG= YES
YLOG= YES
$
$ RELATIVE SHOCK RESPONSES ARE CONTAINED IN THE IMAGINARY/PHASE
$ COMPONENTS OF THE OUTPUT
$ ABSOLUTE SHOCK RESPONSES ARE CONTAINED IN THE REAL/MAGNITUDE
$ COMPONENTS OF THE OUTPUT
$
XTITLE= FREQUENCY (CYCLES/SEC)
YTITLE= RELATIVE DISPLACEMENT
XYPLOT DISP SPECTRAL 1 / 3000 (T1IP)
YTITLE= RELATIVE VELOCITY
XYPLOT VELOCITY SPECTRAL 1 / 3000 (T1IP)
YTITLE= ABSOLUTE ACCELERATION
XYPLOT ACCELERATION SPECTRAL 1 / 3000 (T1RM)
$
$ PUNCH SHOCK SPECTRUM FOR LATER USE
$
XYPUNCH ACCELERATION SPECTRAL 1 / 3000(T1RM)
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
ENDDATA
```

Step 3. Add the Time Dependent Load

Add the 2 in/sec^2 sine pulse load at the fixed edge (grid point 3000).

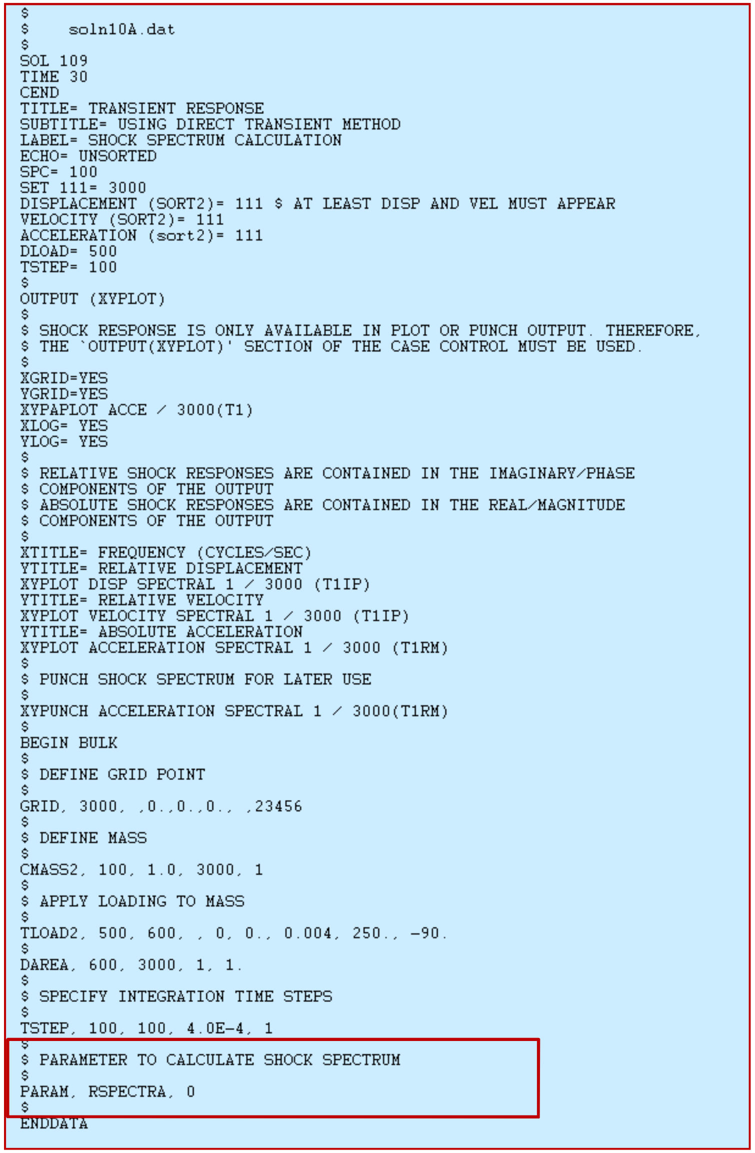
a. Use a **TLOAD2** entry in combination with a **DAREA** and the given information on page WS10A-3:
   - Time = **0 to .004 sec**
   - Frequency = **250 HZ**
   - Phase angle = **-90°**



```
$
$    soln10A.dat
$
SOL 109
TIME 30
CEND
TITLE= TRANSIENT RESPONSE
SUBTITLE= USING DIRECT TRANSIENT METHOD
LABEL= SHOCK SPECTRUM CALCULATION
ECHO= UNSORTED
SPC= 100
SET 111= 3000
DISPLACEMENT (SORT2)= 111 $ AT LEAST DISP AND VEL MUST APPEAR
VELOCITY (SORT2)= 111
ACCELERATION (sort2)= 111
DLOAD= 500
TSTEP= 100
$
OUTPUT (XYPLOT)
$
$ SHOCK RESPONSE IS ONLY AVAILABLE IN PLOT OR PUNCH OUTPUT. THEREFORE,
$ THE `OUTPUT(XYPLOT)' SECTION OF THE CASE CONTROL MUST BE USED.
$
XGRID=YES
YGRID=YES
XYPAPLOT ACCE / 3000(T1)
XLOG= YES
YLOG= YES
$
$ RELATIVE SHOCK RESPONSES ARE CONTAINED IN THE IMAGINARY/PHASE
$ COMPONENTS OF THE OUTPUT
$ ABSOLUTE SHOCK RESPONSES ARE CONTAINED IN THE REAL/MAGNITUDE
$ COMPONENTS OF THE OUTPUT
$
XTITLE= FREQUENCY (CYCLES/SEC)
YTITLE= RELATIVE DISPLACEMENT
XYPLOT DISP SPECTRAL 1 / 3000 (T1IP)
YTITLE= RELATIVE VELOCITY
XYPLOT VELOCITY SPECTRAL 1 / 3000 (T1IP)
YTITLE= ABSOLUTE ACCELERATION
XYPLOT ACCELERATION SPECTRAL 1 / 3000 (T1RM)
$
$ PUNCH SHOCK SPECTRUM FOR LATER USE
$
XYPUNCH ACCELERATION SPECTRAL 1 / 3000(T1RM)
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ APPLY LOADING TO MASS
$
TLOAD2, 500, 600, , 0, 0., 0.004, 250., -90.
$
DAREA, 600, 3000, 1, 1.
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
ENDDATA
```

Step 4. Add the Request for Calculation of Spectra

To request calculation of spectra, use **PARAM, RSPECTRA** with a value of **0** for a transient analysis.

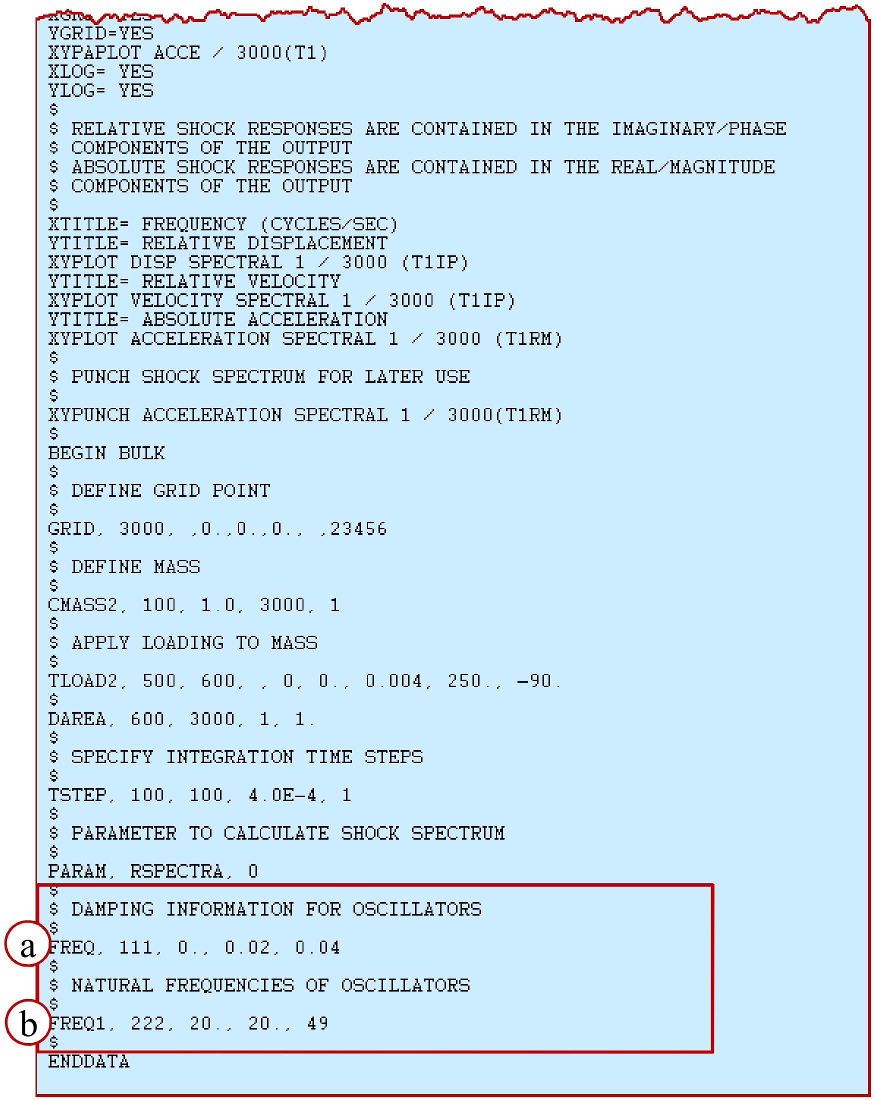


```
$
$    soln10A.dat
$
SOL 109
TIME 30
CEND
TITLE= TRANSIENT RESPONSE
SUBTITLE= USING DIRECT TRANSIENT METHOD
LABEL= SHOCK SPECTRUM CALCULATION
ECHO= UNSORTED
SPC= 100
SET 111= 3000
DISPLACEMENT (SORT2)= 111 $ AT LEAST DISP AND VEL MUST APPEAR
VELOCITY (SORT2)= 111
ACCELERATION (sort2)= 111
DLOAD= 500
TSTEP= 100
$
OUTPUT (XYPLOT)
$
$ SHOCK RESPONSE IS ONLY AVAILABLE IN PLOT OR PUNCH OUTPUT. THEREFORE,
$ THE `OUTPUT(XYPLOT)' SECTION OF THE CASE CONTROL MUST BE USED.
$
XGRID=YES
YGRID=YES
XYPAPLOT ACCE / 3000(T1)
XLOG= YES
YLOG= YES
$
$ RELATIVE SHOCK RESPONSES ARE CONTAINED IN THE IMAGINARY/PHASE
$ COMPONENTS OF THE OUTPUT
$ ABSOLUTE SHOCK RESPONSES ARE CONTAINED IN THE REAL/MAGNITUDE
$ COMPONENTS OF THE OUTPUT
$
XTITLE= FREQUENCY (CYCLES/SEC)
YTITLE= RELATIVE DISPLACEMENT
XYPLOT DISP SPECTRAL 1 / 3000 (T1IP)
YTITLE= RELATIVE VELOCITY
XYPLOT VELOCITY SPECTRAL 1 / 3000 (T1IP)
YTITLE= ABSOLUTE ACCELERATION
XYPLOT ACCELERATION SPECTRAL 1 / 3000 (T1RM)
$
$ PUNCH SHOCK SPECTRUM FOR LATER USE
$
XYPUNCH ACCELERATION SPECTRAL 1 / 3000(T1RM)
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ APPLY LOADING TO MASS
$
TLOAD2, 500, 600, , 0, 0., 0.004, 250., -90.
$
DAREA, 600, 3000, 1, 1.
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
$ PARAMETER TO CALCULATE SHOCK SPECTRUM
$
PARAM, RSPECTRA, 0
$
ENDDATA
```

Step 5. Add Damping and Natural Frequencies

a. Use the entry **FREQ** to specify damping of **0**, **2**, and **4** percent .

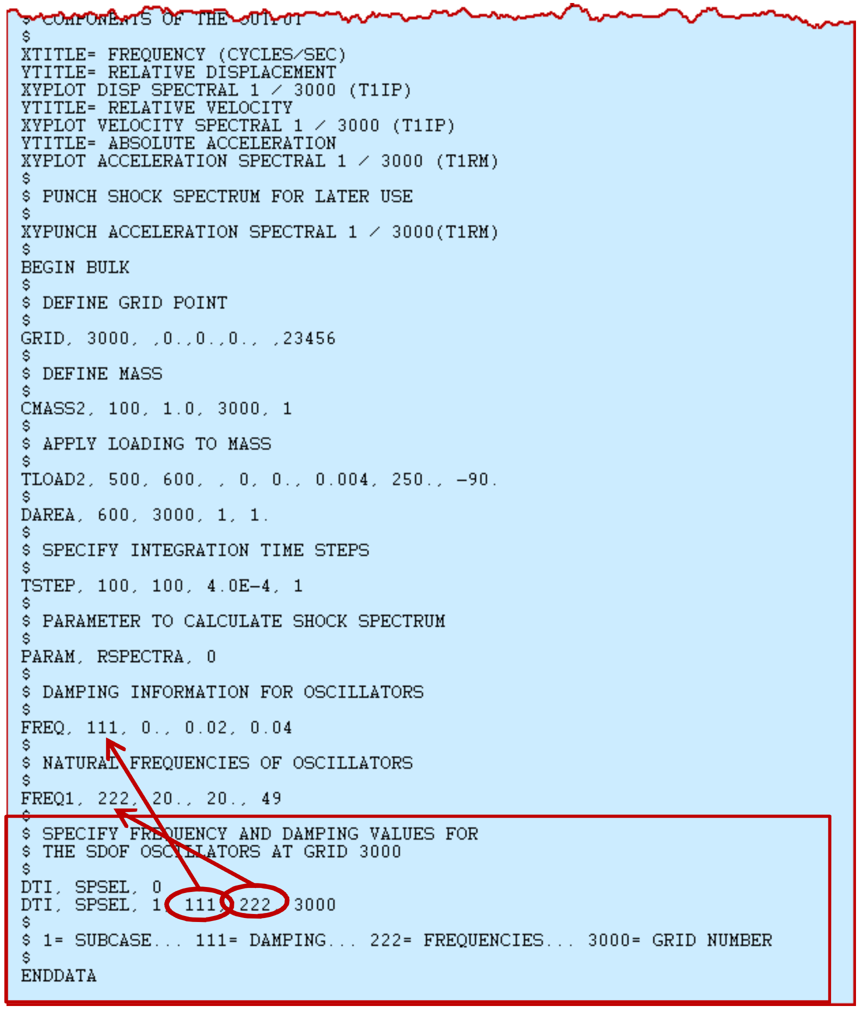
b. Use the **FREQ1** entry to specify the natural frequencies of oscillator.



```
YGRID=YES
XYPAPLOT ACCE / 3000(T1)
XLOG= YES
YLOG= YES
$
$ RELATIVE SHOCK RESPONSES ARE CONTAINED IN THE IMAGINARY/PHASE
$ COMPONENTS OF THE OUTPUT
$ ABSOLUTE SHOCK RESPONSES ARE CONTAINED IN THE REAL/MAGNITUDE
$ COMPONENTS OF THE OUTPUT
$
XTITLE= FREQUENCY (CYCLES/SEC)
YTITLE= RELATIVE DISPLACEMENT
XYPLOT DISP SPECTRAL 1 / 3000 (T1IP)
YTITLE= RELATIVE VELOCITY
XYPLOT VELOCITY SPECTRAL 1 / 3000 (T1IP)
YTITLE= ABSOLUTE ACCELERATION
XYPLOT ACCELERATION SPECTRAL 1 / 3000 (T1RM)
$
$ PUNCH SHOCK SPECTRUM FOR LATER USE
$
XYPUNCH ACCELERATION SPECTRAL 1 / 3000(T1RM)
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ APPLY LOADING TO MASS
$
TLOAD2, 500, 600, , 0, 0., 0.004, 250., -90.
$
DAREA, 600, 3000, 1, 1.
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
$ PARAMETER TO CALCULATE SHOCK SPECTRUM
$
PARAM, RSPECTRA, 0
$
$ DAMPING INFORMATION FOR OSCILLATORS
$
FREQ, 111, 0., 0.02, 0.04
$
$ NATURAL FREQUENCIES OF OSCILLATORS
$
FREQ1, 222, 20., 20., 49
$
ENDDATA
```

Step 6. Add Entry to correlate Frequency and Damping Requests

To correlate the frequency and damping request, use **DTI, SPSEL** entry to specify frequency and damping values for the oscillator at GRID point **3000**.

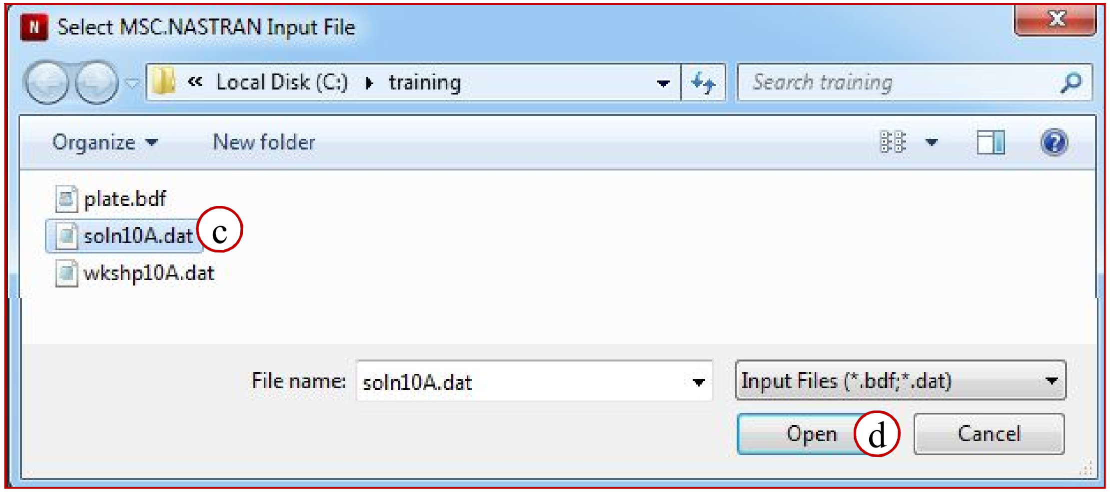


```
$ COMPONENTS OF THE OUTPUT
$
XTITLE= FREQUENCY (CYCLES/SEC)
YTITLE= RELATIVE DISPLACEMENT
XYPLOT DISP SPECTRAL 1 / 3000 (T1IP)
YTITLE= RELATIVE VELOCITY
XYPLOT VELOCITY SPECTRAL 1 / 3000 (T1IP)
YTITLE= ABSOLUTE ACCELERATION
XYPLOT ACCELERATION SPECTRAL 1 / 3000 (T1RM)
$
$ PUNCH SHOCK SPECTRUM FOR LATER USE
$
XYPUNCH ACCELERATION SPECTRAL 1 / 3000(T1RM)
$
BEGIN BULK
$
$ DEFINE GRID POINT
$
GRID, 3000, ,0.,0.,0., ,23456
$
$ DEFINE MASS
$
CMASS2, 100, 1.0, 3000, 1
$
$ APPLY LOADING TO MASS
$
TLOAD2, 500, 600, , 0, 0., 0.004, 250., -90.
$
DAREA, 600, 3000, 1, 1.
$
$ SPECIFY INTEGRATION TIME STEPS
$
TSTEP, 100, 100, 4.0E-4, 1
$
$ PARAMETER TO CALCULATE SHOCK SPECTRUM
$
PARAM, RSPECTRA, 0
$
$ DAMPING INFORMATION FOR OSCILLATORS
$
FREQ, 111, 0., 0.02, 0.04
$
$ NATURAL FREQUENCIES OF OSCILLATORS
$
FREQ1, 222, 20., 20., 49
$
$ SPECIFY FREQUENCY AND DAMPING VALUES FOR
$ THE SDOF OSCILLATORS AT GRID 3000
$
DTI, SPSEL, 0
DTI, SPSEL, 1, 111, 222, 3000
$
$ 1= SUBCASE... 111= DAMPING... 222= FREQUENCIES... 3000= GRID NUMBER
$
ENDDATA
```

Step 7. Save and Run the New Input File

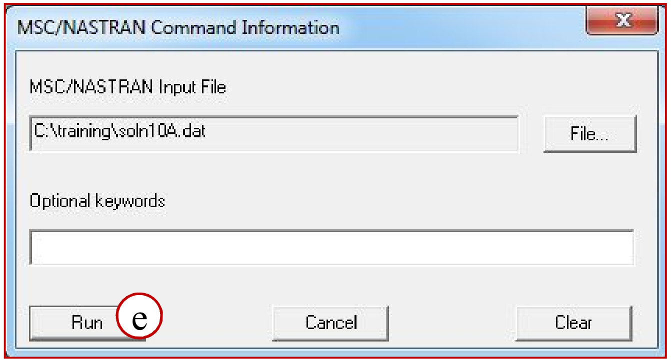
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln10A.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln10A.dat**.
d. Click **Open**.
e. Click **Run**.



File name: soln10A.dat

Input Files (*.bdf;*.dat)

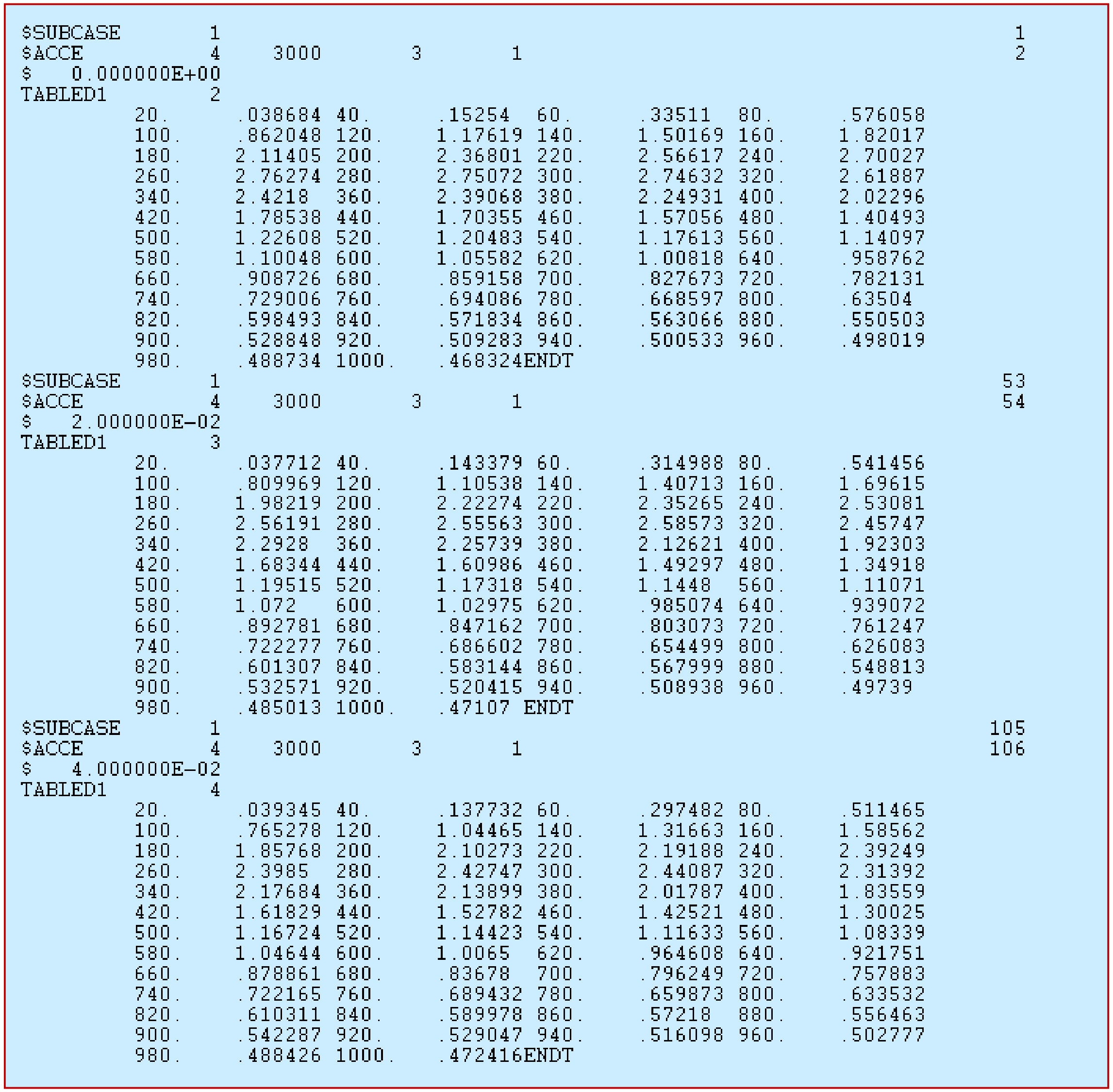


MSC/NASTRAN Input File: C:\training\soln10A.dat

Optional keywords:

Step 8. Review the tabular Results

Open the **soln10A.pch** file to see the tabular results of the acceleration spectra data. This tabular data will be used in the next workshop.

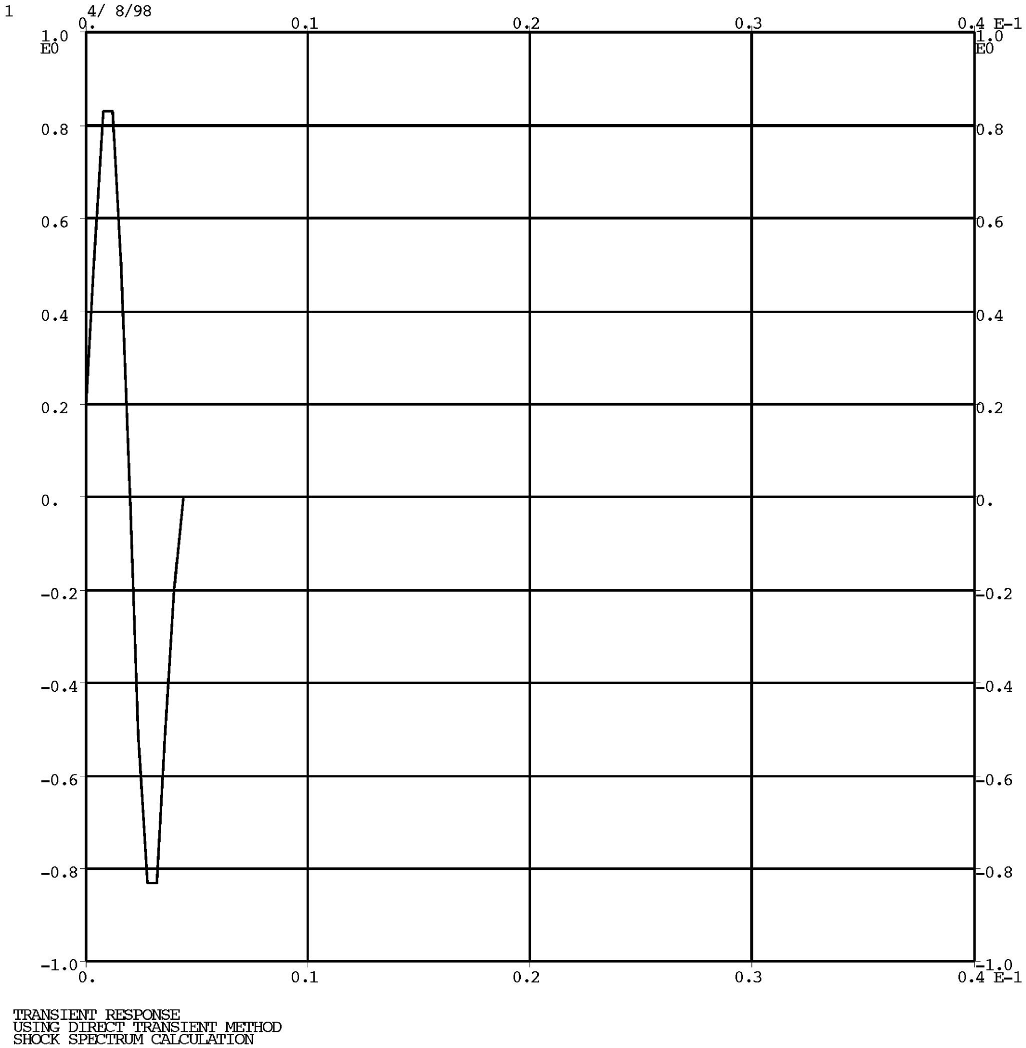


```
$SUBCASE       1                                                               1
$ACCE          4    3000       3       1                                       2
$    0.000000E+00
TABLED1        2
         20.     .038684 40.     .15254  60.     .33511  80.     .576058
         100.    .862048 120.    1.17619 140.    1.50169 160.    1.82017
         180.    2.11405 200.    2.36801 220.    2.56617 240.    2.70027
         260.    2.76274 280.    2.75072 300.    2.74632 320.    2.61887
         340.    2.4218  360.    2.39068 380.    2.24931 400.    2.02296
         420.    1.78538 440.    1.70355 460.    1.57056 480.    1.40493
         500.    1.22608 520.    1.20483 540.    1.17613 560.    1.14097
         580.    1.10048 600.    1.05582 620.    1.00818 640.    .958762
         660.    .908726 680.    .859158 700.    .827673 720.    .782131
         740.    .729006 760.    .694086 780.    .668597 800.    .63504
         820.    .598493 840.    .571834 860.    .563066 880.    .550503
         900.    .528848 920.    .509283 940.    .500533 960.    .498019
         980.    .488734 1000.   .468324ENDT
$SUBCASE       1                                                              53
$ACCE          4    3000       3       1                                      54
$    2.000000E-02
TABLED1        3
         20.     .037712 40.     .143379 60.     .314988 80.     .541456
         100.    .809969 120.    1.10538 140.    1.40713 160.    1.69615
         180.    1.98219 200.    2.22274 220.    2.35265 240.    2.53081
         260.    2.56191 280.    2.55563 300.    2.58573 320.    2.45747
         340.    2.2928  360.    2.25739 380.    2.12621 400.    1.92303
         420.    1.68344 440.    1.60986 460.    1.49297 480.    1.34918
         500.    1.19515 520.    1.17318 540.    1.1448  560.    1.11071
         580.    1.072   600.    1.02975 620.    .985074 640.    .939072
         660.    .892781 680.    .847162 700.    .803073 720.    .761247
         740.    .722277 760.    .686602 780.    .654499 800.    .626083
         820.    .601307 840.    .583144 860.    .567999 880.    .548813
         900.    .532571 920.    .520415 940.    .508938 960.    .49739
         980.    .485013 1000.   .47107 ENDT
$SUBCASE       1                                                             105
$ACCE          4    3000       3       1                                     106
$    4.000000E-02
TABLED1        4
         20.     .039345 40.     .137732 60.     .297482 80.     .511465
         100.    .765278 120.    1.04465 140.    1.31663 160.    1.58562
         180.    1.85768 200.    2.10273 220.    2.19188 240.    2.39249
         260.    2.3985  280.    2.42747 300.    2.44087 320.    2.31392
         340.    2.17684 360.    2.13899 380.    2.01787 400.    1.83559
         420.    1.61829 440.    1.52782 460.    1.42521 480.    1.30025
         500.    1.16724 520.    1.14423 540.    1.11633 560.    1.08339
         580.    1.04644 600.    1.0065  620.    .964608 640.    .921751
         660.    .878861 680.    .83678  700.    .796249 720.    .757883
         740.    .722165 760.    .689432 780.    .659873 800.    .633532
         820.    .610311 840.    .589978 860.    .57218  880.    .556463
         900.    .542287 920.    .529047 940.    .516098 960.    .502777
         980.    .488426 1000.   .472416ENDT
```

Step 9. Review the Graphical Results

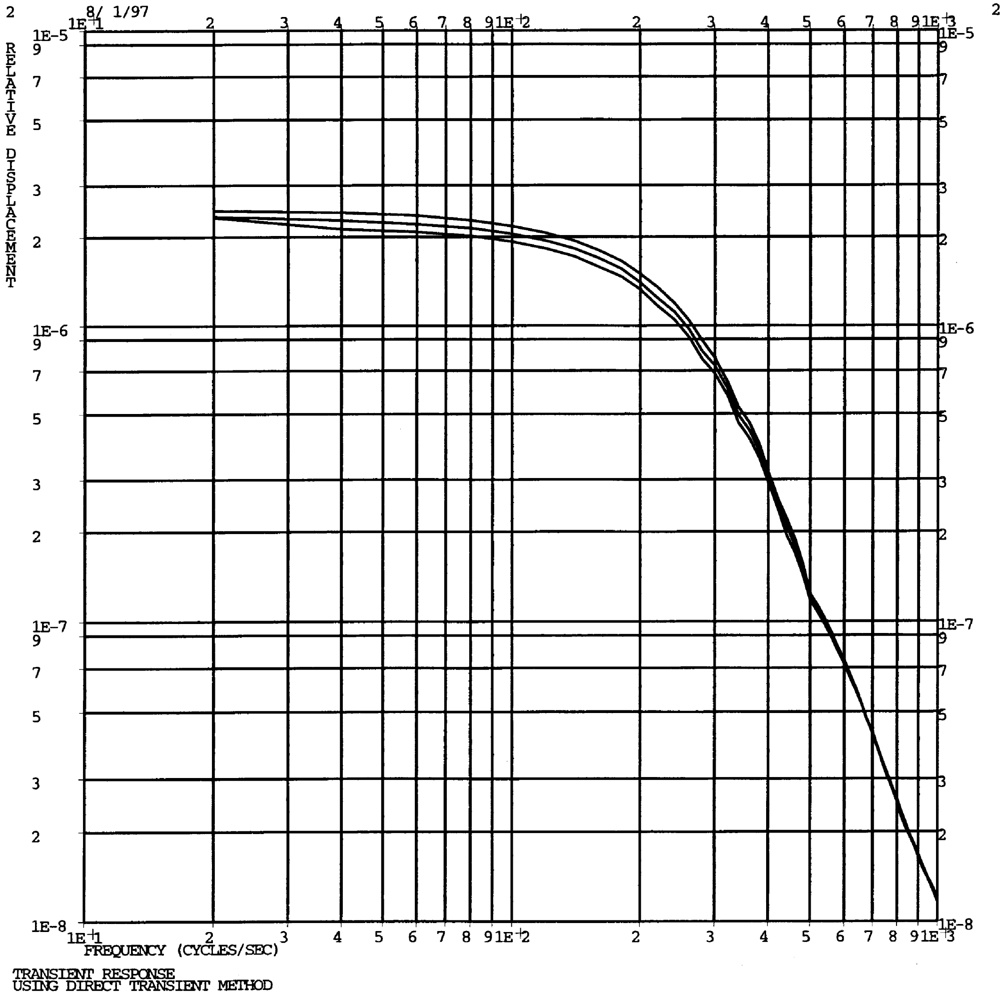
Recall that to obtain the graphs you will need to convert the .plt file to a .ps file, if needed, use the directions given in workshop 4, step 9.

Acceleration shock spectrum with damping = 0



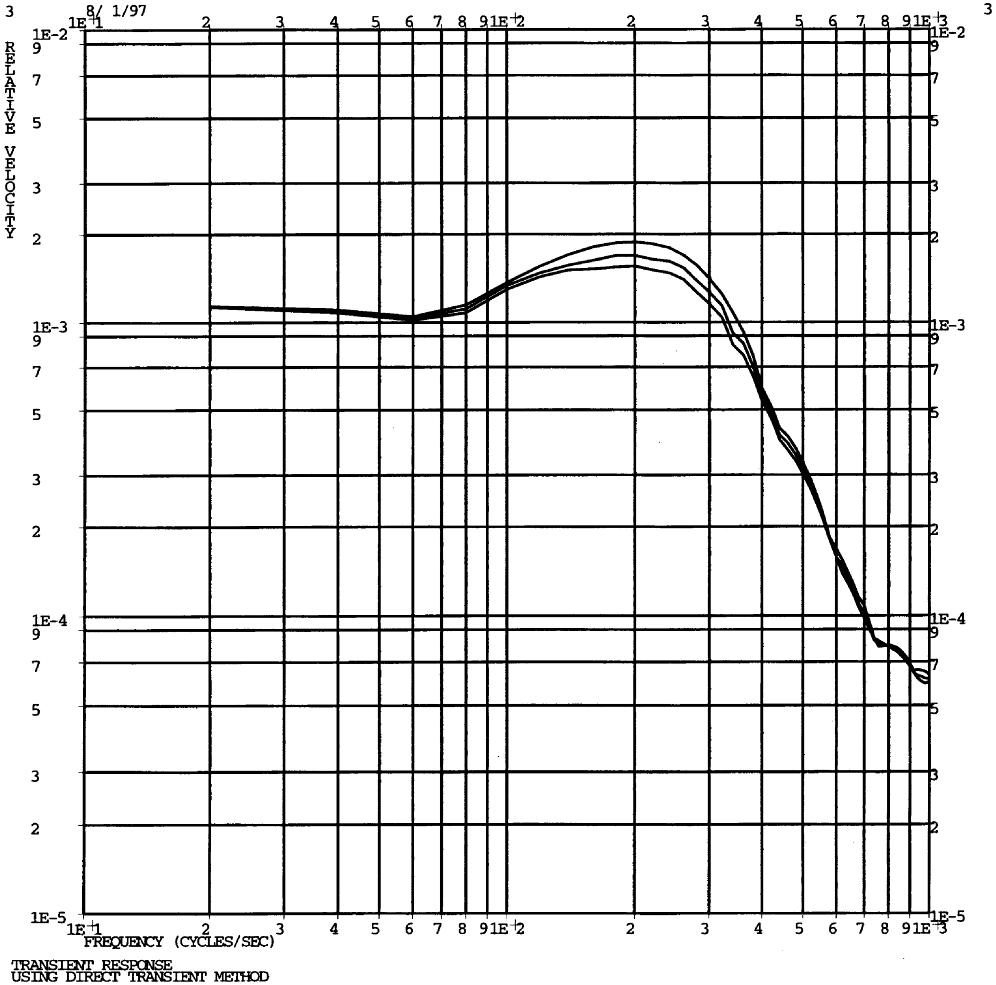
Step 9. Review the Graphical Results (Cont.)

Relative displacement spectral graph



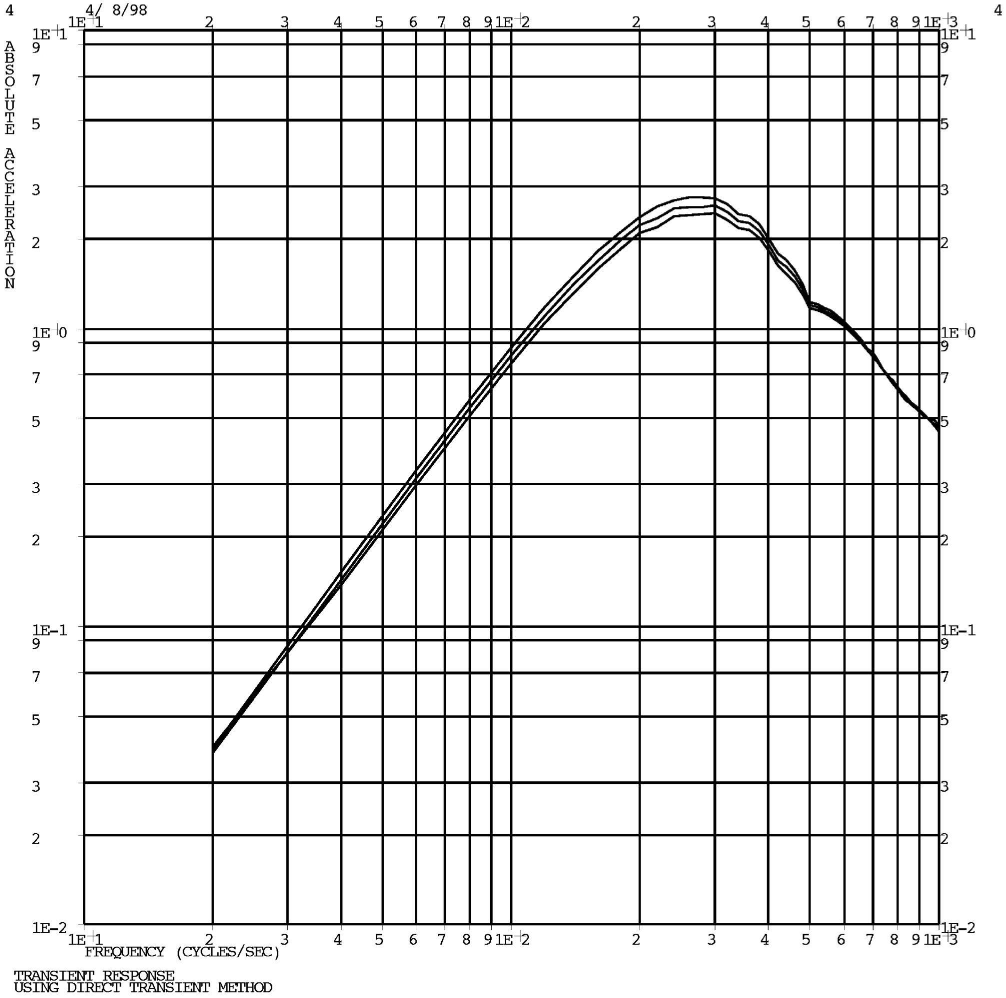
Step 9. Review the Graphical Results (Cont.)

Relative velocity spectral graph



Step 9. Review the Graphical Results (Cont.)

Absolute acceleration spectral graph



WORKSHOP 10B
APPLY THE SHOCK SPECTRUM

- **Workshop Objective**
  - Apply the shock spectrum generated in workshop 10A and sum the response using the SRSS option.

- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp10B.dat

- **Problem Description**
  - This is the second part to a two part workshop. In the first part you should have added to the wkshp10A.dat input file the necessary entries to create the shock spectrum. In this workshop you will use the input file wkshp10B.dat and add the necessary entries to apply the shock spectrum. The data for the tables will come from the soln10a.pch file. Be sure to include modes up to 1000 Hz using 3% critical damping. The model is the plate described in workshop 1.

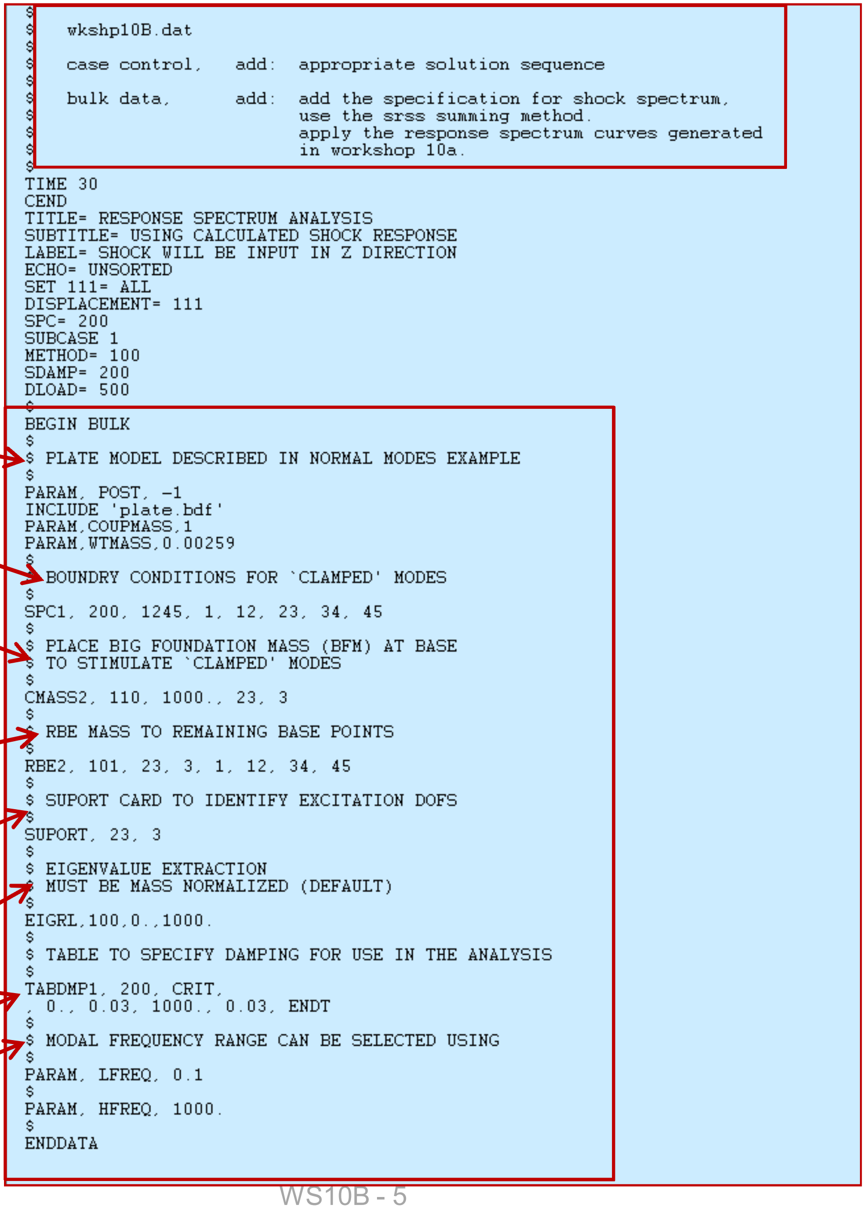
- **Suggested Steps**
  1. Open and review the input file wkshp10B.dat
  2. Add the specification for shock spectrum.
  3. Add Shock tables.
  4. Save and run the new input file in MSC Nastran.
  5. Review the MSC Nastran results using the solution file soln10B.f06.

Step 1. Open and Review Input File wkshp10B.dat

The file wkshp10B.dat is the starting input file to be modified.

The following information is already included in the input file.

- Model information, same as workshop 1.
- Boundary condition for clamped modes
- Foundation 1000 lbs mass at base (grid point 23) to stimulate clamped modes
- RBE mass at remaining points at the base of plate.
- SUPORT entry at Grid point 23, Z-direction
- Lanczos method of Eigenvalue extraction. Frequency range from 0 to 1000.
- 3% critical Modal damping
- Modal frequency range



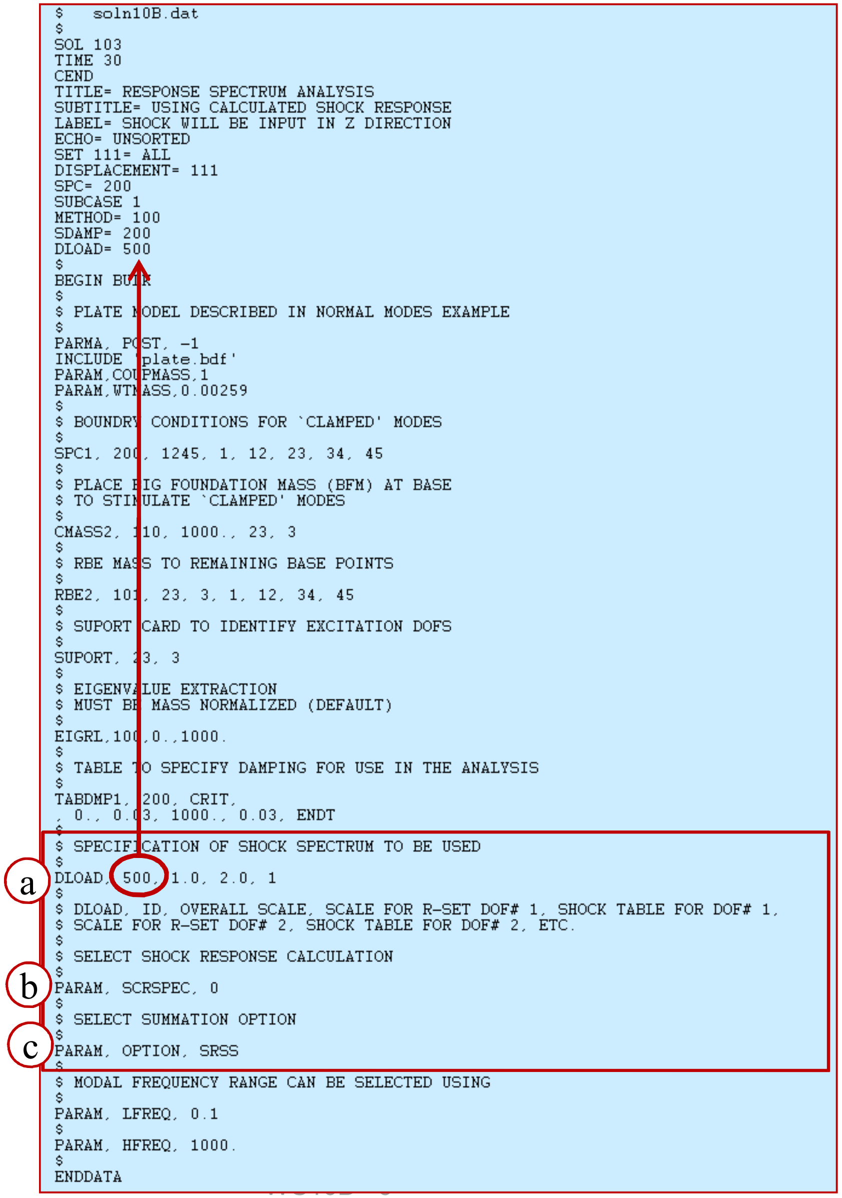
```
$
$   wkshp10B.dat
$
$   case control,    add:   appropriate solution sequence
$
$   bulk data,       add:   add the specification for shock spectrum,
$                           use the srss summing method.
$                           apply the response spectrum curves generated
$                           in workshop 10a.
$
TIME 30
CEND
TITLE= RESPONSE SPECTRUM ANALYSIS
SUBTITLE= USING CALCULATED SHOCK RESPONSE
LABEL= SHOCK WILL BE INPUT IN Z DIRECTION
ECHO= UNSORTED
SET 111= ALL
DISPLACEMENT= 111
SPC= 200
SUBCASE 1
METHOD= 100
SDAMP= 200
DLOAD= 500
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARAM, POST, -1
INCLUDE 'plate.bdf'
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
$
$ BOUNDRY CONDITIONS FOR `CLAMPED' MODES
$
SPC1, 200, 1245, 1, 12, 23, 34, 45
$
$ PLACE BIG FOUNDATION MASS (BFM) AT BASE
$ TO STIMULATE `CLAMPED' MODES
$
CMASS2, 110, 1000., 23, 3
$
$ RBE MASS TO REMAINING BASE POINTS
$
RBE2, 101, 23, 3, 1, 12, 34, 45
$
$ SUPORT CARD TO IDENTIFY EXCITATION DOFS
$
SUPORT, 23, 3
$
$ EIGENVALUE EXTRACTION
$ MUST BE MASS NORMALIZED (DEFAULT)
$
EIGRL,100,0.,1000.
$
$ TABLE TO SPECIFY DAMPING FOR USE IN THE ANALYSIS
$
TABDMP1, 200, CRIT,
, 0., 0.03, 1000., 0.03, ENDT
$
$ MODAL FREQUENCY RANGE CAN BE SELECTED USING
$
PARAM, LFREQ, 0.1
$
PARAM, HFREQ, 1000.
$
ENDDATA
```

Step 2. Add the specification for Shock Spectrum

a. To add specification of shock spectrum use a **DLOAD**. Make sure that the **DLOAD** SID matches the indentification number of the **DLOAD** in the Case Control Section.

b. To select shock response calculation. Set the **PARAM SCRSPEC** to a value of **0**.

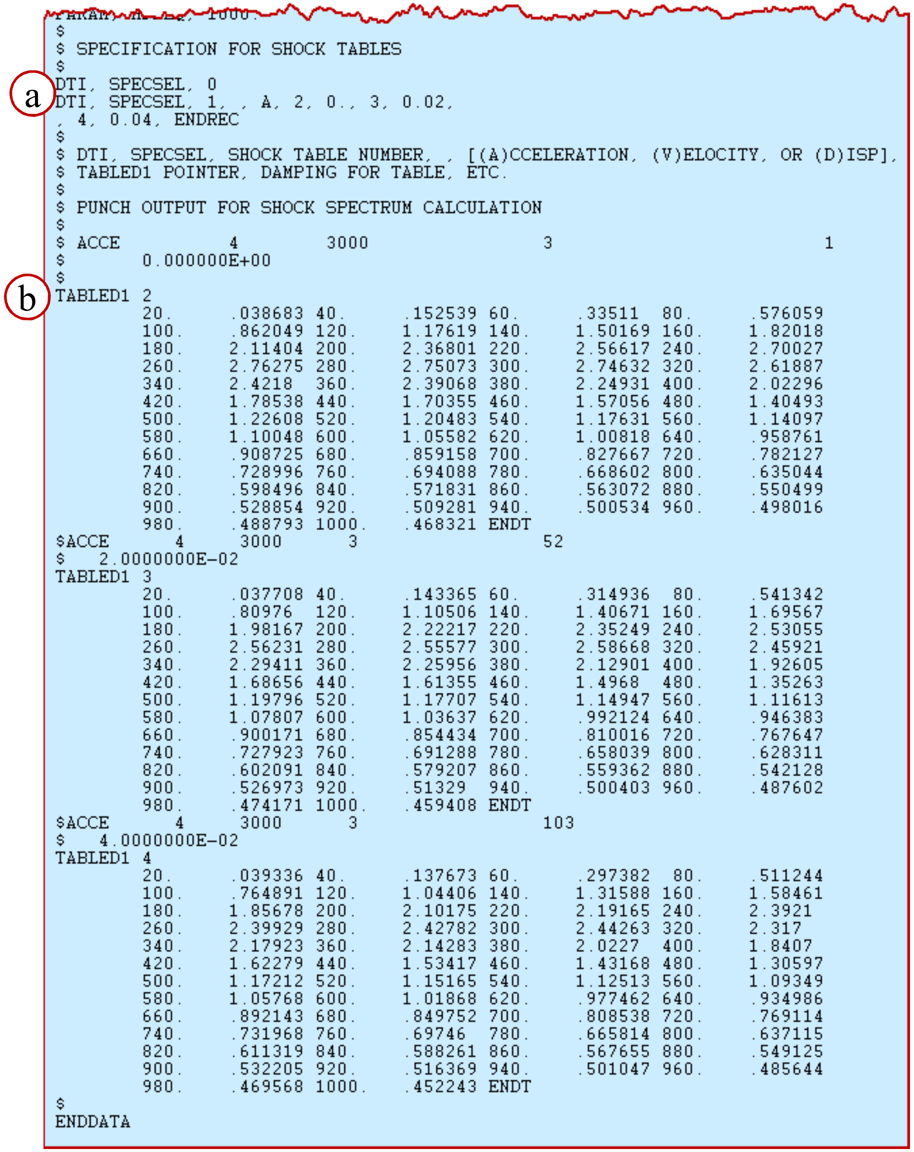
c. Use **PARAM, OPTION, SRSS** to select the SRSS method to combined the modes.



```
$   soln10B.dat
$
SOL 103
TIME 30
CEND
TITLE= RESPONSE SPECTRUM ANALYSIS
SUBTITLE= USING CALCULATED SHOCK RESPONSE
LABEL= SHOCK WILL BE INPUT IN Z DIRECTION
ECHO= UNSORTED
SET 111= ALL
DISPLACEMENT= 111
SPC= 200
SUBCASE 1
METHOD= 100
SDAMP= 200
DLOAD= 500
$
BEGIN BULK
$
$ PLATE MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
PARMA, POST, -1
INCLUDE 'plate.bdf'
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
$
$ BOUNDRY CONDITIONS FOR `CLAMPED' MODES
$
SPC1, 200, 1245, 1, 12, 23, 34, 45
$
$ PLACE BIG FOUNDATION MASS (BFM) AT BASE
$ TO STIMULATE `CLAMPED' MODES
$
CMASS2, 110, 1000., 23, 3
$
$ RBE MASS TO REMAINING BASE POINTS
$
RBE2, 101, 23, 3, 1, 12, 34, 45
$
$ SUPORT CARD TO IDENTIFY EXCITATION DOFS
$
SUPORT, 23, 3
$
$ EIGENVALUE EXTRACTION
$ MUST BE MASS NORMALIZED (DEFAULT)
$
EIGRL,100,0.,1000.
$
$ TABLE TO SPECIFY DAMPING FOR USE IN THE ANALYSIS
$
TABDMP1, 200, CRIT,
, 0., 0.03, 1000., 0.03, ENDT
$
$ SPECIFICATION OF SHOCK SPECTRUM TO BE USED
$
DLOAD, 500, 1.0, 2.0, 1
$
$ DLOAD, ID, OVERALL SCALE, SCALE FOR R-SET DOF# 1, SHOCK TABLE FOR DOF# 1,
$ SCALE FOR R-SET DOF# 2, SHOCK TABLE FOR DOF# 2, ETC.
$
$ SELECT SHOCK RESPONSE CALCULATION
$
PARAM, SCRSPEC, 0
$
$ SELECT SUMMATION OPTION
$
PARAM, OPTION, SRSS
$
$ MODAL FREQUENCY RANGE CAN BE SELECTED USING
$
PARAM, LFREQ, 0.1
$
PARAM, HFREQ, 1000.
$
ENDDATA
```

Step 3. Add Shock Tables

a. First add the specification for the shock tables using **the DTI SPECSEL** entry.
b. To add the shock tables, open the file from the previous workshop **soln10a.pch** and copy the tables to this input file for **TABLED1** TID numbers **2, 3, 4**

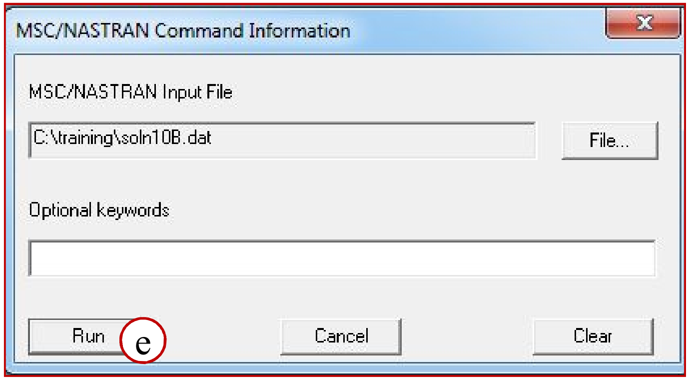


```
$
$ SPECIFICATION FOR SHOCK TABLES
$
DTI, SPECSEL, 0
DTI, SPECSEL, 1, , A, 2, 0., 3, 0.02,
, 4, 0.04, ENDREC
$
$ DTI, SPECSEL, SHOCK TABLE NUMBER, , [(A)CCELERATION, (V)ELOCITY, OR (D)ISP],
$ TABLED1 POINTER, DAMPING FOR TABLE, ETC.
$
$ PUNCH OUTPUT FOR SHOCK SPECTRUM CALCULATION
$
$ ACCE          4        3000                3                         1
$       0.000000E+00
$
TABLED1 2
        20.     .038683 40.     .152539 60.     .33511   80.    .576059
        100.    .862049 120.    1.17619 140.    1.50169 160.    1.82018
        180.    2.11404 200.    2.36801 220.    2.56617 240.    2.70027
        260.    2.76275 280.    2.75073 300.    2.74632 320.    2.61887
        340.    2.4218  360.    2.39068 380.    2.24931 400.    2.02296
        420.    1.78538 440.    1.70355 460.    1.57056 480.    1.40493
        500.    1.22608 520.    1.20483 540.    1.17631 560.    1.14097
        580.    1.10048 600.    1.05582 620.    1.00818 640.    .958761
        660.    .908725 680.    .859158 700.    .827667 720.    .782127
        740.    .728996 760.    .694088 780.    .668602 800.    .635044
        820.    .598496 840.    .571831 860.    .563072 880.    .550499
        900.    .528854 920.    .509281 940.    .500534 960.    .498016
        980.    .488793 1000.   .468321 ENDT
$ACCE      4     3000      3                 52
$   2.0000000E-02
TABLED1 3
        20.     .037708 40.     .143365 60.     .314936  80.    .541342
        100.    .80976  120.    1.10506 140.    1.40671 160.    1.69567
        180.    1.98167 200.    2.22217 220.    2.35249 240.    2.53055
        260.    2.56231 280.    2.55577 300.    2.58668 320.    2.45921
        340.    2.29411 360.    2.25956 380.    2.12901 400.    1.92605
        420.    1.68656 440.    1.61355 460.    1.4968  480.    1.35263
        500.    1.19796 520.    1.17707 540.    1.14947 560.    1.11613
        580.    1.07807 600.    1.03637 620.    .992124 640.    .946383
        660.    .900171 680.    .854434 700.    .810016 720.    .767647
        740.    .727923 760.    .691288 780.    .658039 800.    .628311
        820.    .602091 840.    .579207 860.    .559362 880.    .542128
        900.    .526973 920.    .51329  940.    .500403 960.    .487602
        980.    .474171 1000.   .459408 ENDT
$ACCE      4     3000      3                 103
$   4.0000000E-02
TABLED1 4
        20.     .039336 40.     .137673 60.     .297382  80.    .511244
        100.    .764891 120.    1.04406 140.    1.31588 160.    1.58461
        180.    1.85678 200.    2.10175 220.    2.19165 240.    2.3921
        260.    2.39929 280.    2.42782 300.    2.44263 320.    2.317
        340.    2.17923 360.    2.14283 380.    2.0227  400.    1.8407
        420.    1.62279 440.    1.53417 460.    1.43168 480.    1.30597
        500.    1.17212 520.    1.15165 540.    1.12513 560.    1.09349
        580.    1.05768 600.    1.01868 620.    .977462 640.    .934986
        660.    .892143 680.    .849752 700.    .808538 720.    .769114
        740.    .731968 760.    .69746  780.    .665814 800.    .637115
        820.    .611319 840.    .588261 860.    .567655 880.    .549125
        900.    .532205 920.    .516369 940.    .501047 960.    .485644
        980.    .469568 1000.   .452243 ENDT
$
ENDDATA
```

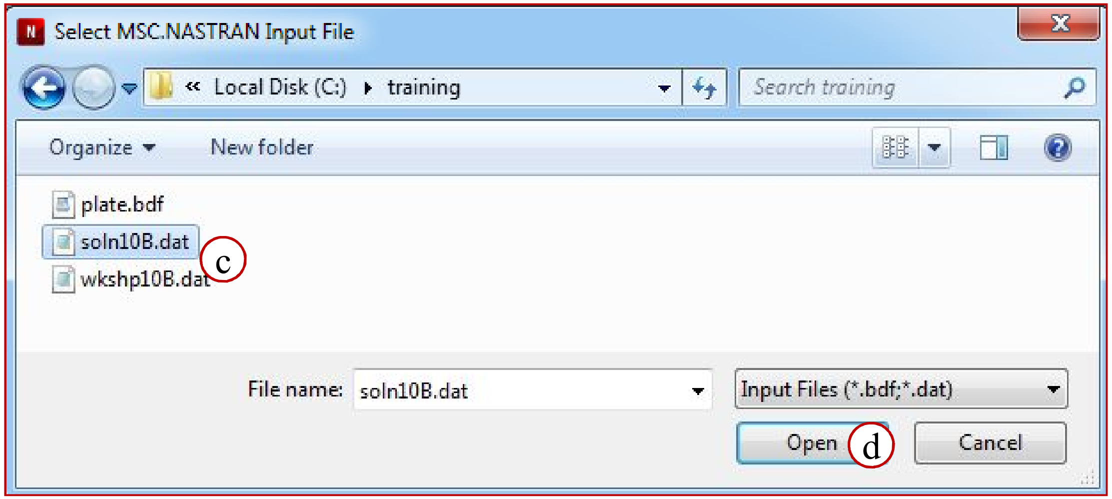
Step 4. Save and Run the New Input File

Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln10B.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln10B.dat**.
d. Click **Open**.
e. Click **Run**.



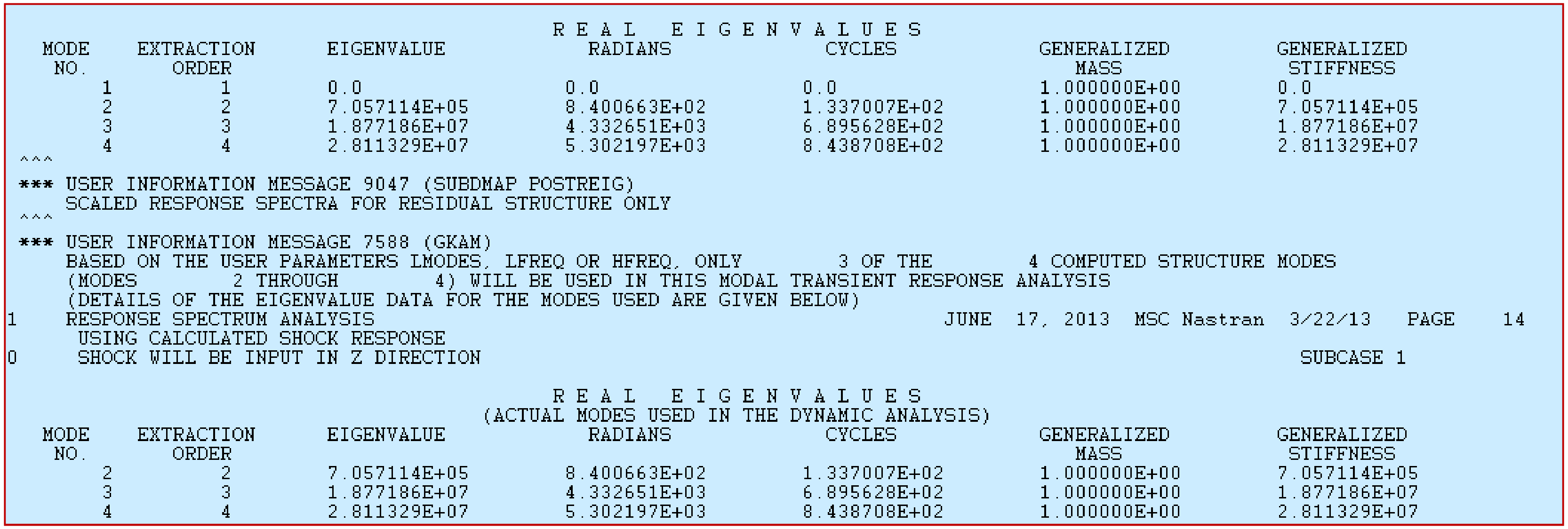
MSC/NASTRAN Input File
C:\training\soln10B.dat



File name: soln10B.dat
Input Files (*.bdf;*.dat)

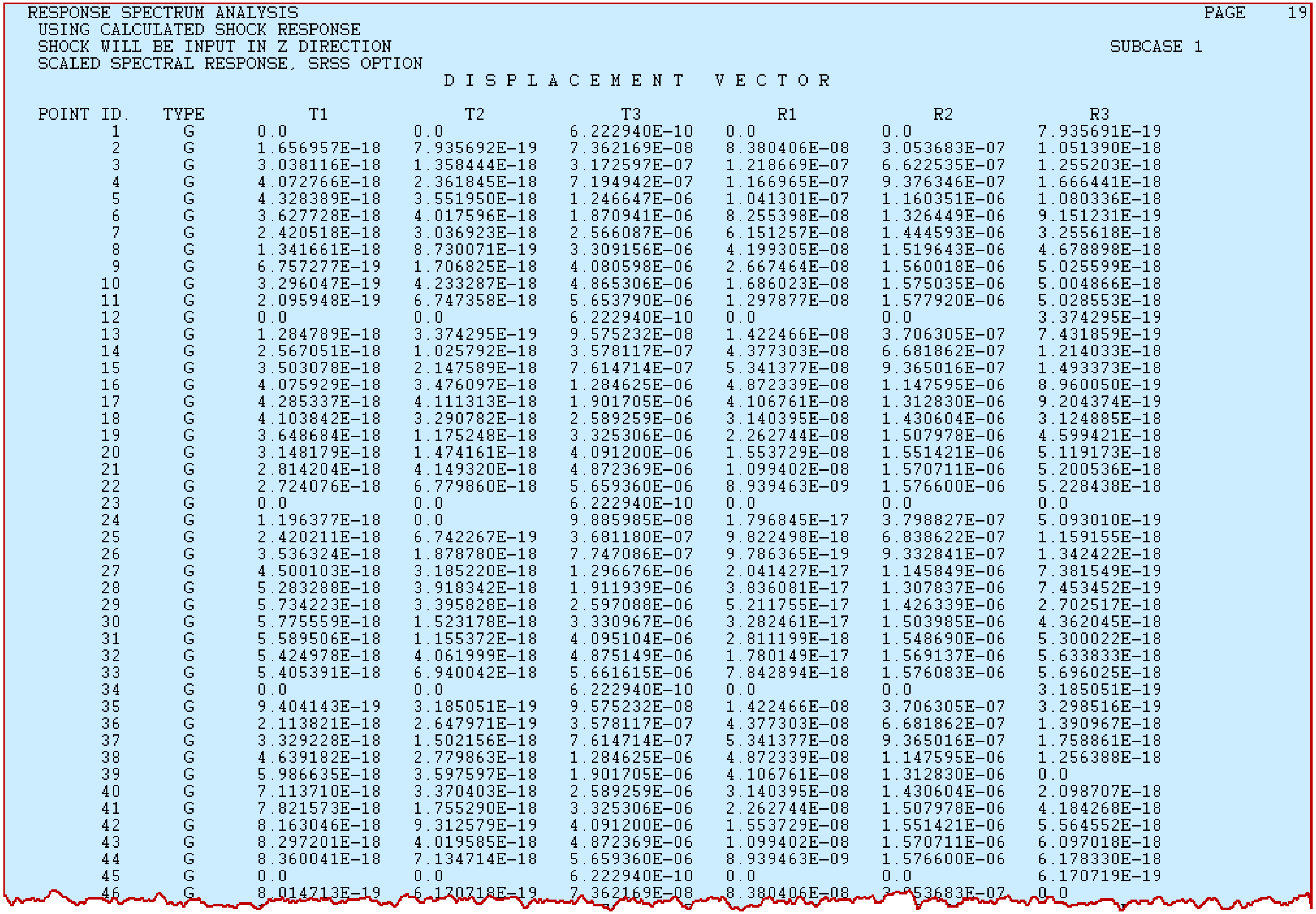
Step 5. Review the Results in the Solution File

To review the results open the soln10b.f06 file.



```
                                              R E A L   E I G E N V A L U E S
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        1         1        0.0                 0.0                 0.0                 1.000000E+00        0.0
        2         2        7.057114E+05        8.400663E+02        1.337007E+02        1.000000E+00        7.057114E+05
        3         3        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
        4         4        2.811329E+07        5.302197E+03        8.438708E+02        1.000000E+00        2.811329E+07
 ^^^
 *** USER INFORMATION MESSAGE 9047 (SUBDMAP POSTREIG)
     SCALED RESPONSE SPECTRA FOR RESIDUAL STRUCTURE ONLY
 ^^^
 *** USER INFORMATION MESSAGE 7588 (GKAM)
     BASED ON THE USER PARAMETERS LMODES, LFREQ OR HFREQ, ONLY        3 OF THE        4 COMPUTED STRUCTURE MODES
     (MODES        2 THROUGH        4) WILL BE USED IN THIS MODAL TRANSIENT RESPONSE ANALYSIS
     (DETAILS OF THE EIGENVALUE DATA FOR THE MODES USED ARE GIVEN BELOW)
1    RESPONSE SPECTRUM ANALYSIS                                                 JUNE  17, 2013  MSC Nastran  3/22/13   PAGE    14
      USING CALCULATED SHOCK RESPONSE
0     SHOCK WILL BE INPUT IN Z DIRECTION                                                                     SUBCASE 1

                                              R E A L   E I G E N V A L U E S
                                        (ACTUAL MODES USED IN THE DYNAMIC ANALYSIS)
   MODE    EXTRACTION      EIGENVALUE            RADIANS             CYCLES            GENERALIZED         GENERALIZED
    NO.       ORDER                                                                       MASS              STIFFNESS
        2         2        7.057114E+05        8.400663E+02        1.337007E+02        1.000000E+00        7.057114E+05
        3         3        1.877186E+07        4.332651E+03        6.895628E+02        1.000000E+00        1.877186E+07
        4         4        2.811329E+07        5.302197E+03        8.438708E+02        1.000000E+00        2.811329E+07
```

Step 5. Review the Results in the Solution File (Cont.)



```
RESPONSE SPECTRUM ANALYSIS                                                                        PAGE    19
 USING CALCULATED SHOCK RESPONSE
 SHOCK WILL BE INPUT IN Z DIRECTION                                                      SUBCASE 1
 SCALED SPECTRAL RESPONSE, SRSS OPTION
                                        D I S P L A C E M E N T   V E C T O R

 POINT ID.   TYPE          T1             T2             T3             R1             R2             R3
         1      G     0.0            0.0            6.222940E-10   0.0            0.0            7.935691E-19
         2      G     1.656957E-18   7.935692E-19   7.362169E-08   8.380406E-08   3.053683E-07   1.051390E-18
         3      G     3.038116E-18   1.358444E-18   3.172597E-07   1.218669E-07   6.622535E-07   1.255203E-18
         4      G     4.072766E-18   2.361845E-18   7.194942E-07   1.166965E-07   9.376346E-07   1.666441E-18
         5      G     4.328389E-18   3.551950E-18   1.246647E-06   1.041301E-07   1.160351E-06   1.080336E-18
         6      G     3.627728E-18   4.017596E-18   1.870941E-06   8.255398E-08   1.326449E-06   9.151231E-19
         7      G     2.420518E-18   3.036923E-18   2.566087E-06   6.151257E-08   1.444593E-06   3.255618E-18
         8      G     1.341661E-18   8.730071E-19   3.309156E-06   4.199305E-08   1.519643E-06   4.678898E-18
         9      G     6.757277E-19   1.706825E-18   4.080598E-06   2.667464E-08   1.560018E-06   5.025599E-18
        10      G     3.296047E-19   4.233287E-18   4.865306E-06   1.686023E-08   1.575035E-06   5.004866E-18
        11      G     2.095948E-19   6.747358E-18   5.653790E-06   1.297877E-08   1.577920E-06   5.028553E-18
        12      G     0.0            0.0            6.222940E-10   0.0            0.0            3.374295E-19
        13      G     1.284789E-18   3.374295E-19   9.575232E-08   1.422466E-08   3.706305E-07   7.431859E-19
        14      G     2.567051E-18   1.025792E-18   3.578117E-07   4.377303E-08   6.681862E-07   1.214033E-18
        15      G     3.503078E-18   2.147589E-18   7.614714E-07   5.341377E-08   9.365016E-07   1.493373E-18
        16      G     4.075929E-18   3.476097E-18   1.284625E-06   4.872339E-08   1.147595E-06   8.960050E-19
        17      G     4.285337E-18   4.111313E-18   1.901705E-06   4.106761E-08   1.312830E-06   9.204374E-19
        18      G     4.103842E-18   3.290782E-18   2.589259E-06   3.140395E-08   1.430604E-06   3.124885E-18
        19      G     3.648684E-18   1.175248E-18   3.325306E-06   2.262744E-08   1.507978E-06   4.599421E-18
        20      G     3.148179E-18   1.474161E-18   4.091200E-06   1.553729E-08   1.551421E-06   5.119173E-18
        21      G     2.814204E-18   4.149320E-18   4.872369E-06   1.099402E-08   1.570711E-06   5.200536E-18
        22      G     2.724076E-18   6.779860E-18   5.659360E-06   8.939463E-09   1.576600E-06   5.228438E-18
        23      G     0.0            0.0            6.222940E-10   0.0            0.0            0.0
        24      G     1.196377E-18   0.0            9.885985E-08   1.796845E-17   3.798827E-07   5.093010E-19
        25      G     2.420211E-18   6.742267E-19   3.681180E-07   9.822498E-18   6.838622E-07   1.159155E-18
        26      G     3.536324E-18   1.878780E-18   7.747086E-07   9.786365E-19   9.332841E-07   1.342422E-18
        27      G     4.500103E-18   3.185220E-18   1.296676E-06   2.041427E-17   1.145849E-06   7.381549E-19
        28      G     5.283288E-18   3.918342E-18   1.911939E-06   3.836081E-17   1.307837E-06   7.453452E-19
        29      G     5.734223E-18   3.395828E-18   2.597088E-06   5.211755E-17   1.426339E-06   2.702517E-18
        30      G     5.775559E-18   1.523178E-18   3.330967E-06   3.282461E-17   1.503985E-06   4.362045E-18
        31      G     5.589506E-18   1.155372E-18   4.095104E-06   2.811199E-18   1.548690E-06   5.300022E-18
        32      G     5.424978E-18   4.061999E-18   4.875149E-06   1.780149E-17   1.569137E-06   5.633833E-18
        33      G     5.405391E-18   6.940042E-18   5.661615E-06   7.842894E-18   1.576083E-06   5.696025E-18
        34      G     0.0            0.0            6.222940E-10   0.0            0.0            3.185051E-19
        35      G     9.404143E-19   3.185051E-19   9.575232E-08   1.422466E-08   3.706305E-07   3.298516E-19
        36      G     2.113821E-18   2.647971E-19   3.578117E-07   4.377303E-08   6.681862E-07   1.390967E-18
        37      G     3.329228E-18   1.502156E-18   7.614714E-07   5.341377E-08   9.365016E-07   1.758861E-18
        38      G     4.639182E-18   2.779863E-18   1.284625E-06   4.872339E-08   1.147595E-06   1.256388E-18
        39      G     5.986635E-18   3.597597E-18   1.901705E-06   4.106761E-08   1.312830E-06   0.0
        40      G     7.113710E-18   3.370403E-18   2.589259E-06   3.140395E-08   1.430604E-06   2.098707E-18
        41      G     7.821573E-18   1.755290E-18   3.325306E-06   2.262744E-08   1.507978E-06   4.184268E-18
        42      G     8.163046E-18   9.312579E-19   4.091200E-06   1.553729E-08   1.551421E-06   5.564552E-18
        43      G     8.297201E-18   4.019585E-18   4.872369E-06   1.099402E-08   1.570711E-06   6.097018E-18
        44      G     8.360041E-18   7.134714E-18   5.659360E-06   8.939463E-09   1.576600E-06   6.178330E-18
        45      G     0.0            0.0            6.222940E-10   0.0            0.0            6.170719E-19
        46      G     8.014713E-19   6.170718E-19   7.362169E-08   8.380406E-08   3.053683E-07   0.0
```

WORKSHOP 11
RANDOM RESPONSE WITH SINGLE INPUT

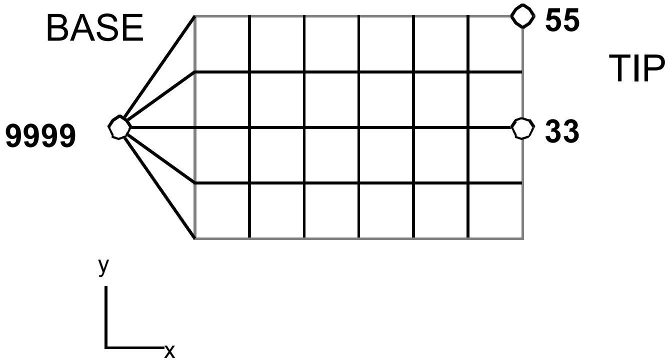
- **Workshop Objective**
  - For the plate (from workshop 1) with a base motion in the z-direction (described on the next page), determine the acceleration PSD response at the drive point (grid point 9999) and at the corner and center of the tip of the plate (grid points 33 and 55).

- **Software Version**
  - MSC Nastran 2013

- **Files Required**
  - plate.bdf
  - wkshp11.dat

- **Problem Description Continued:**
  - Apply the base a motion in the z-direction to the plate using the power spectral density, (PSD) described on the next page.

Problem Description Continued



Autospectra of the Base Excitation	
Frequency (Hz)	**G2/Hz**
20	0.1
30	1
100	1
500	0.1
1000	0.1

- Connect the base of the plate with an RBE2 to grid point 9999 and apply the enforced motion at grid point 9999
- Use a modal solution.
- Assume a constant critical damping ratio of 3% across the whole frequency range.
- Use a log-log input for the PSD.
- Determine the acceleration PSD response at the drive point (grid point 9999) and at the corner and center of the tip (grid points 33 and 55)
- Request output in both print and xyplot format

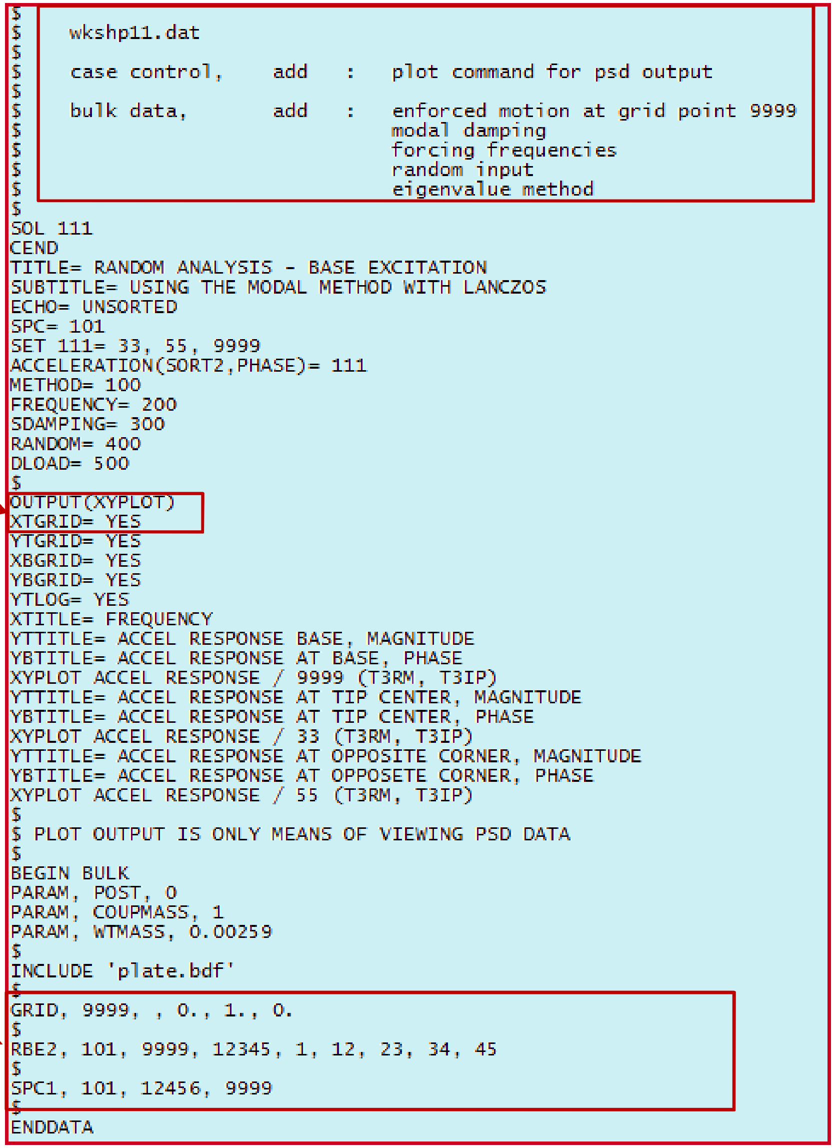
- **Suggested Steps**
  1. Open and review the input file wkshp11.dat.
  2. Add output plots for PSD data.
  3. Add Eigenvalue method.
  4. Add Modal damping.
  5. Add enforced motion at Grid point 9999.
  6. Add the frequency steps.
  7. Add the spectral density.
  8. Save and run the new input file in MSC Nastran.
  9. Review the MSC Nastran results using the solution file soln11.f06.
  10. Review the graph results.

Step 1. Open and Review Input File wkshp11.dat

This is the starting input file to be modified.

Plot a logarithmic y-axis

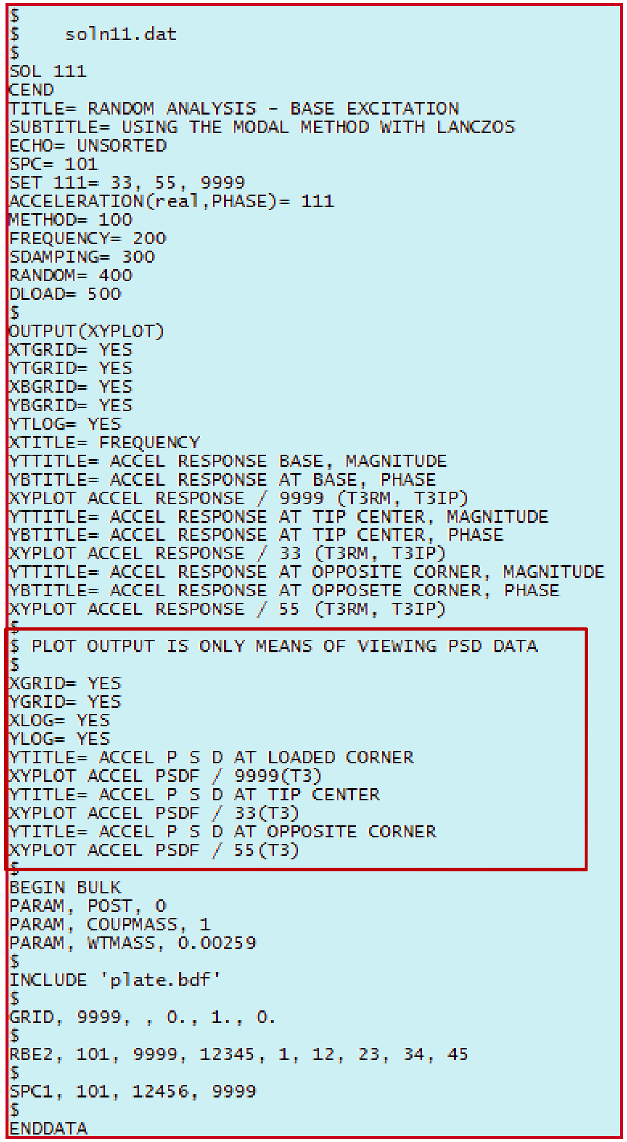
Grid point 9999 is
already defined



```
$
$    wkshp11.dat
$
$    case control,     add    :    plot command for psd output
$
$    bulk data,        add    :    enforced motion at grid point 9999
$                                  modal damping
$                                  forcing frequencies
$                                  random input
$                                  eigenvalue method
$
SOL 111
CEND
TITLE= RANDOM ANALYSIS - BASE EXCITATION
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 101
SET 111= 33, 55, 9999
ACCELERATION(SORT2,PHASE)= 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSETE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
ENDDATA
```

Step 2. Add Output Plots for PSD Data

Add the XY Plot commands to print plots of the PSD data at the loaded base point (grid 9999), at tip center (grid 33) and at tip corner (grid 55) as shown to the right.



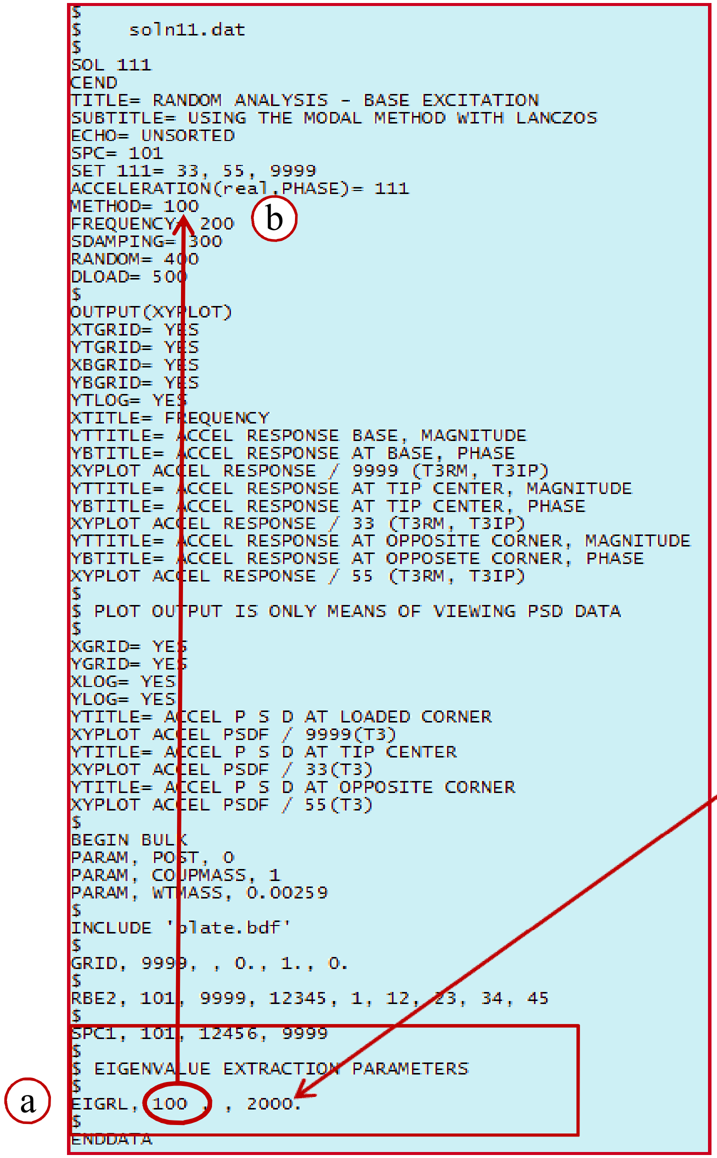
```
$
$    soln11.dat
$
SOL 111
CEND
TITLE= RANDOM ANALYSIS - BASE EXCITATION
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 101
SET 111= 33, 55, 9999
ACCELERATION(real,PHASE)= 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSETE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= ACCEL P S D AT LOADED CORNER
XYPLOT ACCEL PSDF / 9999(T3)
YTITLE= ACCEL P S D AT TIP CENTER
XYPLOT ACCEL PSDF / 33(T3)
YTITLE= ACCEL P S D AT OPPOSITE CORNER
XYPLOT ACCEL PSDF / 55(T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
ENDDATA
```

Step 3. Add the Eigenvalue Method

To add the eigenvalue Method:

a. Use the **EIGRL** entry with a frequency range of interest from **0 to 2000**. (see note below)

b. Make sure that the **METHOD** Case Control command identification number matches the **EIGRL** SID.



```
$
$    soln11.dat
$
SOL 111
CEND
TITLE= RANDOM ANALYSIS - BASE EXCITATION
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 101
SET 111= 33, 55, 9999
ACCELERATION(real,PHASE)= 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSETE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= ACCEL P S D AT LOADED CORNER
XYPLOT ACCEL PSDF / 9999(T3)
YTITLE= ACCEL P S D AT TIP CENTER
XYPLOT ACCEL PSDF / 33(T3)
YTITLE= ACCEL P S D AT OPPOSITE CORNER
XYPLOT ACCEL PSDF / 55(T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100 , , 2000.
$
ENDDATA
```

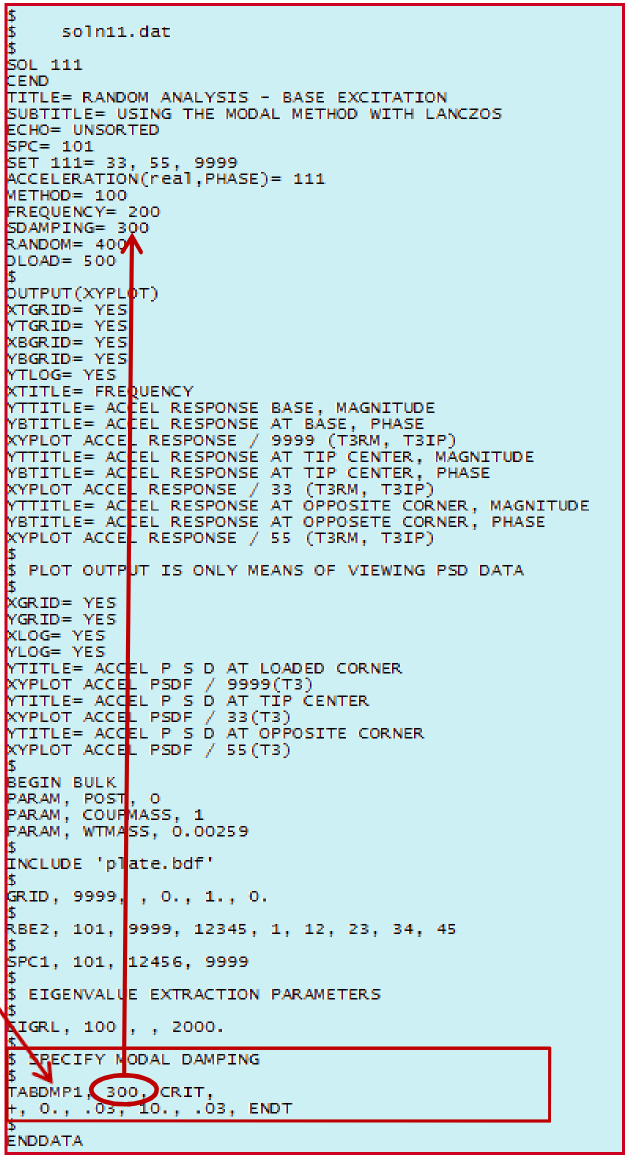
The frequency range here just needs to be larger than the frequency range of the base excitation.

Step 4. Add Modal Damping

To add a constant critical damping ratio of 3% across the whole frequency range

a. Use the **TABDMP1** entry
   - TID = **300** (note must match identification number from SDAMPING in Case Control)
   - Type = **CRIT**
   - First Natural Freq. = **0.0**
   - Damping Value = **.03**
   - Last Natural Freq.= **10.0** (see note below)
   - Damping Value = **.03**

Tables in MSC Nastran are extrapolated. Since in this case, the table represents a straight line, then any two points on that line will work.



```
$
$    soln11.dat
$
SOL 111
CEND
TITLE= RANDOM ANALYSIS - BASE EXCITATION
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 101
SET 111= 33, 55, 9999
ACCELERATION(real,PHASE)= 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSETE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= ACCEL P S D AT LOADED CORNER
XYPLOT ACCEL PSDF / 9999(T3)
YTITLE= ACCEL P S D AT TIP CENTER
XYPLOT ACCEL PSDF / 33(T3)
YTITLE= ACCEL P S D AT OPPOSITE CORNER
XYPLOT ACCEL PSDF / 55(T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100 , , 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
ENDDATA
```

ⓐ

Step 5. Add Enforced Motion at Base of Plate

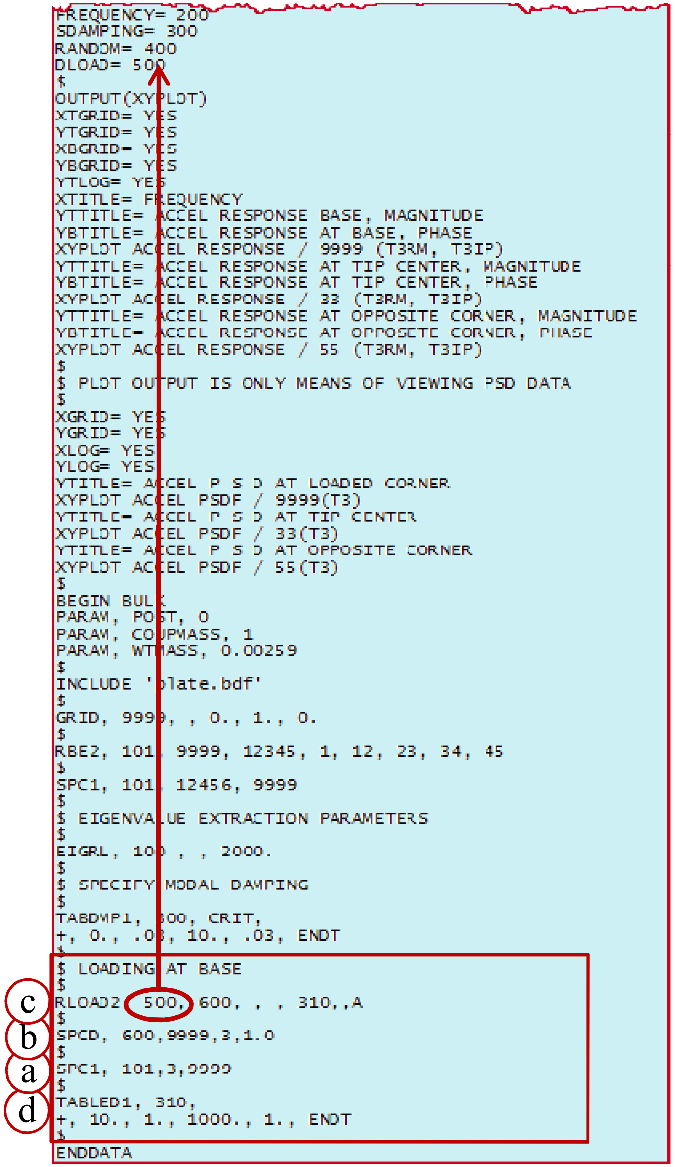
Apply at the base a motion in the z-direction using the given power spectral density, (PSD).

a. **SPC1** – grid point 9999, z direction.

b. **SPCD** – Apply enforced motion to point 9999 in z direction.

c. **RLOAD 2** – define excitation as enforced acceleration and point to **SPCD** and **TABLED1**. Make sure the SID for the **RLOAD2** entry matches the identification number for the **DLOAD** in the Case Control section.

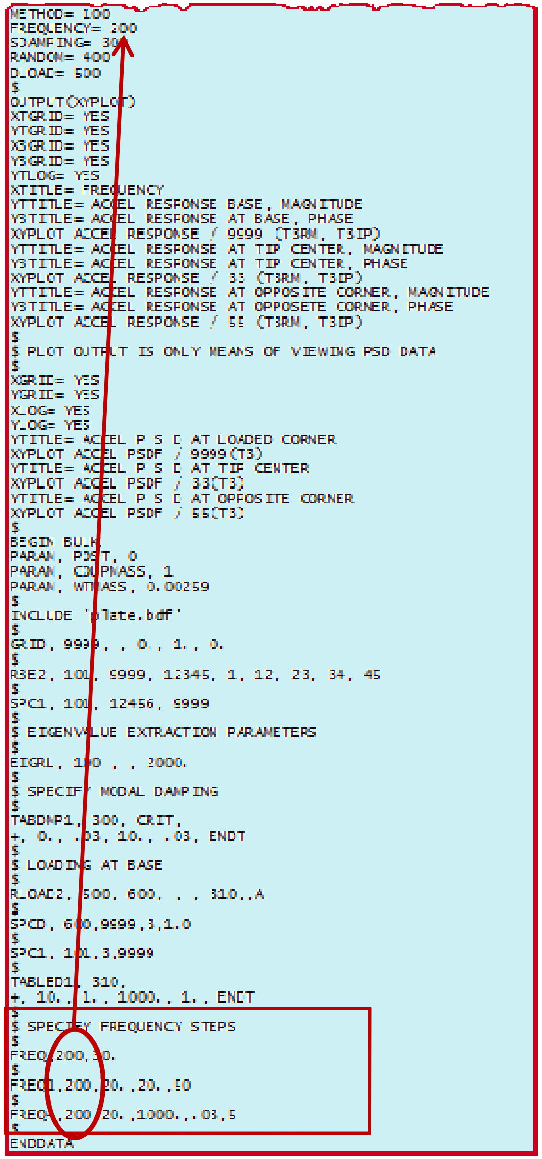
d. **TABLED1** – add frequencies for loading.



```
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= ACCEL P S D AT LOADED CORNER
XYPLOT ACCEL PSDF / 9999(T3)
YTITLE= ACCEL P S D AT TIP CENTER
XYPLOT ACCEL PSDF / 33(T3)
YTITLE= ACCEL P S D AT OPPOSITE CORNER
XYPLOT ACCEL PSDF / 55(T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100 , , 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ LOADING AT BASE
$
RLOAD2  500, 600, , , 310,,A
$
SPCD, 600,9999,3,1.0
$
SPC1, 101,3,9999
$
TABLED1, 310,
+, 10., 1., 1000., 1., ENDT
$
ENDDATA
```

Step 6. Add Frequency Steps

Make sure the SIDs for the **FREQ**, **FREQ1**, **FREQ4** steps matches the **FREQUENCY** identification number in the Case Control section.

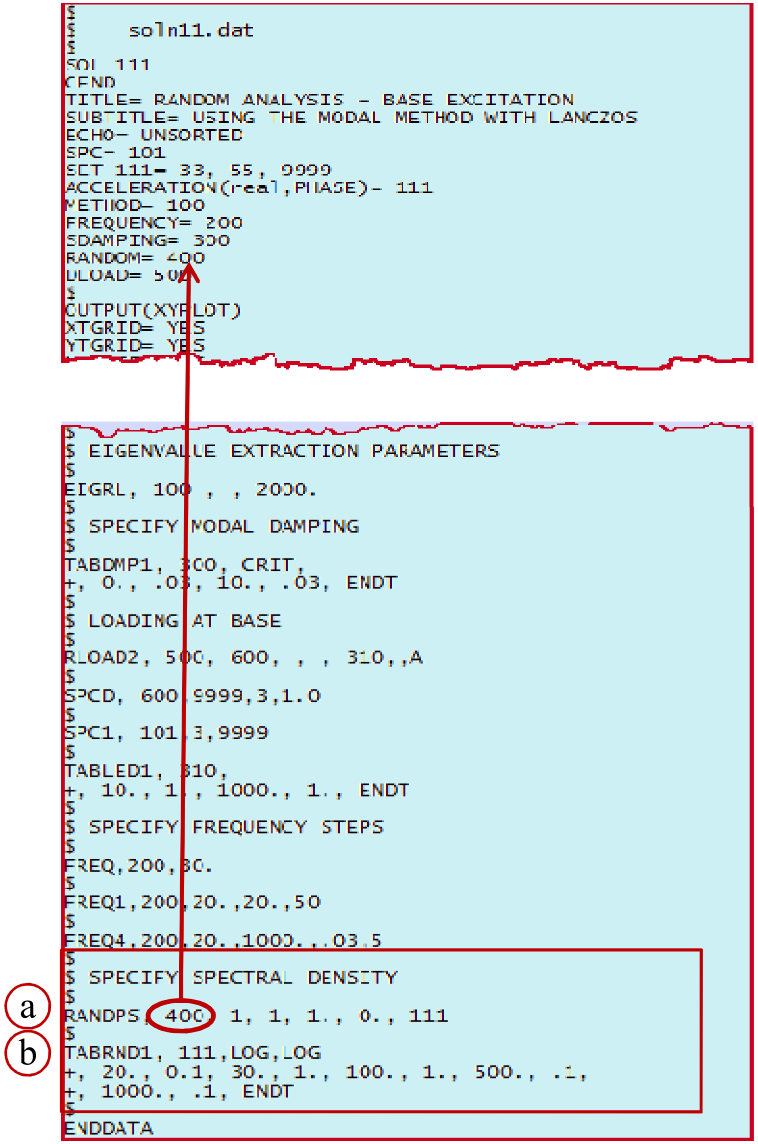


```
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
XBGRID= YES
YBGRID= YES
YTLOG= YES
XTITLE= FREQUENCY
YTTITLE= ACCEL RESPONSE BASE, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT BASE, PHASE
XYPLOT ACCEL RESPONSE / 9999 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT TIP CENTER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT TIP CENTER, PHASE
XYPLOT ACCEL RESPONSE / 33 (T3RM, T3IP)
YTTITLE= ACCEL RESPONSE AT OPPOSITE CORNER, MAGNITUDE
YBTITLE= ACCEL RESPONSE AT OPPOSETE CORNER, PHASE
XYPLOT ACCEL RESPONSE / 55 (T3RM, T3IP)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= ACCEL P S D AT LOADED CORNER
XYPLOT ACCEL PSDF / 9999(T3)
YTITLE= ACCEL P S D AT TIP CENTER
XYPLOT ACCEL PSDF / 33(T3)
YTITLE= ACCEL P S D AT OPPOSITE CORNER
XYPLOT ACCEL PSDF / 55(T3)
$
BEGIN BULK
PARAM, POST, 0
PARAM, COUPMASS, 1
PARAM, WTMASS, 0.00259
$
INCLUDE 'plate.bdf'
$
GRID, 9999, , 0., 1., 0.
$
RBE2, 101, 9999, 12345, 1, 12, 23, 34, 45
$
SPC1, 101, 12456, 9999
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100 , , 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ LOADING AT BASE
$
RLOAD2, 500, 600, , , 310,,A
$
SPCD, 600,9999,3,1.0
$
SPC1, 101,3,9999
$
TABLED1, 310,
+, 10., 1., 1000., 1., ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ,200,30.
$
FREQ1,200,20.,20.,50
$
FREQ4,200,20.,1000.,.03,5
$
ENDDATA
```

Step 7. Add Spectral Density

a. To define a power spectral density for a random analysis, use **RANDPS** entry.
   - Subcase of excited load set = **1**
   - Subcase of applied load set = **1**
   - Component X = **1.0**
   - Component Y = **0**
   - Reference **TABRDN1**
   - Make sure that the SID matches the identification number for **RANDOM** in the Case Control section.

b. The **TABRND1** table defines the power spectral density as a tabular function of frequency for a random analysis. Here the input for the PSD is defined as **log-log**.



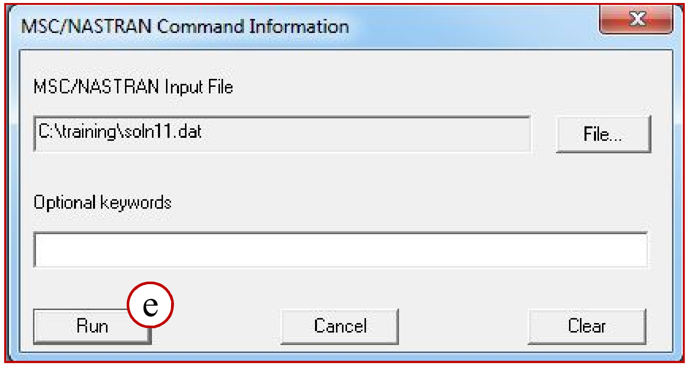
```
$
$    soln11.dat
$
SOL 111
CEND
TITLE= RANDOM ANALYSIS - BASE EXCITATION
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO- UNSORTED
SPC- 101
SET 111- 33, 55, 9999
ACCELERATION(real,PHASE)- 111
METHOD- 100
FREQUENCY= 200
SDAMPING= 300
RANDOM= 400
DLOAD= 500
$
OUTPUT(XYPLOT)
XTGRID= YES
YTGRID= YES
```

```
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100 , , 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ LOADING AT BASE
$
RLOAD2, 500, 600, , , 310,,A
$
SPCD, 600,9999,3,1.0
$
SPC1, 101,3,9999
$
TABLED1, 310,
+, 10., 1., 1000., 1., ENDT
$
$ SPECIFY FREQUENCY STEPS
$
FREQ,200,30.
$
FREQ1,200,20.,20.,50
$
FREQ4,200,20.,1000.,.03,5
$
$ SPECIFY SPECTRAL DENSITY
$
RANDPS, 400, 1, 1, 1., 0., 111
$
TABRND1, 111,LOG,LOG
+, 20., 0.1, 30., 1., 100., 1., 500., .1,
+, 1000., .1, ENDT
$
ENDDATA
```

Step 8. Save and Run the New Input File

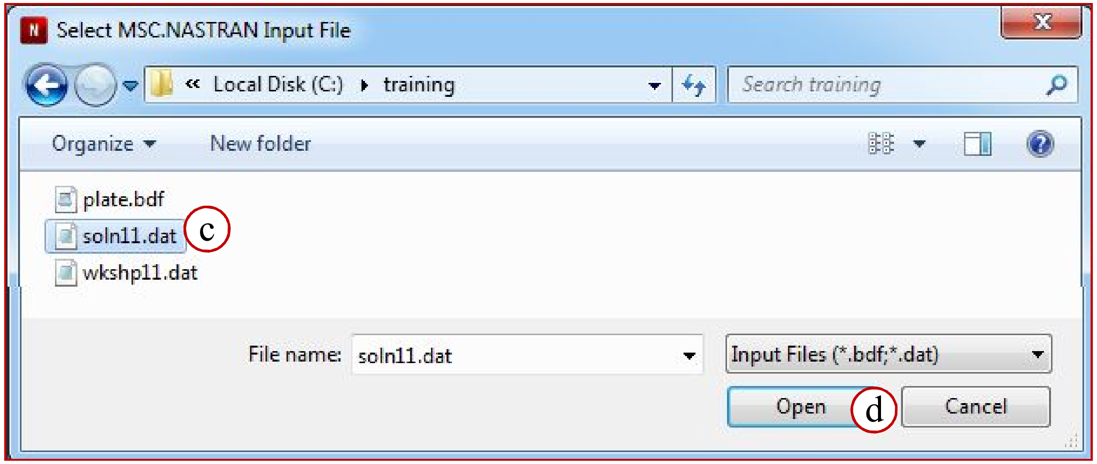
Save and run the modified file in MSC Nastran.

a. Save the modified file as **soln11.dat**
b. Double click the **MSC Nastran** icon.
c. Navigate to the correct directory and select the file **soln11.dat**.
d. Click **Open**.
e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln11.dat

Optional keywords:

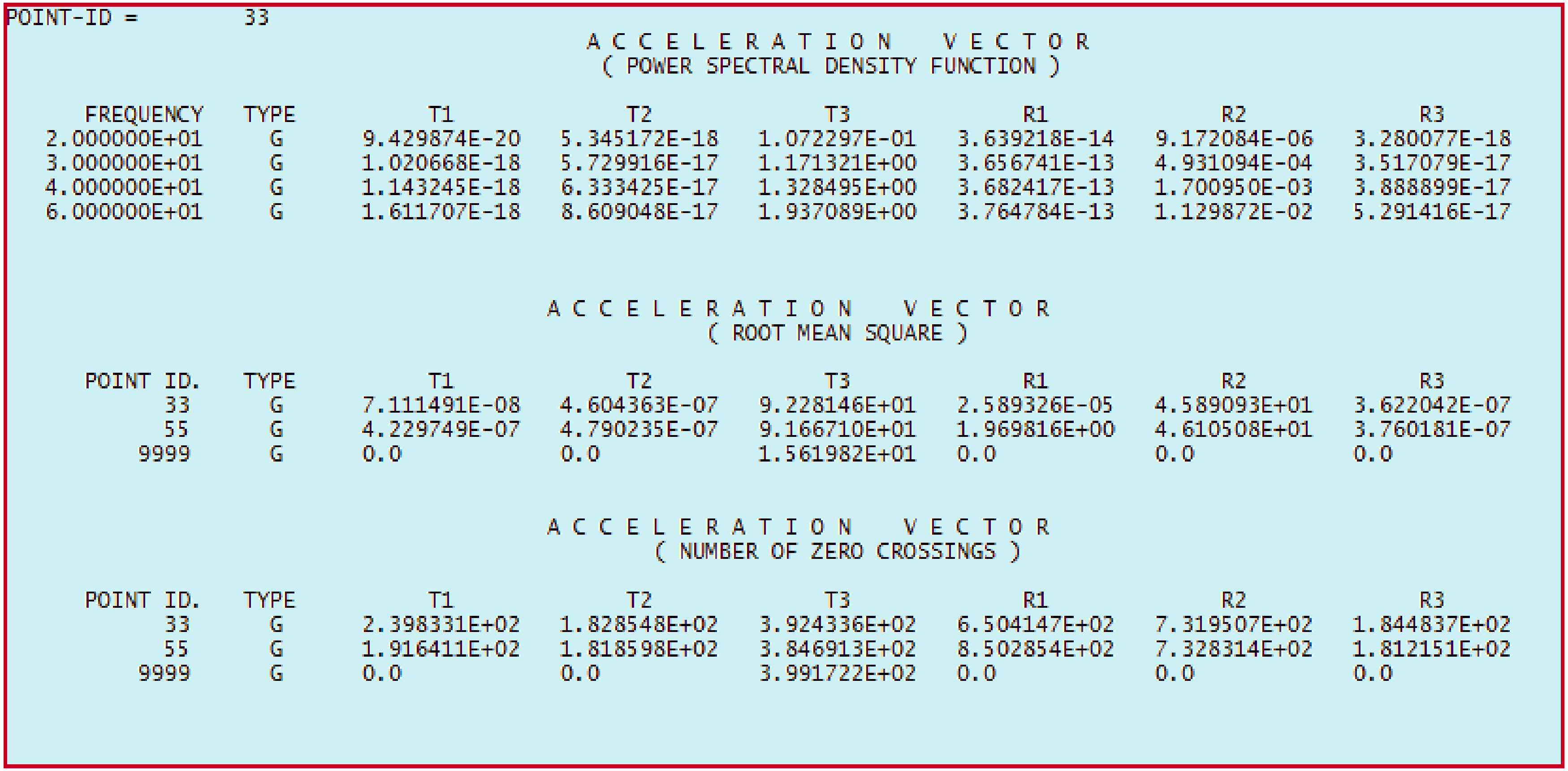


Local Disk (C:) ▸ training

File name: soln11.dat

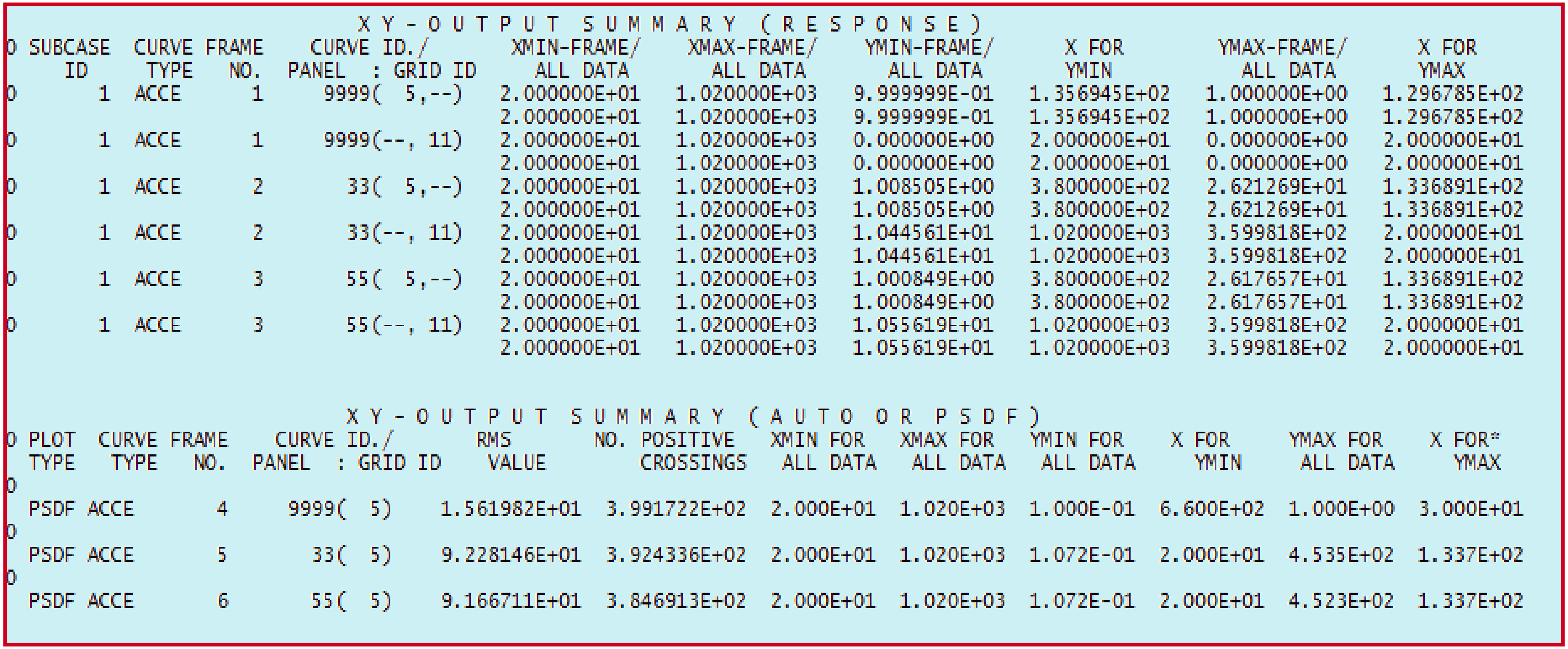
Input Files (*.bdf;*.dat)

Step 9. Review the Results in the Solution File



```
POINT-ID =         33
                                            A C C E L E R A T I O N    V E C T O R
                                             ( POWER SPECTRAL DENSITY FUNCTION )

      FREQUENCY      TYPE          T1             T2             T3             R1             R2             R3
   2.000000E+01       G       9.429874E-20   5.345172E-18   1.072297E-01   3.639218E-14   9.172084E-06   3.280077E-18
   3.000000E+01       G       1.020668E-18   5.729916E-17   1.171321E+00   3.656741E-13   4.931094E-04   3.517079E-17
   4.000000E+01       G       1.143245E-18   6.333425E-17   1.328495E+00   3.682417E-13   1.700950E-03   3.888899E-17
   6.000000E+01       G       1.611707E-18   8.609048E-17   1.937089E+00   3.764784E-13   1.129872E-02   5.291416E-17


                                         A C C E L E R A T I O N    V E C T O R
                                                 ( ROOT MEAN SQUARE )

      POINT ID.      TYPE          T1             T2             T3             R1             R2             R3
            33        G       7.111491E-08   4.604363E-07   9.228146E+01   2.589326E-05   4.589093E+01   3.622042E-07
            55        G       4.229749E-07   4.790235E-07   9.166710E+01   1.969816E+00   4.610508E+01   3.760181E-07
          9999        G       0.0            0.0            1.561982E+01   0.0            0.0            0.0

                                         A C C E L E R A T I O N    V E C T O R
                                             ( NUMBER OF ZERO CROSSINGS )

      POINT ID.      TYPE          T1             T2             T3             R1             R2             R3
            33        G       2.398331E+02   1.828548E+02   3.924336E+02   6.504147E+02   7.319507E+02   1.844837E+02
            55        G       1.916411E+02   1.818598E+02   3.846913E+02   8.502854E+02   7.328314E+02   1.812151E+02
          9999        G       0.0            0.0            3.991722E+02   0.0            0.0            0.0
```

Step 9. Review the Results in the Solution File (Cont.)

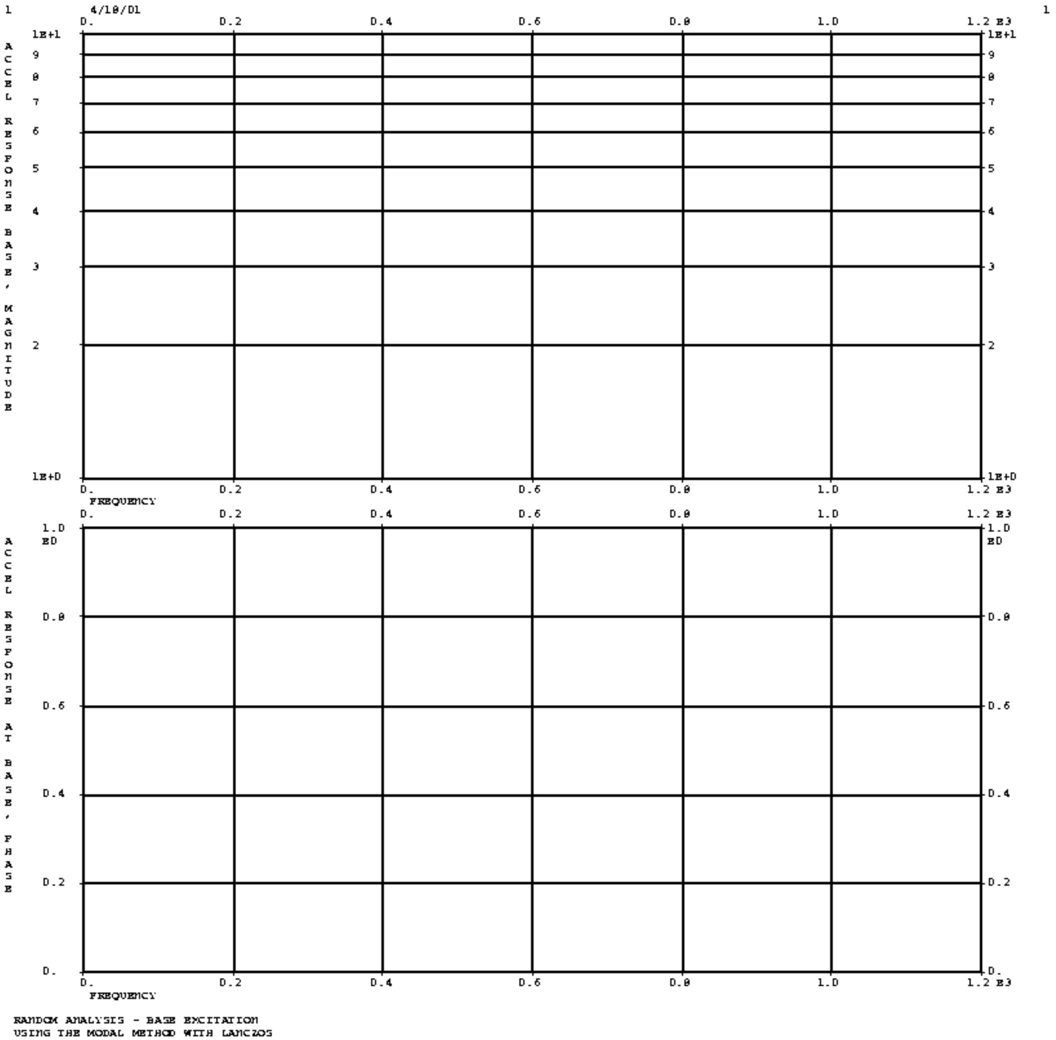


```
                                     X Y - O U T P U T   S U M M A R Y   ( R E S P O N S E )
0 SUBCASE  CURVE FRAME     CURVE ID./        XMIN-FRAME/    XMAX-FRAME/    YMIN-FRAME/      X FOR        YMAX-FRAME/      X FOR
     ID     TYPE    NO.   PANEL   : GRID ID     ALL DATA       ALL DATA       ALL DATA        YMIN          ALL DATA        YMAX
0       1  ACCE       1       9999(   5,--)  2.000000E+01   1.020000E+03   9.999999E-01   1.356945E+02   1.000000E+00   1.296785E+02
                                             2.000000E+01   1.020000E+03   9.999999E-01   1.356945E+02   1.000000E+00   1.296785E+02
0       1  ACCE       1       9999(--, 11)   2.000000E+01   1.020000E+03   0.000000E+00   2.000000E+01   0.000000E+00   2.000000E+01
                                             2.000000E+01   1.020000E+03   0.000000E+00   2.000000E+01   0.000000E+00   2.000000E+01
0       1  ACCE       2         33(   5,--)  2.000000E+01   1.020000E+03   1.008505E+00   3.800000E+02   2.621269E+01   1.336891E+02
                                             2.000000E+01   1.020000E+03   1.008505E+00   3.800000E+02   2.621269E+01   1.336891E+02
0       1  ACCE       2         33(--, 11)   2.000000E+01   1.020000E+03   1.044561E+01   1.020000E+03   3.599818E+02   2.000000E+01
                                             2.000000E+01   1.020000E+03   1.044561E+01   1.020000E+03   3.599818E+02   2.000000E+01
0       1  ACCE       3         55(   5,--)  2.000000E+01   1.020000E+03   1.000849E+00   3.800000E+02   2.617657E+01   1.336891E+02
                                             2.000000E+01   1.020000E+03   1.000849E+00   3.800000E+02   2.617657E+01   1.336891E+02
0       1  ACCE       3         55(--, 11)   2.000000E+01   1.020000E+03   1.055619E+01   1.020000E+03   3.599818E+02   2.000000E+01
                                             2.000000E+01   1.020000E+03   1.055619E+01   1.020000E+03   3.599818E+02   2.000000E+01


                                    X Y - O U T P U T   S U M M A R Y   ( A U T O   O R   P S D F )
0 PLOT  CURVE  FRAME     CURVE ID./        RMS        NO. POSITIVE   XMIN FOR   XMAX FOR   YMIN FOR     X FOR     YMAX FOR    X FOR*
  TYPE   TYPE    NO.   PANEL   : GRID ID    VALUE        CROSSINGS    ALL DATA   ALL DATA   ALL DATA     YMIN     ALL DATA     YMAX
0
  PSDF  ACCE       4      9999(   5)    1.561982E+01  3.991722E+02  2.000E+01  1.020E+03  1.000E-01  6.600E+02  1.000E+00  3.000E+01
0
  PSDF  ACCE       5        33(   5)    9.228146E+01  3.924336E+02  2.000E+01  1.020E+03  1.072E-01  2.000E+01  4.535E+02  1.337E+02
0
  PSDF  ACCE       6        55(   5)    9.166711E+01  3.846913E+02  2.000E+01  1.020E+03  1.072E-01  2.000E+01  4.523E+02  1.337E+02
```

Step 10. Review the Graph Results

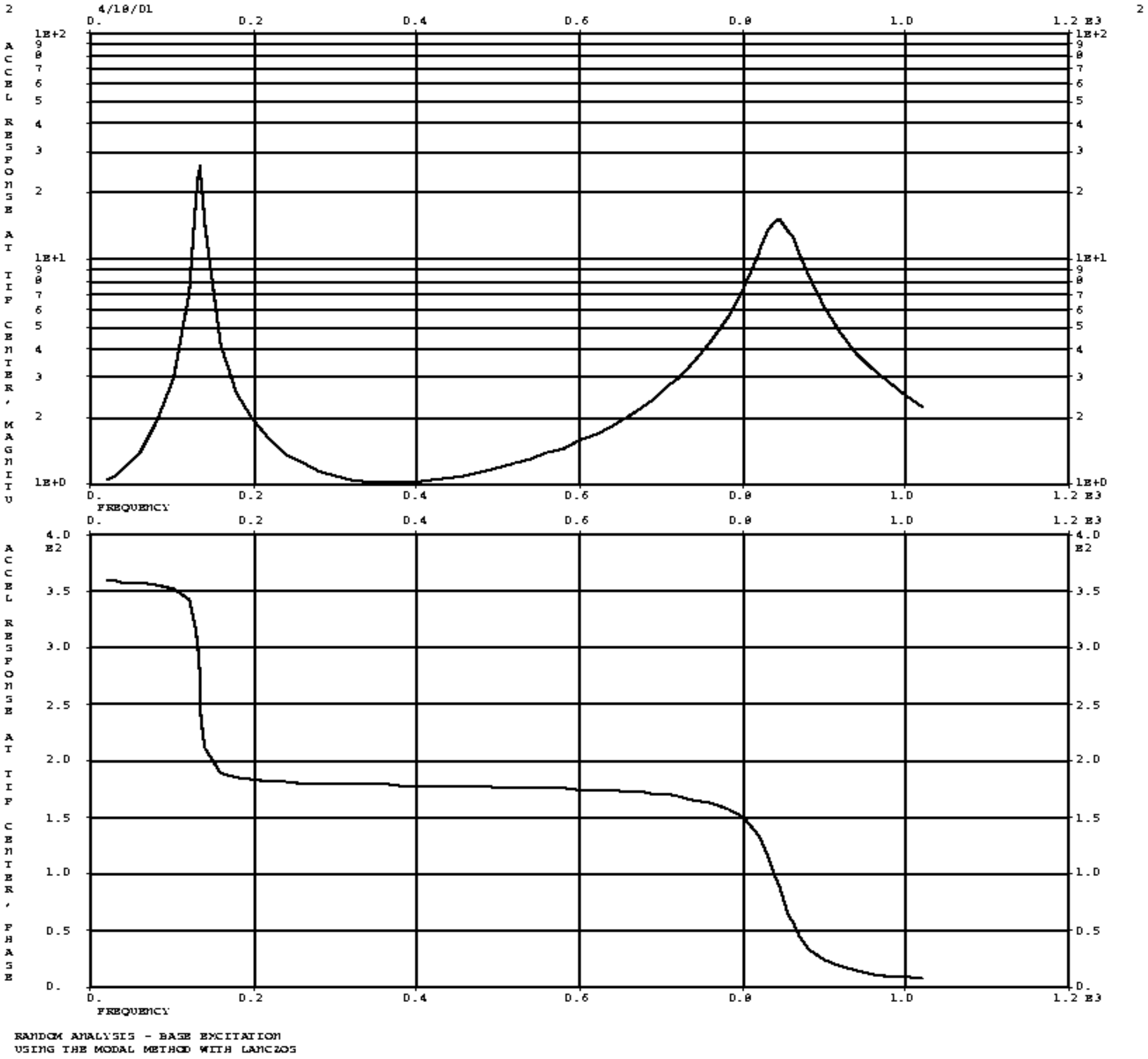
Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions in workshop 4, step 9.

Acceleration response at the base, Grid point 9999



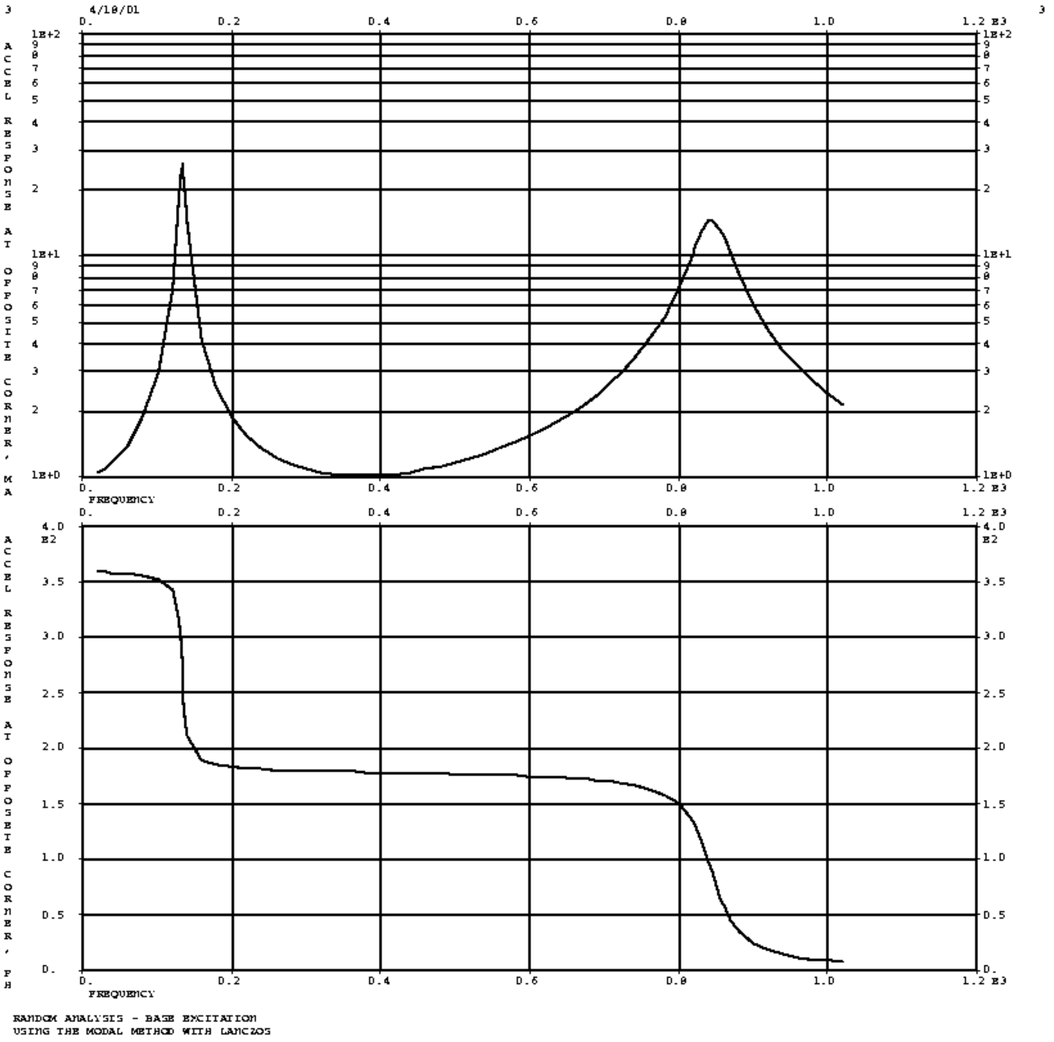
Step 10. Review the Graph Results (Cont.)

Acceleration response at tip center, Grid point 33



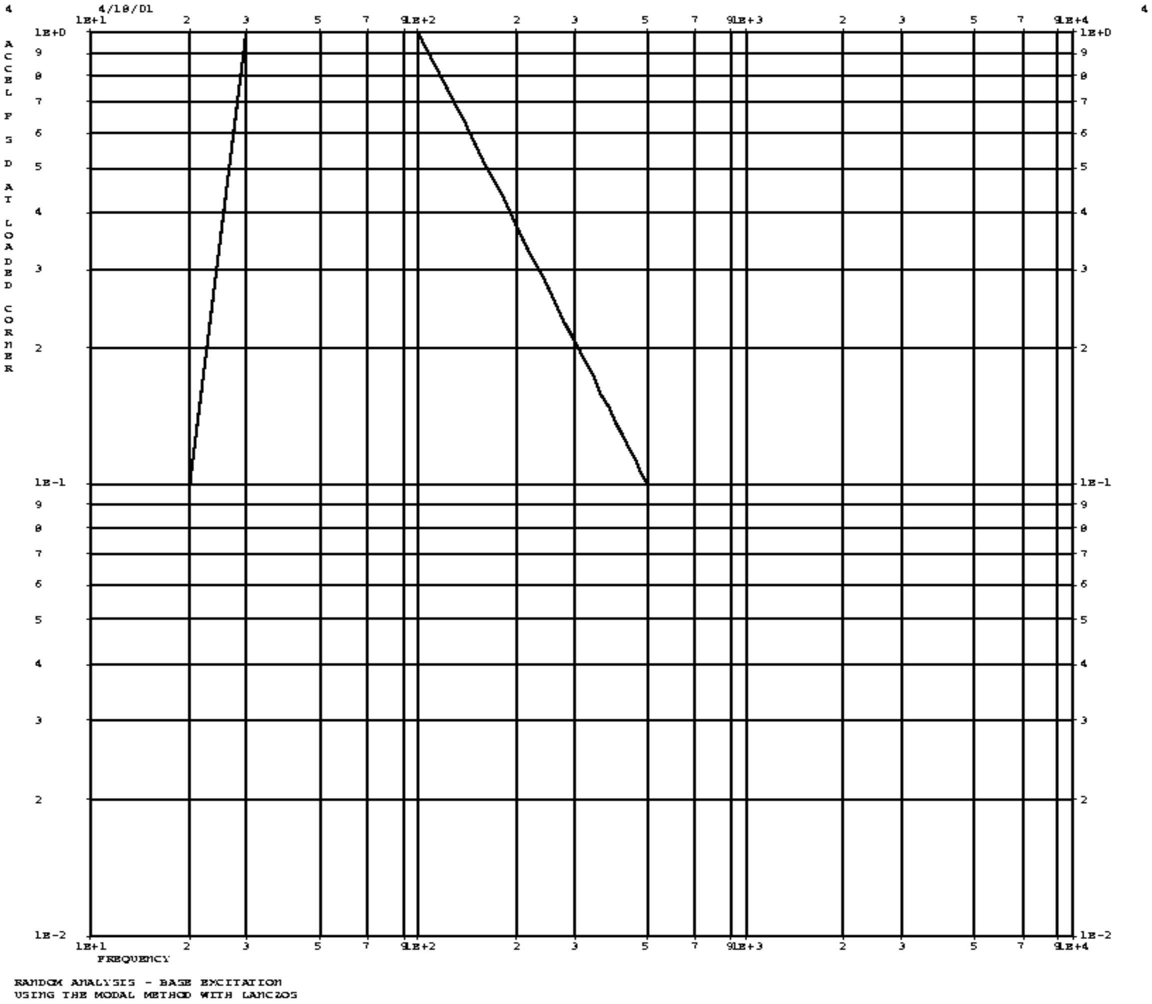
Step 10. Review the Graph Results (Cont.)

Acceleration response at corner of tip, Grid point 55



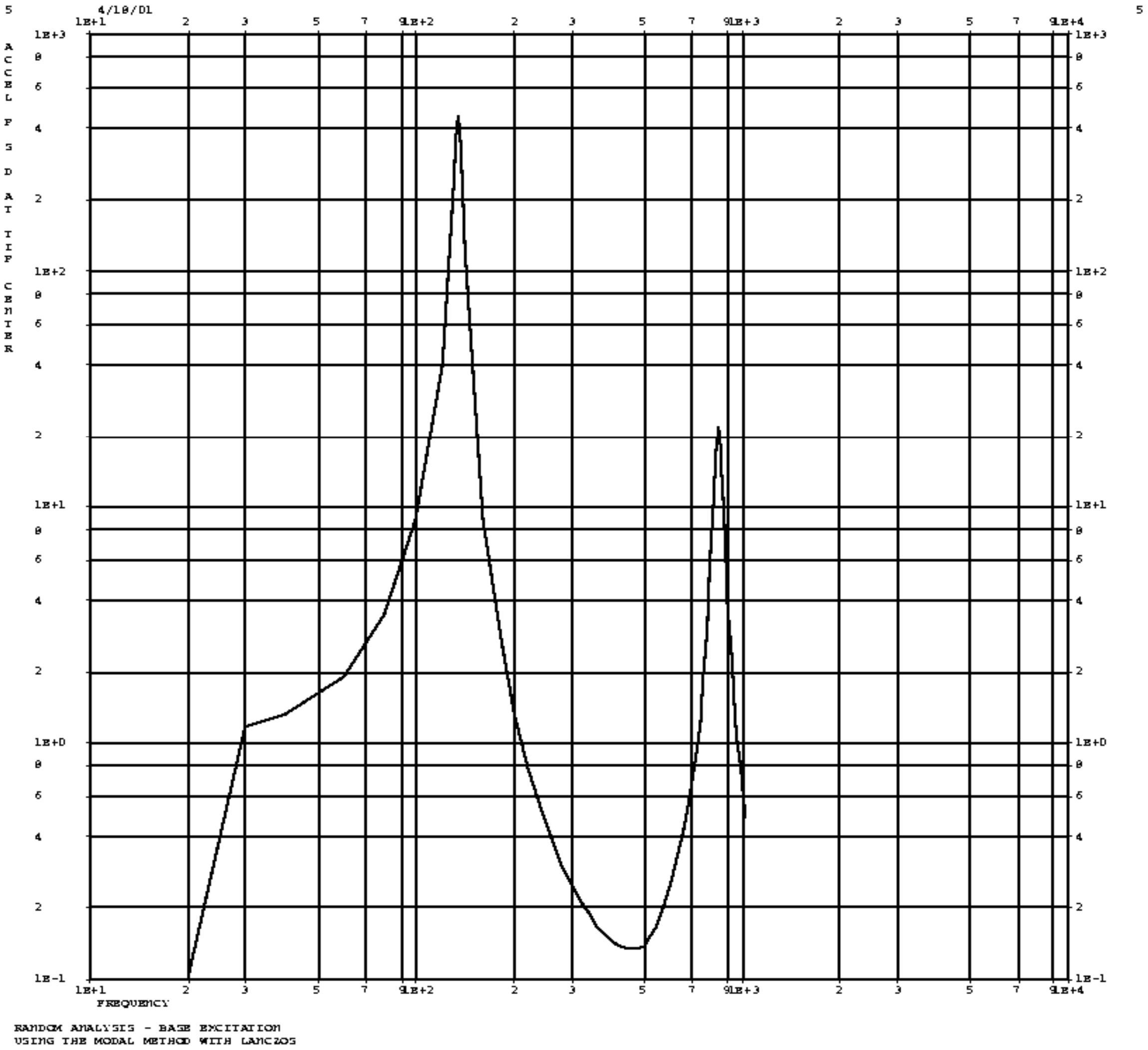
Step 10. Review the Graph Results (Cont.)

Acceleration PSD at loaded base, Grid 9999



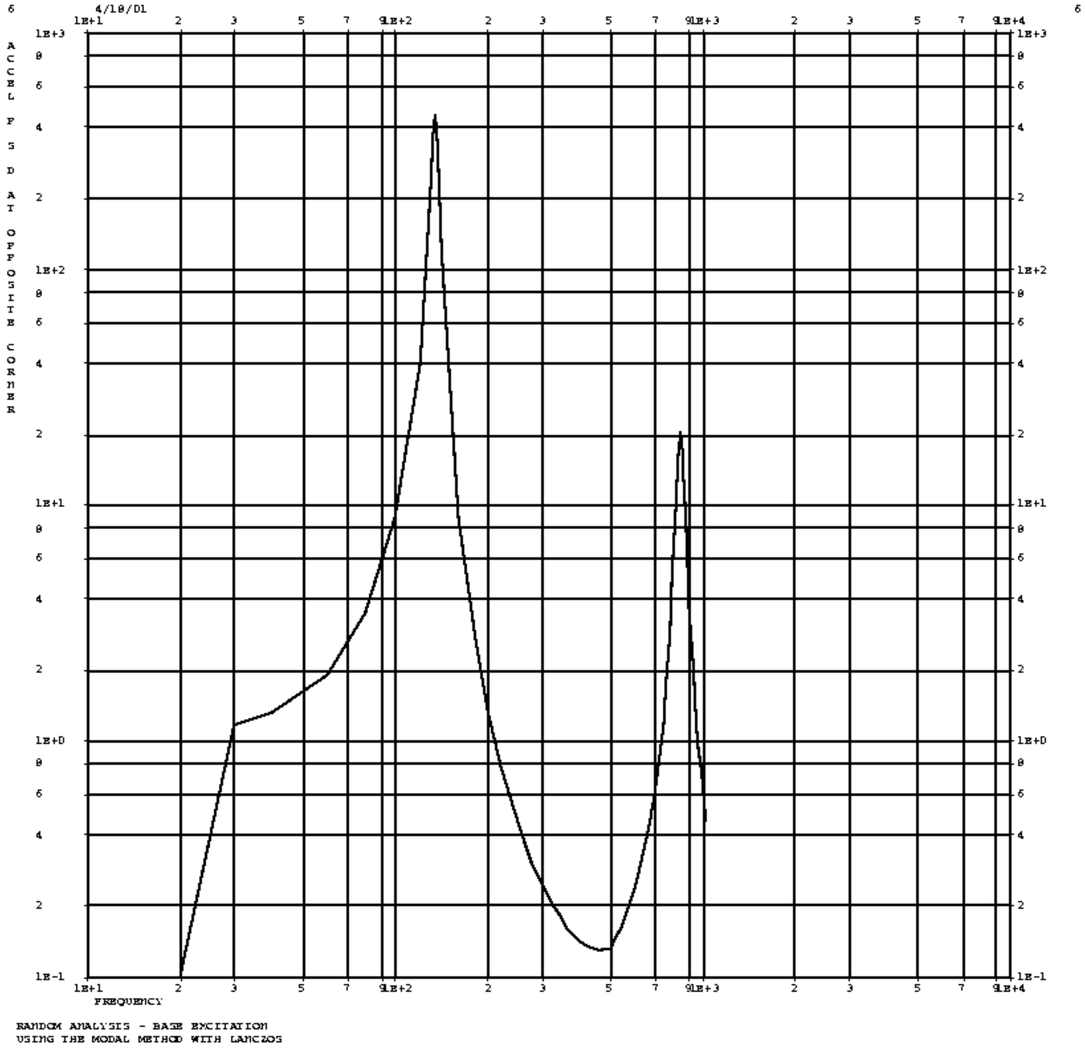
Step 10. Review the Graph Results (Cont.)

Acceleration PSD at tip center, Grid point 33



Step 10. Review the Graph Results (Cont.)

Acceleration PSD at tip corner, Grid point 55



WORKSHOP 12
RANDOM RESPONSE WITH MULTIPLE INPUTS

- **Workshop Objective**
  - Using the modal method, determine the displacement response spectrum of the tip center point due to the input spectrum of the pressure and point loads listed on the next page.

- **Software Version**
  - MSC Nastran 2013

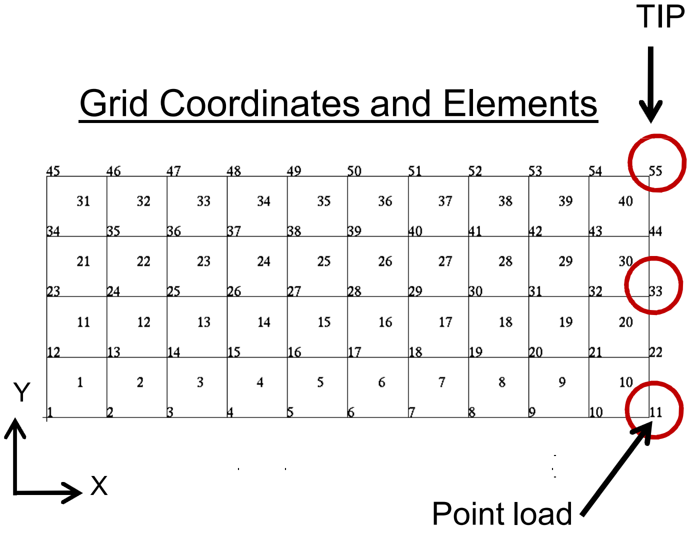
- **Files Required**
  - plate.bdf
  - wkshp12.dat

- **Problem Description:**
  - The model is the plate from workshop 1. The pressure load is a unit pressure load in the z-direction over the entire plate and the point unit load is at grid point 11 in the z direction. The input spectrum of the pressure and unit point is at grid point 11 in the z direction. Use the complex matrix representation (SAB) for the cross spectrum.

Autospectra of Pressure Load		Auto Spectra of Corner Load	
Frequency (Hz)	**psi/Hz**	**Frequency (Hz)**	**lb/Hz**
20	0.1	20	0.5
30	1	30	2.5
100	1	500	2.5
500	0.1	1000	0
1000	0.1		

Cross-Spectrum of Pressure and Corner Loads Real/Imaginary		
Frequency (Hz)	**Real Part**	**Imaginary Part**
20	-0.099619	0.007816
100	-0.498097	0.043579
500	0.070711	-0.070711
1000	0	0

Grid Coordinates and Elements

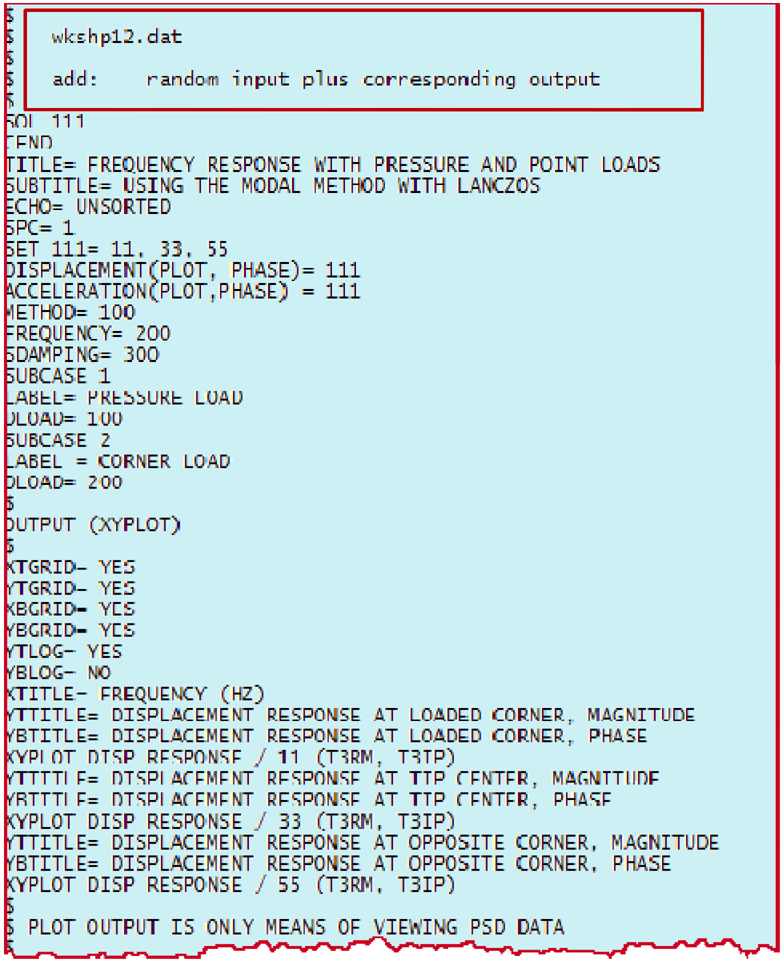


  - Request Auto psdf and CRMS displacement output at grid points 11, 33, and 55
  - Request cross spectrum displacement output between grid point 11 direction 3 and grid point 55 direction 3

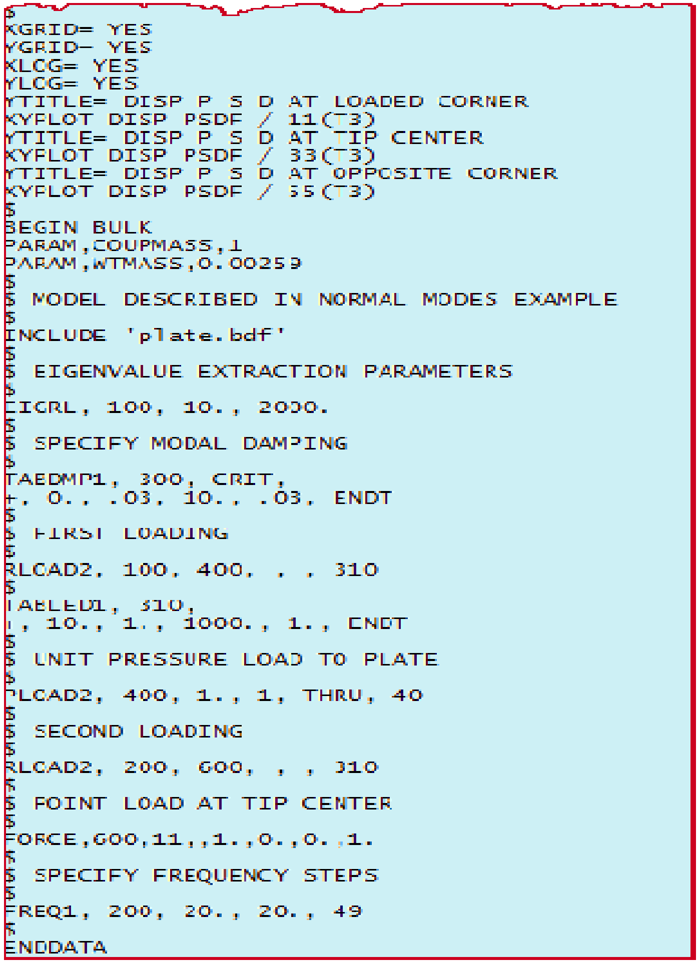
- **Suggested Steps**
  1. Open and review input file wkshp12.dat.
  2. Add Power Spectral Density.
  3. Add Auto PSDF and CRSM displacement output.
  4. Add request cross spectrum displacement output.
  5. Save and run new input file in MSC Nastran.
  6. Review the MSC Nastran results using the solution file soln12.f06.
  7. Review the graph results.

Step 1. Open and Review Input File wkshp12.dat

Wkshp12.dat is the starting input file. It already has the data for the point and pressure loads. It needs to be modified to add the random input plus corresponding output.



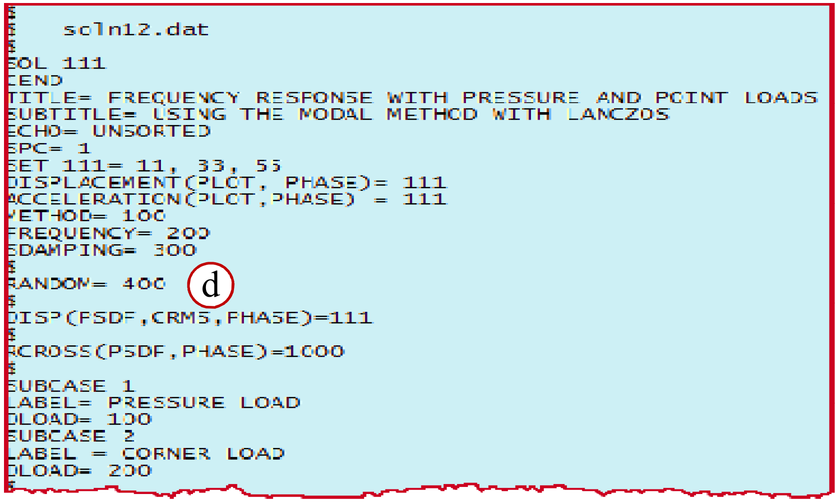
```
$
$   wkshp12.dat
$
$   add:    random input plus corresponding output
$
SOL 111
CEND
TITLE= FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PLOT, PHASE)= 111
ACCELERATION(PLOT,PHASE) = 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
SUBCASE 1
LABEL= PRESSURE LOAD
DLOAD= 100
SUBCASE 2
LABEL = CORNER LOAD
DLOAD= 200
$
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)
$
$ PLOT OUTPUT IS ONLY MEANS OF VIEWING PSD DATA
$
```



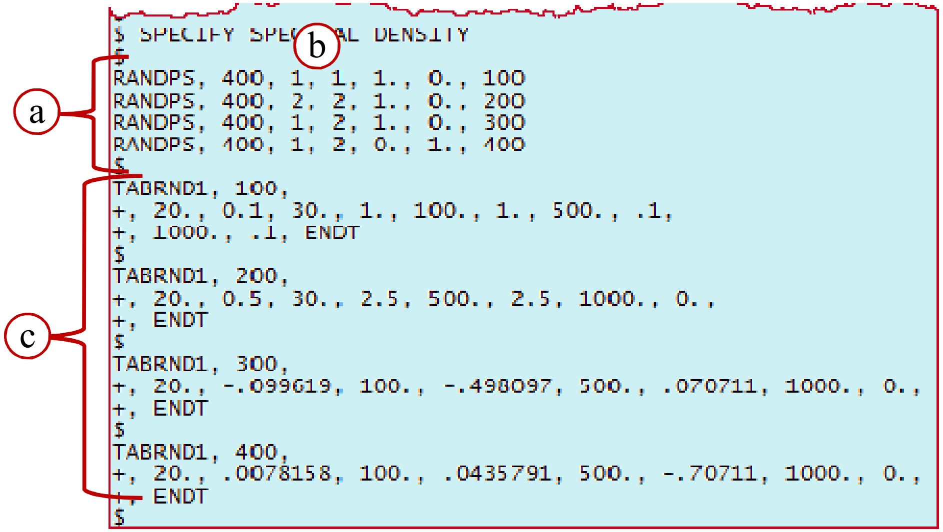
```
$
XGRID= YES
YGRID= YES
XLOG= YES
YLOG= YES
YTITLE= DISP P S D AT LOADED CORNER
XYPLOT DISP PSDF / 11(T3)
YTITLE= DISP P S D AT TIP CENTER
XYPLOT DISP PSDF / 33(T3)
YTITLE= DISP P S D AT OPPOSITE CORNER
XYPLOT DISP PSDF / 55(T3)
$
BEGIN BULK
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
$
$ MODEL DESCRIBED IN NORMAL MODES EXAMPLE
$
INCLUDE 'plate.bdf'
$
$ EIGENVALUE EXTRACTION PARAMETERS
$
EIGRL, 100, 10., 2000.
$
$ SPECIFY MODAL DAMPING
$
TABDMP1, 300, CRIT,
+, 0., .03, 10., .03, ENDT
$
$ FIRST LOADING
$
RLOAD2, 100, 400, , , 310
$
TABLED1, 310,
+, 10., 1., 1000., 1., ENDT
$
$ UNIT PRESSURE LOAD TO PLATE
$
PLOAD2, 400, 1., 1, THRU, 40
$
$ SECOND LOADING
$
RLOAD2, 200, 600, , , 310
$
$ POINT LOAD AT TIP CENTER
$
FORCE,600,11,,1.,0.,0.,1.
$
$ SPECIFY FREQUENCY STEPS
$
FREQ1, 200, 20., 20., 49
$
ENDDATA
```

Step 2. Add Power Spectral Density

a. Define the power spectral density using the **RANDPS** entry in combination with the **TABRND1**.
b. For the **RANDPS** entry subcase 1 is the pressure load and subcase 2 is the point load.
c. To fill in the tabular information for the **TABRND1** entries use the tables on page WS12-4.
d. Add **RANDOM** Case Control Command. With the same identification number as the **RANDPS** entries.



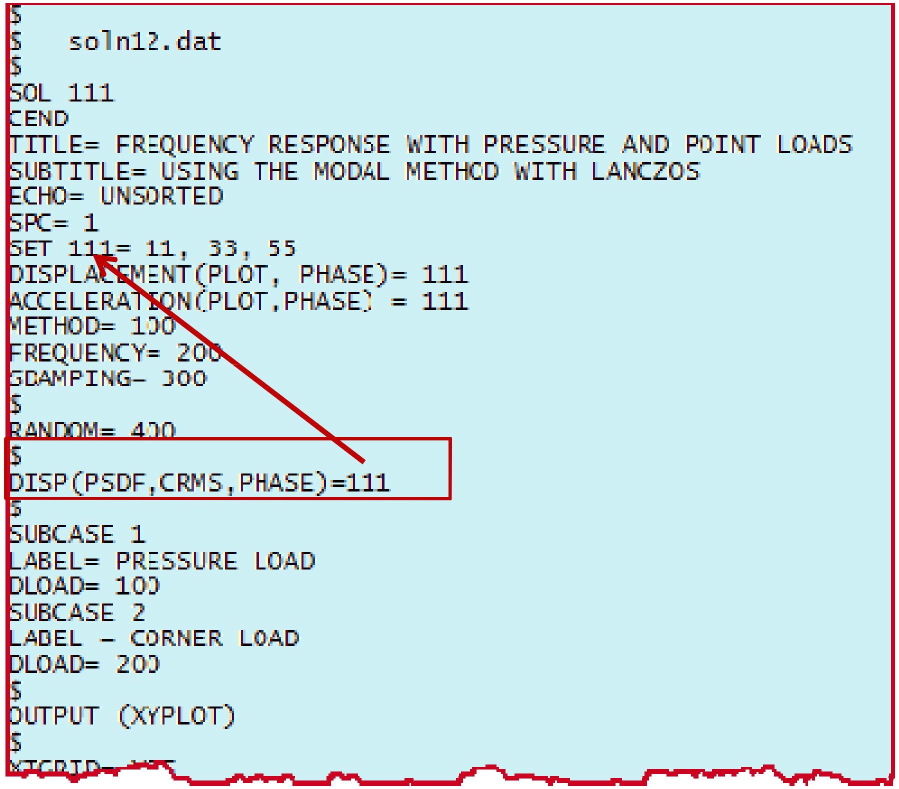
```
$
$    scln12.dat
$
SOL 111
CEND
TITLE= FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PLOT, PHASE)= 111
ACCELERATION(PLOT,PHASE) = 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
$
RANDOM= 400
$
DISP(PSDF,CRMS,PHASE)=111
$
RCROSS(PSDF,PHASE)=1000
$
SUBCASE 1
LABEL= PRESSURE LOAD
DLOAD= 100
SUBCASE 2
LABEL = CORNER LOAD
DLOAD= 200
$
```



```
$ SPECIFY SPEC[illegible]AL DENSITY
$
RANDPS, 400, 1, 1, 1., 0., 100
RANDPS, 400, 2, 2, 1., 0., 200
RANDPS, 400, 1, 2, 1., 0., 300
RANDPS, 400, 1, 2, 0., 1., 400
$
TABRND1, 100,
+, 20., 0.1, 30., 1., 100., 1., 500., .1,
+, 1000., .1, ENDT
$
TABRND1, 200,
+, 20., 0.5, 30., 2.5, 500., 2.5, 1000., 0.,
+, ENDT
$
TABRND1, 300,
+, 20., -.099619, 100., -.498097, 500., .070711, 1000., 0.,
+, ENDT
$
TABRND1, 400,
+, 20., .0078158, 100., .0435791, 500., -.70711, 1000., 0.,
+, ENDT
$
```

Step 3. Add Auto PSDF and CRMS Displacement output

Add a **DISP** command in the Case Control section to request the **PSDF, CRMS,** and **PHASE** output. Make sure the value for this command equals the **SET** ID number.

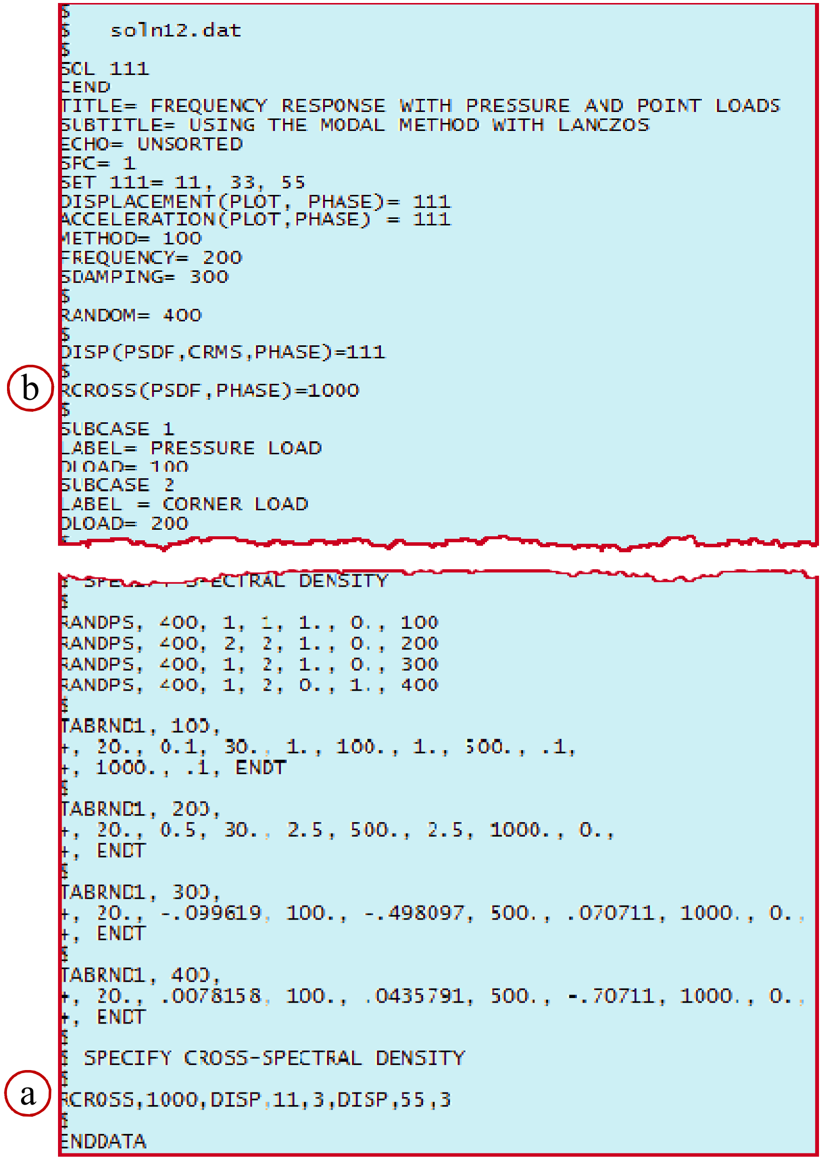


```
$
$   soln12.dat
$
SOL 111
CEND
TITLE= FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PLOT, PHASE)= 111
ACCELERATION(PLOT,PHASE) = 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
$
RANDOM= 400
$
DISP(PSDF,CRMS,PHASE)=111
$
SUBCASE 1
LABEL= PRESSURE LOAD
DLOAD= 100
SUBCASE 2
LABEL - CORNER LOAD
DLOAD= 200
$
OUTPUT (XYPLOT)
$
XTGRID=
```

Step 4. Add Request Cross Spectrum Displacement output

a. Add the cross-spectral entry **RCROSS**, request displacement output between grid point 11 direction 3 and grid point 55 direction 3

b. Add the **RCROSS** output in the Case Control Section. Make sure the identification number matches the SID for the **RCROSS** entry in the Bulk Data section.



```
$
$   soln12.dat
$
SOL 111
CEND
TITLE= FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
SUBTITLE= USING THE MODAL METHOD WITH LANCZOS
ECHO= UNSORTED
SPC= 1
SET 111= 11, 33, 55
DISPLACEMENT(PLOT, PHASE)= 111
ACCELERATION(PLOT,PHASE) = 111
METHOD= 100
FREQUENCY= 200
SDAMPING= 300
$
RANDOM= 400
$
DISP(PSDF,CRMS,PHASE)=111
$
RCROSS(PSDF,PHASE)=1000
$
SUBCASE 1
LABEL= PRESSURE LOAD
DLOAD= 100
SUBCASE 2
LABEL = CORNER LOAD
DLOAD= 200
$
```

```
$ SPECIFY SPECTRAL DENSITY
$
RANDPS, 400, 1, 1, 1., 0., 100
RANDPS, 400, 2, 2, 1., 0., 200
RANDPS, 400, 1, 2, 1., 0., 300
RANDPS, 400, 1, 2, 0., 1., 400
$
TABRND1, 100,
+, 20., 0.1, 30., 1., 100., 1., 500., .1,
+, 1000., .1, ENDT
$
TABRND1, 200,
+, 20., 0.5, 30., 2.5, 500., 2.5, 1000., 0.,
+, ENDT
$
TABRND1, 300,
+, 20., -.099619, 100., -.498097, 500., .070711, 1000., 0.,
+, ENDT
$
TABRND1, 400,
+, 20., .0078158, 100., .0435791, 500., -.70711, 1000., 0.,
+, ENDT
$
$ SPECIFY CROSS-SPECTRAL DENSITY
$
RCROSS,1000,DISP,11,3,DISP,55,3
$
ENDDATA
```

Step 5. Save and Run the New Input File

Save and run the modified file in Nastran.

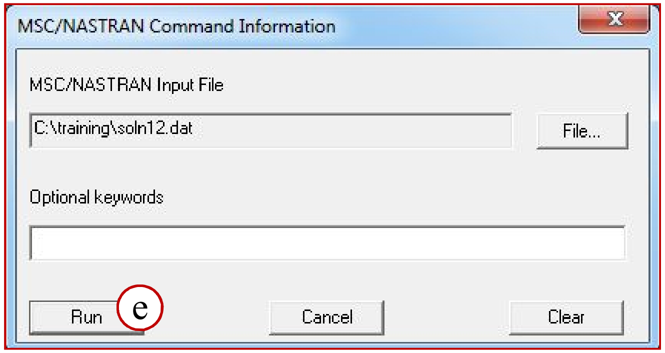
a. Save the modified file as **soln12.dat**.

b. Double click the **MSC Nastran** icon.

c. Navigate to the correct directory and select the file **soln12.dat**.

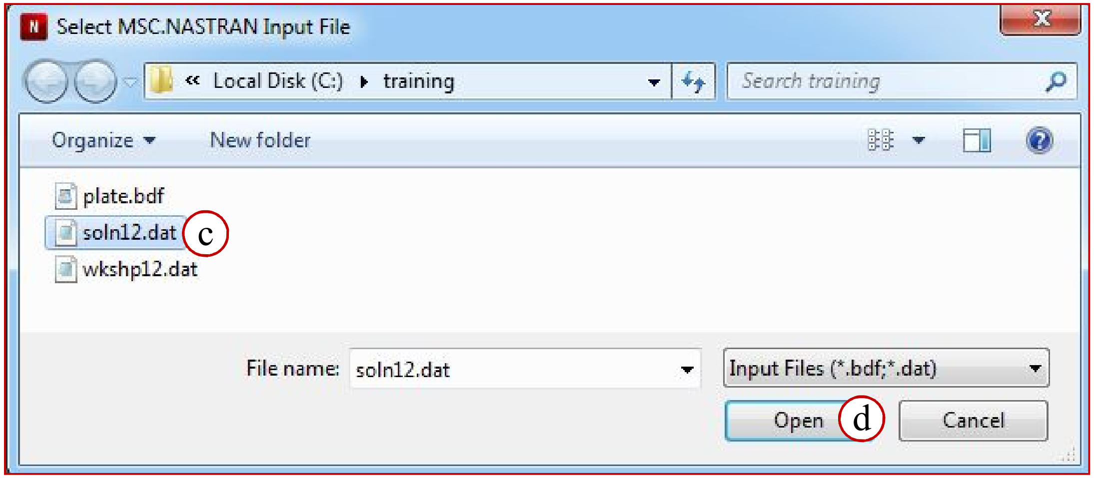
d. Click **Open**.

e. Click **Run**.



MSC/NASTRAN Input File: C:\training\soln12.dat

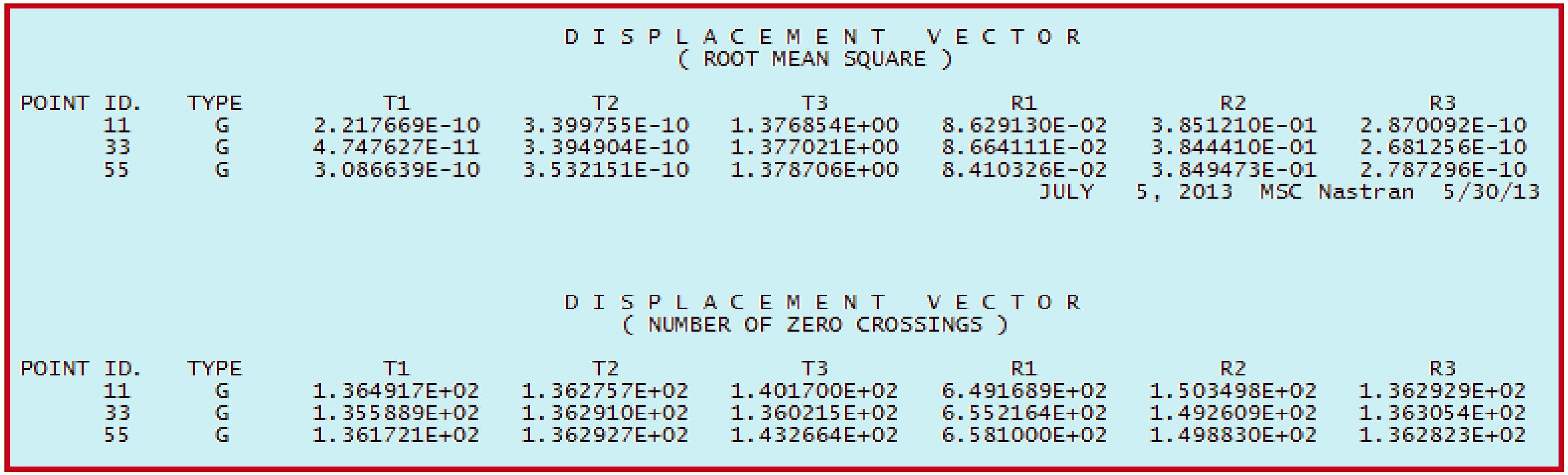
Optional keywords:



File name: soln12.dat

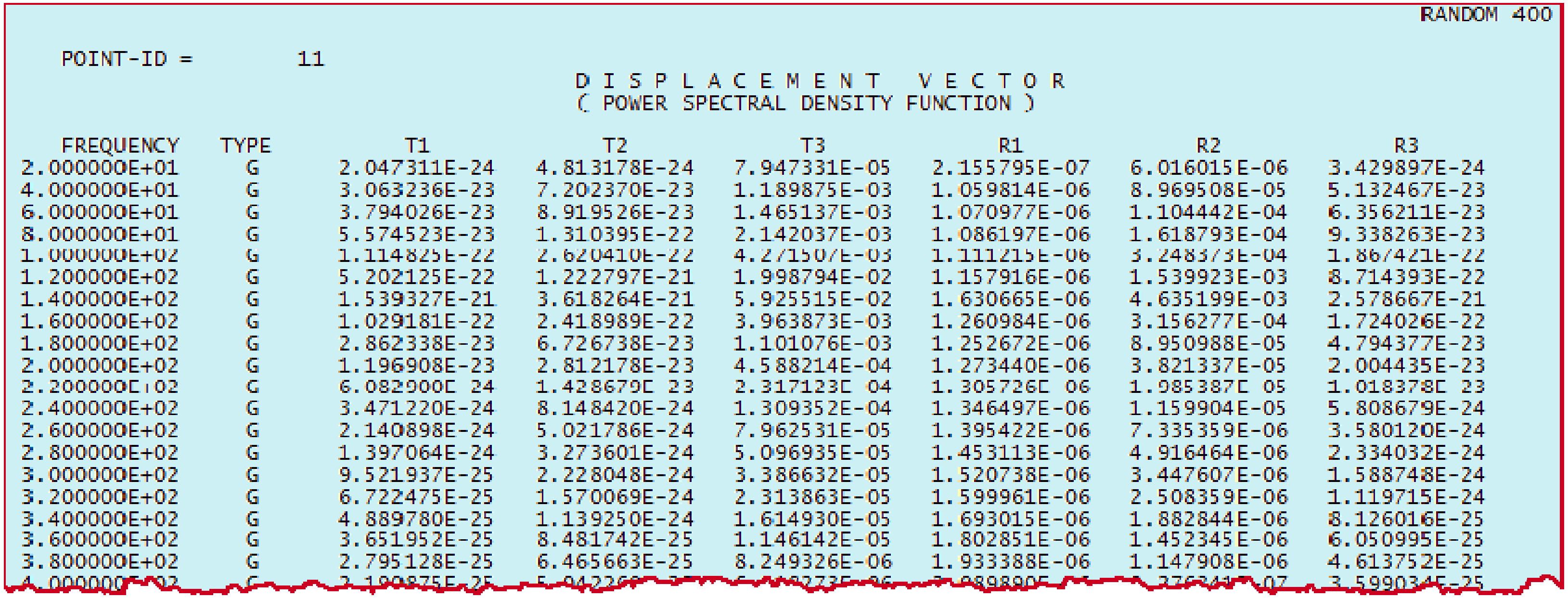
Input Files (*.bdf;*.dat)

Step 6. Review the Results in the Solution File

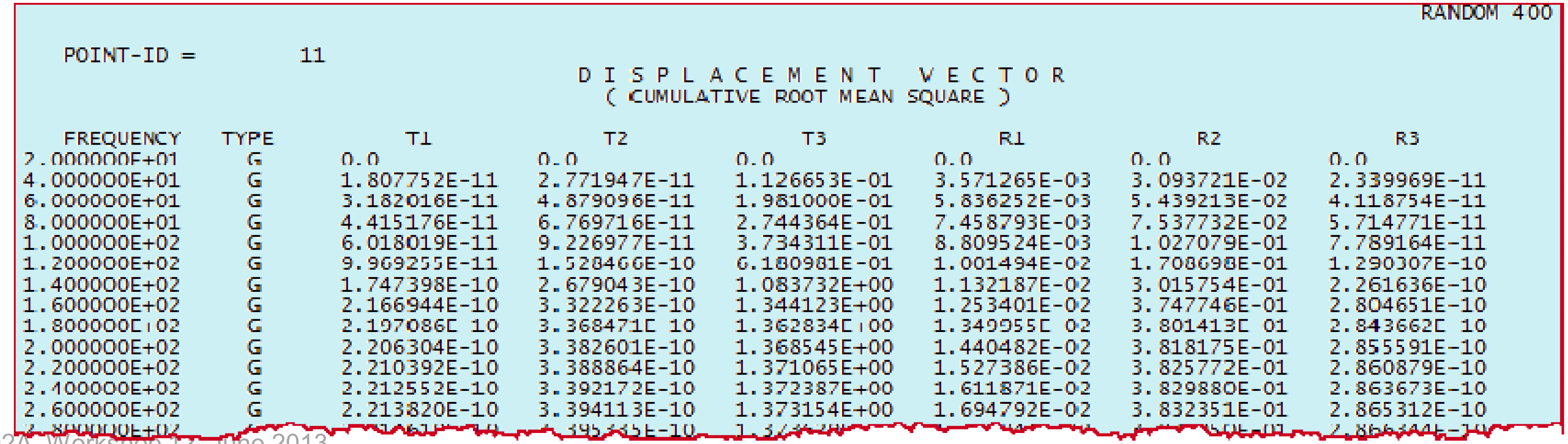


```
                                             D I S P L A C E M E N T   V E C T O R
                                                   ( ROOT MEAN SQUARE )

POINT ID.   TYPE          T1             T2             T3             R1             R2             R3
     11      G       2.217669E-10   3.399755E-10   1.376854E+00   8.629130E-02   3.851210E-01   2.870092E-10
     33      G       4.747627E-11   3.394904E-10   1.377021E+00   8.664111E-02   3.844410E-01   2.681256E-10
     55      G       3.086639E-10   3.532151E-10   1.378706E+00   8.410326E-02   3.849473E-01   2.787296E-10
                                                                       JULY    5, 2013  MSC Nastran  5/30/13



                                             D I S P L A C E M E N T   V E C T O R
                                               ( NUMBER OF ZERO CROSSINGS )

POINT ID.   TYPE          T1             T2             T3             R1             R2             R3
     11      G       1.364917E+02   1.362757E+02   1.401700E+02   6.491689E+02   1.503498E+02   1.362929E+02
     33      G       1.355889E+02   1.362910E+02   1.360215E+02   6.552164E+02   1.492609E+02   1.363054E+02
     55      G       1.361721E+02   1.362927E+02   1.432664E+02   6.581000E+02   1.498830E+02   1.362823E+02
```

Step 6. Review the Results in the Solution File (Cont.)

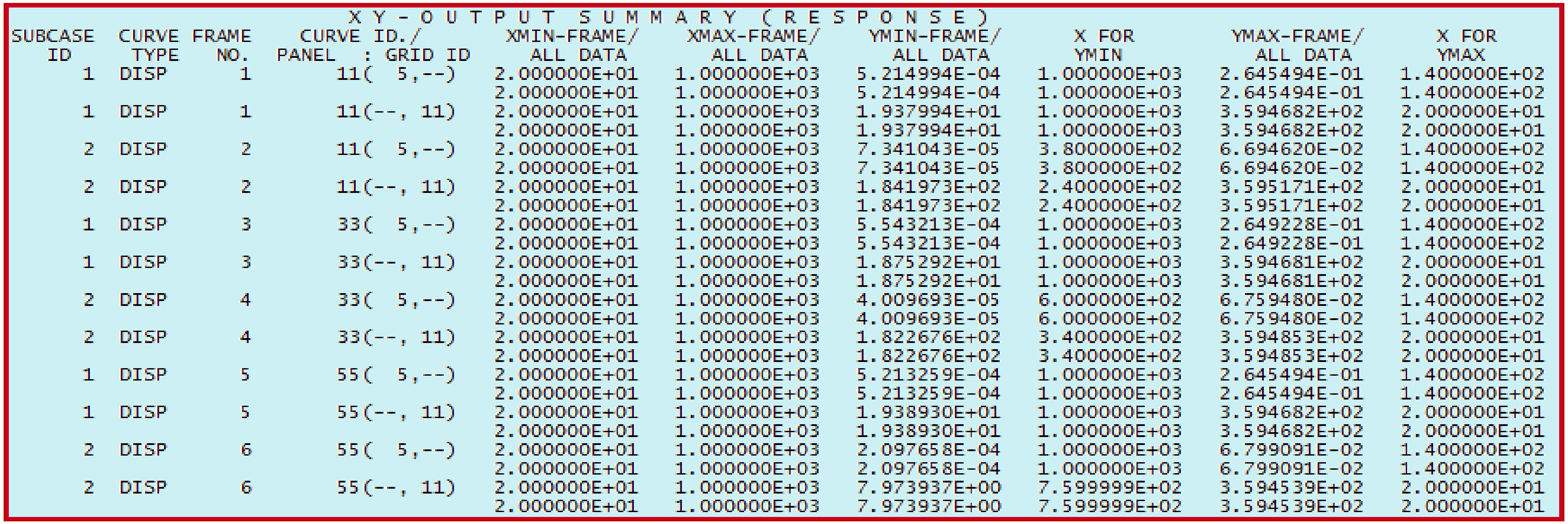


```
                                                                                                             RANDOM 400

   POINT-ID =         11
                                             D I S P L A C E M E N T   V E C T O R
                                             ( POWER SPECTRAL DENSITY FUNCTION )

   FREQUENCY    TYPE          T1             T2             T3             R1             R2             R3
 2.000000E+01     G      2.047311E-24   4.813178E-24   7.947331E-05   2.155795E-07   6.016015E-06   3.429897E-24
 4.000000E+01     G      3.063236E-23   7.202370E-23   1.189875E-03   1.059814E-06   8.969508E-05   5.132467E-23
 6.000000E+01     G      3.794026E-23   8.919526E-23   1.465137E-03   1.070977E-06   1.104442E-04   6.356211E-23
 8.000000E+01     G      5.574523E-23   1.310395E-22   2.142037E-03   1.086197E-06   1.618793E-04   9.338263E-23
 1.000000E+02     G      1.114825E-22   2.620410E-22   4.271507E-03   1.111215E-06   3.248373E-04   1.867421E-22
 1.200000E+02     G      5.202125E-22   1.222797E-21   1.998794E-02   1.157916E-06   1.539923E-03   8.714393E-22
 1.400000E+02     G      1.539327E-21   3.618264E-21   5.925515E-02   1.630665E-06   4.635199E-03   2.578667E-21
 1.600000E+02     G      1.029181E-22   2.418989E-22   3.963873E-03   1.260984E-06   3.156277E-04   1.724026E-22
 1.800000E+02     G      2.862338E-23   6.726738E-23   1.101076E-03   1.252672E-06   8.950988E-05   4.794377E-23
 2.000000E+02     G      1.196908E-23   2.812178E-23   4.588214E-04   1.273440E-06   3.821337E-05   2.004435E-23
 2.200000E+02     G      6.082900E-24   1.428679E-23   2.317123E-04   1.305726E-06   1.985387E-05   1.018378E-23
 2.400000E+02     G      3.471220E-24   8.148420E-24   1.309352E-04   1.346497E-06   1.159904E-05   5.808679E-24
 2.600000E+02     G      2.140898E-24   5.021786E-24   7.962531E-05   1.395422E-06   7.335359E-06   3.580120E-24
 2.800000E+02     G      1.397064E-24   3.273601E-24   5.096935E-05   1.453113E-06   4.916464E-06   2.334032E-24
 3.000000E+02     G      9.521937E-25   2.228048E-24   3.386632E-05   1.520738E-06   3.447607E-06   1.588748E-24
 3.200000E+02     G      6.722475E-25   1.570069E-24   2.313863E-05   1.599961E-06   2.508359E-06   1.119715E-24
 3.400000E+02     G      4.889780E-25   1.139250E-24   1.614930E-05   1.693015E-06   1.882844E-06   8.126016E-25
 3.600000E+02     G      3.651952E-25   8.481742E-25   1.146142E-05   1.802851E-06   1.452345E-06   6.050995E-25
 3.800000E+02     G      2.795128E-25   6.465663E-25   8.249326E-06   1.933388E-06   1.147908E-06   4.613752E-25
```

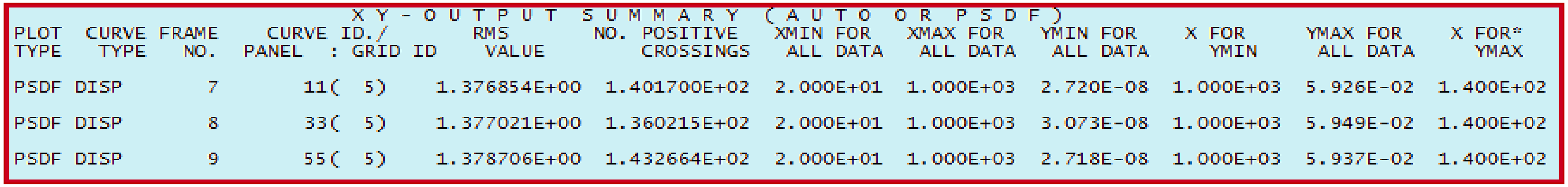


```
                                                                                                             RANDOM 400

  POINT-ID =         11
                                            D I S P L A C E M E N T   V E C T O R
                                              ( CUMULATIVE ROOT MEAN SQUARE )

  FREQUENCY    TYPE          T1             T2             T3             R1             R2             R3
2.000000E+01     G      0.0            0.0            0.0            0.0            0.0            0.0
4.000000E+01     G      1.807752E-11   2.771947E-11   1.126653E-01   3.571265E-03   3.093721E-02   2.339969E-11
6.000000E+01     G      3.182016E-11   4.879096E-11   1.981000E-01   5.836252E-03   5.439213E-02   4.118754E-11
8.000000E+01     G      4.415176E-11   6.769716E-11   2.744364E-01   7.458793E-03   7.537732E-02   5.714771E-11
1.000000E+02     G      6.018019E-11   9.226977E-11   3.734311E-01   8.809524E-03   1.027079E-01   7.789164E-11
1.200000E+02     G      9.969255E-11   1.528466E-10   6.180981E-01   1.001494E-02   1.708698E-01   1.290307E-10
1.400000E+02     G      1.747398E-10   2.679043E-10   1.083732E+00   1.132187E-02   3.015754E-01   2.261636E-10
1.600000E+02     G      2.166944E-10   3.322263E-10   1.344123E+00   1.253401E-02   3.747746E-01   2.804651E-10
1.800000E+02     G      2.197086E-10   3.368471E-10   1.362834E+00   1.349955E-02   3.801413E-01   2.843662E-10
2.000000E+02     G      2.206304E-10   3.382601E-10   1.368545E+00   1.440482E-02   3.818175E-01   2.855591E-10
2.200000E+02     G      2.210392E-10   3.388864E-10   1.371065E+00   1.527386E-02   3.825772E-01   2.860879E-10
2.400000E+02     G      2.212552E-10   3.392172E-10   1.372387E+00   1.611871E-02   3.829880E-01   2.863673E-10
2.600000E+02     G      2.213820E-10   3.394113E-10   1.373154E+00   1.694792E-02   3.832351E-01   2.865312E-10
```

Step 6. Review the Results in the Solution File (Cont.)

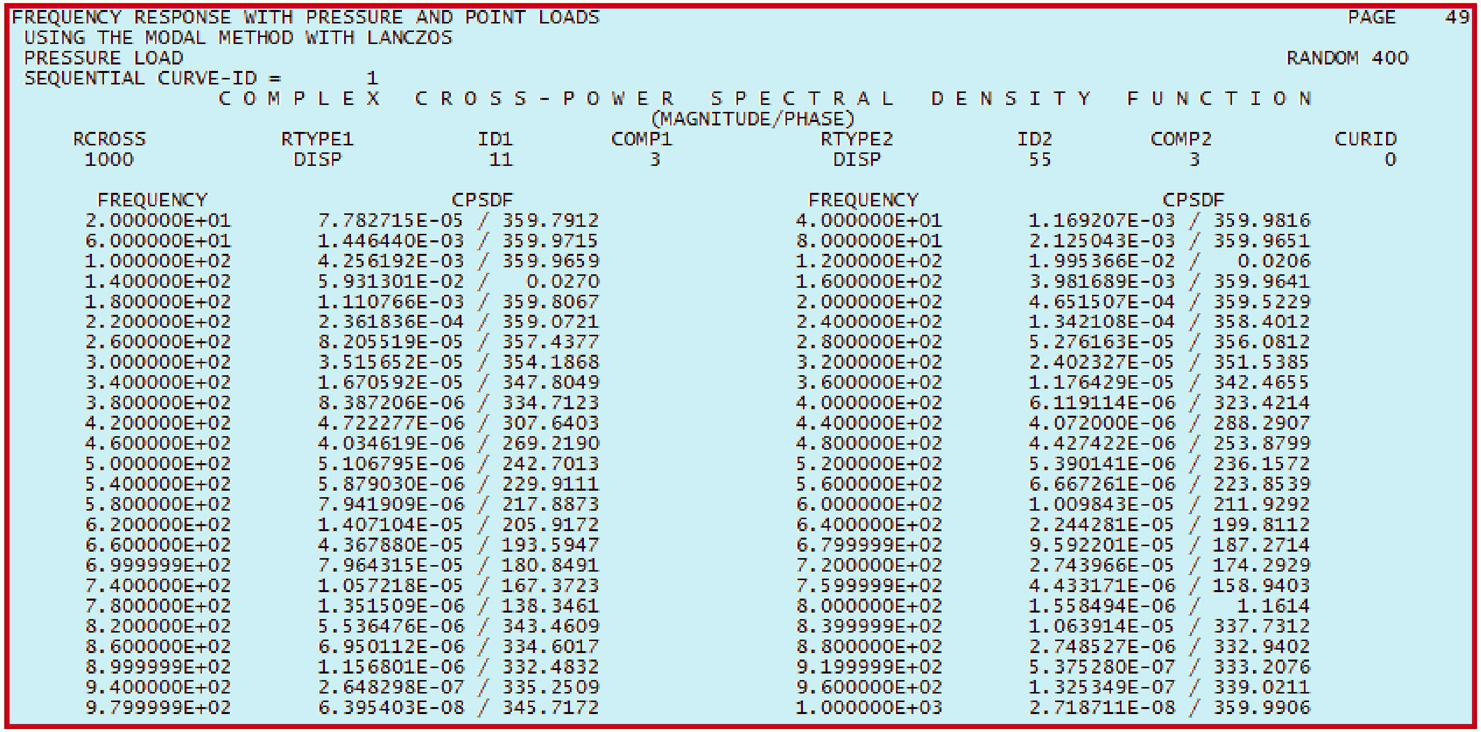


```
                                       X Y - O U T P U T   S U M M A R Y   ( R E S P O N S E )
SUBCASE   CURVE  FRAME    CURVE ID./     XMIN-FRAME/    XMAX-FRAME/    YMIN-FRAME/      X FOR       YMAX-FRAME/     X FOR
   ID      TYPE   NO.   PANEL  : GRID ID   ALL DATA       ALL DATA       ALL DATA        YMIN         ALL DATA        YMAX
      1   DISP      1         11(  5,--)  2.000000E+01   1.000000E+03   5.214994E-04   1.000000E+03   2.645494E-01   1.400000E+02
                                          2.000000E+01   1.000000E+03   5.214994E-04   1.000000E+03   2.645494E-01   1.400000E+02
      1   DISP      1         11(--, 11)  2.000000E+01   1.000000E+03   1.937994E+01   1.000000E+03   3.594682E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   1.937994E+01   1.000000E+03   3.594682E+02   2.000000E+01
      2   DISP      2         11(  5,--)  2.000000E+01   1.000000E+03   7.341043E-05   3.800000E+02   6.694620E-02   1.400000E+02
                                          2.000000E+01   1.000000E+03   7.341043E-05   3.800000E+02   6.694620E-02   1.400000E+02
      2   DISP      2         11(--, 11)  2.000000E+01   1.000000E+03   1.841973E+02   2.400000E+02   3.595171E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   1.841973E+02   2.400000E+02   3.595171E+02   2.000000E+01
      1   DISP      3         33(  5,--)  2.000000E+01   1.000000E+03   5.543213E-04   1.000000E+03   2.649228E-01   1.400000E+02
                                          2.000000E+01   1.000000E+03   5.543213E-04   1.000000E+03   2.649228E-01   1.400000E+02
      1   DISP      3         33(--, 11)  2.000000E+01   1.000000E+03   1.875292E+01   1.000000E+03   3.594681E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   1.875292E+01   1.000000E+03   3.594681E+02   2.000000E+01
      2   DISP      4         33(  5,--)  2.000000E+01   1.000000E+03   4.009693E-05   6.000000E+02   6.759480E-02   1.400000E+02
                                          2.000000E+01   1.000000E+03   4.009693E-05   6.000000E+02   6.759480E-02   1.400000E+02
      2   DISP      4         33(--, 11)  2.000000E+01   1.000000E+03   1.822676E+02   3.400000E+02   3.594853E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   1.822676E+02   3.400000E+02   3.594853E+02   2.000000E+01
      1   DISP      5         55(  5,--)  2.000000E+01   1.000000E+03   5.213259E-04   1.000000E+03   2.645494E-01   1.400000E+02
                                          2.000000E+01   1.000000E+03   5.213259E-04   1.000000E+03   2.645494E-01   1.400000E+02
      1   DISP      5         55(--, 11)  2.000000E+01   1.000000E+03   1.938930E+01   1.000000E+03   3.594682E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   1.938930E+01   1.000000E+03   3.594682E+02   2.000000E+01
      2   DISP      6         55(  5,--)  2.000000E+01   1.000000E+03   2.097658E-04   1.000000E+03   6.799091E-02   1.400000E+02
                                          2.000000E+01   1.000000E+03   2.097658E-04   1.000000E+03   6.799091E-02   1.400000E+02
      2   DISP      6         55(--, 11)  2.000000E+01   1.000000E+03   7.973937E+00   7.599999E+02   3.594539E+02   2.000000E+01
                                          2.000000E+01   1.000000E+03   7.973937E+00   7.599999E+02   3.594539E+02   2.000000E+01
```



```
                                  X Y - O U T P U T   S U M M A R Y   ( A U T O   O R   P S D F )
PLOT  CURVE  FRAME     CURVE ID./         RMS        NO. POSITIVE   XMIN FOR    XMAX FOR    YMIN FOR     X FOR     YMAX FOR     X FOR*
TYPE   TYPE   NO.    PANEL  : GRID ID    VALUE          CROSSINGS   ALL DATA    ALL DATA    ALL DATA     YMIN      ALL DATA     YMAX

PSDF  DISP      7          11(  5)     1.376854E+00  1.401700E+02  2.000E+01   1.000E+03   2.720E-08   1.000E+03   5.926E-02   1.400E+02

PSDF  DISP      8          33(  5)     1.377021E+00  1.360215E+02  2.000E+01   1.000E+03   3.073E-08   1.000E+03   5.949E-02   1.400E+02

PSDF  DISP      9          55(  5)     1.378706E+00  1.432664E+02  2.000E+01   1.000E+03   2.718E-08   1.000E+03   5.937E-02   1.400E+02
```

Step 6. Review the Results in the Solution File (Cont.)

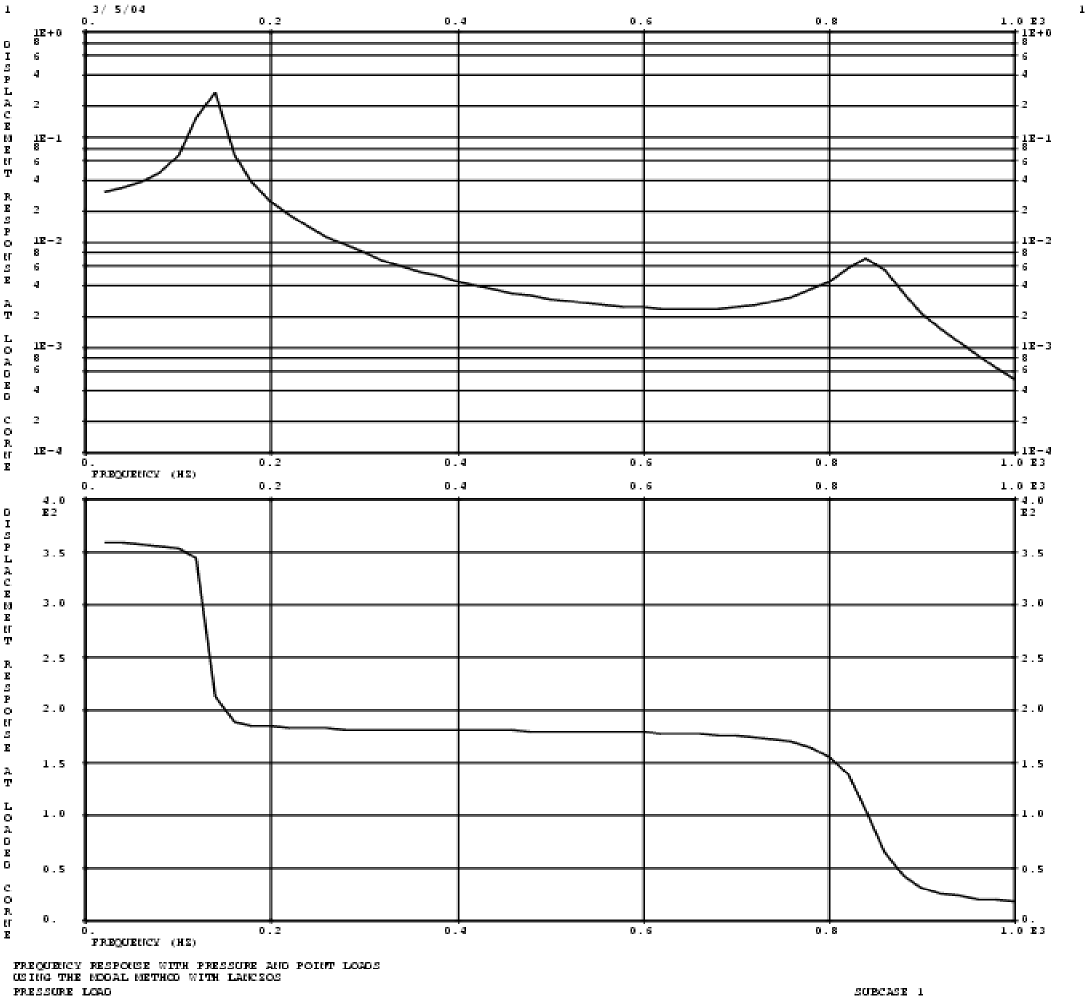


```
FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS                                                             PAGE    49
 USING THE MODAL METHOD WITH LANCZOS
 PRESSURE LOAD                                                                                          RANDOM 400
 SEQUENTIAL CURVE-ID =        1
                 C O M P L E X   C R O S S - P O W E R   S P E C T R A L   D E N S I T Y   F U N C T I O N
                                                    (MAGNITUDE/PHASE)
     RCROSS           RTYPE1          ID1        COMP1            RTYPE2          ID2        COMP2             CURID
      1000             DISP            11           3              DISP            55           3                  0

       FREQUENCY                    CPSDF                        FREQUENCY                    CPSDF
      2.000000E+01       7.782715E-05 / 359.7912                4.000000E+01       1.169207E-03 / 359.9816
      6.000000E+01       1.446440E-03 / 359.9715                8.000000E+01       2.125043E-03 / 359.9651
      1.000000E+02       4.256192E-03 / 359.9659                1.200000E+02       1.995366E-02 /   0.0206
      1.400000E+02       5.931301E-02 /   0.0270                1.600000E+02       3.981689E-03 / 359.9641
      1.800000E+02       1.110766E-03 / 359.8067                2.000000E+02       4.651507E-04 / 359.5229
      2.200000E+02       2.361836E-04 / 359.0721                2.400000E+02       1.342108E-04 / 358.4012
      2.600000E+02       8.205519E-05 / 357.4377                2.800000E+02       5.276163E-05 / 356.0812
      3.000000E+02       3.515652E-05 / 354.1868                3.200000E+02       2.402327E-05 / 351.5385
      3.400000E+02       1.670592E-05 / 347.8049                3.600000E+02       1.176429E-05 / 342.4655
      3.800000E+02       8.387206E-06 / 334.7123                4.000000E+02       6.119114E-06 / 323.4214
      4.200000E+02       4.722277E-06 / 307.6403                4.400000E+02       4.072000E-06 / 288.2907
      4.600000E+02       4.034619E-06 / 269.2190                4.800000E+02       4.427422E-06 / 253.8799
      5.000000E+02       5.106795E-06 / 242.7013                5.200000E+02       5.390141E-06 / 236.1572
      5.400000E+02       5.879030E-06 / 229.9111                5.600000E+02       6.667261E-06 / 223.8539
      5.800000E+02       7.941909E-06 / 217.8873                6.000000E+02       1.009843E-05 / 211.9292
      6.200000E+02       1.407104E-05 / 205.9172                6.400000E+02       2.244281E-05 / 199.8112
      6.600000E+02       4.367880E-05 / 193.5947                6.799999E+02       9.592201E-05 / 187.2714
      6.999999E+02       7.964315E-05 / 180.8491                7.200000E+02       2.743966E-05 / 174.2929
      7.400000E+02       1.057218E-05 / 167.3723                7.599999E+02       4.433171E-06 / 158.9403
      7.800000E+02       1.351509E-06 / 138.3461                8.000000E+02       1.558494E-06 /   1.1614
      8.200000E+02       5.536476E-06 / 343.4609                8.399999E+02       1.063914E-05 / 337.7312
      8.600000E+02       6.950112E-06 / 334.6017                8.800000E+02       2.748527E-06 / 332.9402
      8.999999E+02       1.156801E-06 / 332.4832                9.199999E+02       5.375280E-07 / 333.2076
      9.400000E+02       2.648298E-07 / 335.2509                9.600000E+02       1.325349E-07 / 339.0211
      9.799999E+02       6.395403E-08 / 345.7172                1.000000E+03       2.718711E-08 / 359.9906
```

Step 7. Review the Graph Results

Recall that to obtain the graphs you will need to convert the **.plt** file to a **.ps** file, if needed, use the directions given in the workshop 4, step 9.

Pressure load displacement response at loaded corner, grid point 11

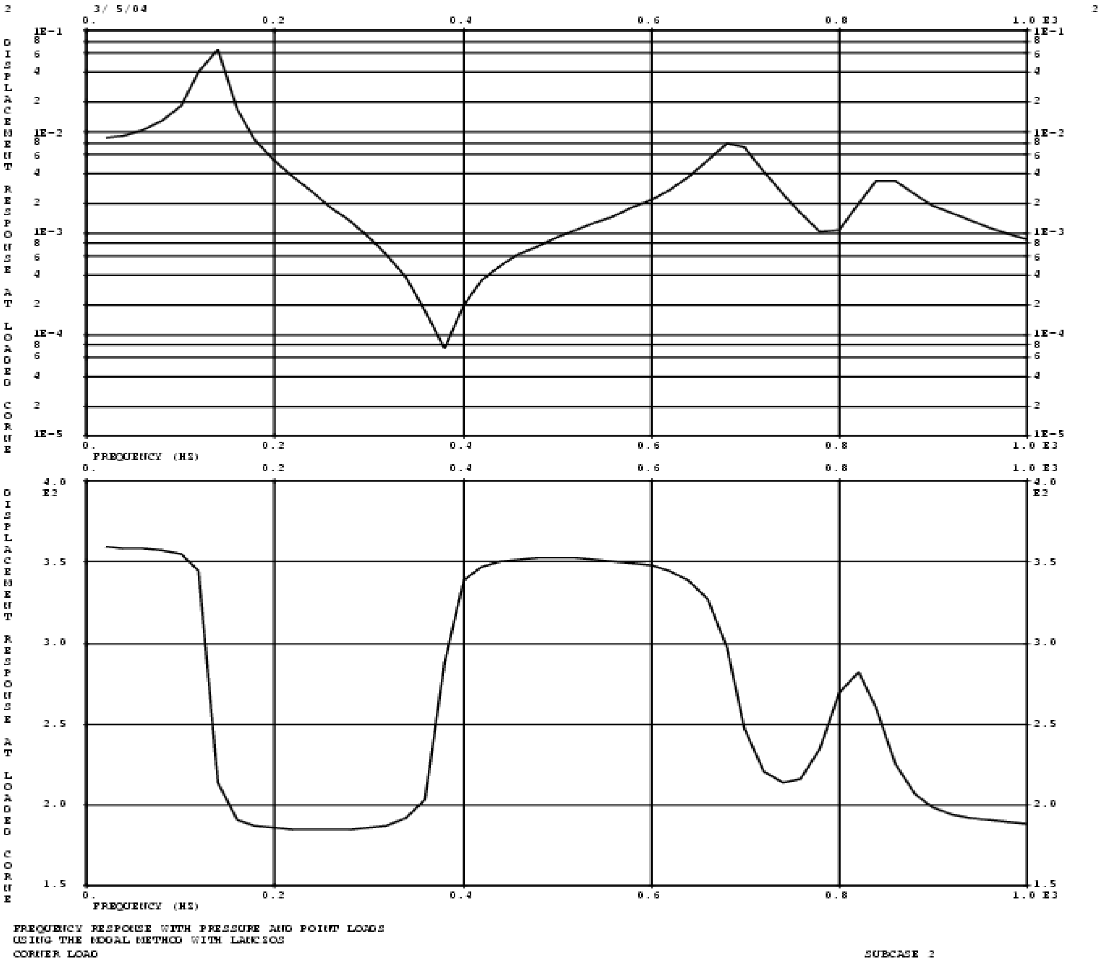


FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
USING THE MODAL METHOD WITH LANCZOS
PRESSURE LOAD

SUBCASE 1

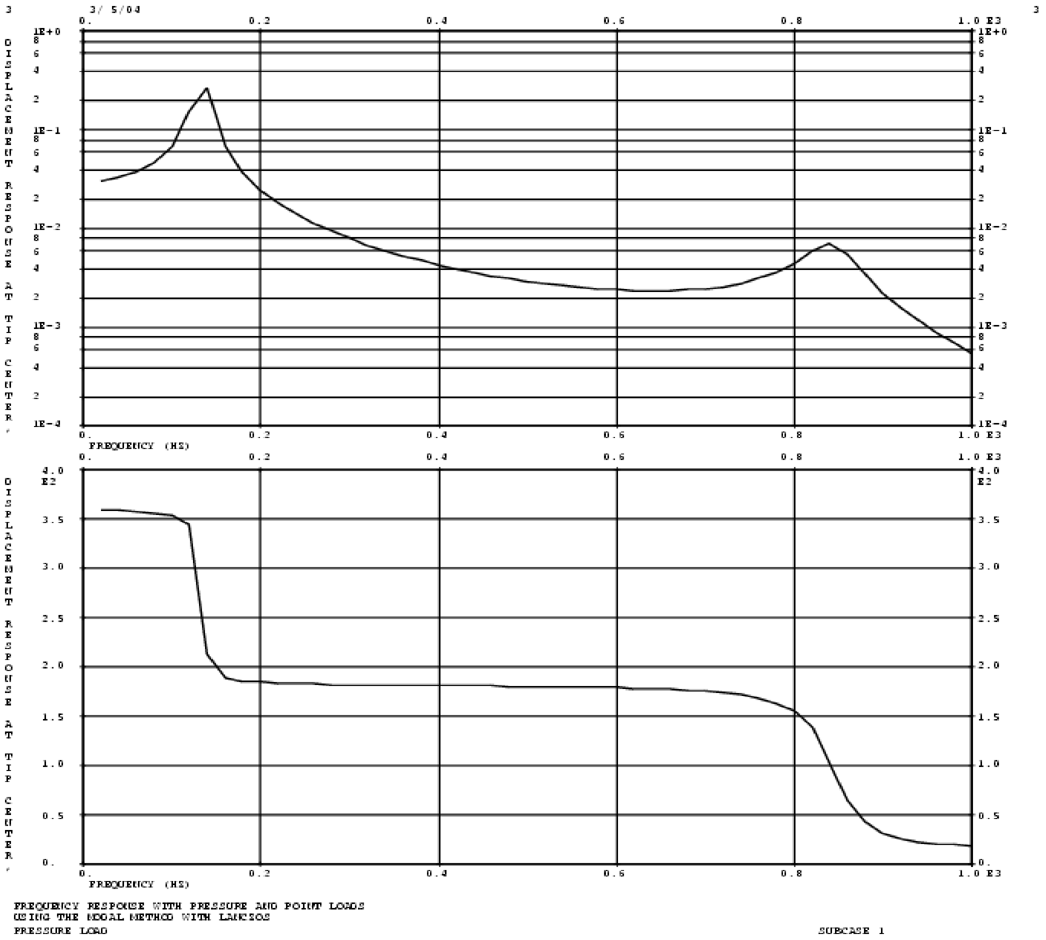
Step 7. Review the Graph Results (Cont.)

Point load displacement response at loaded corner, grid point 11



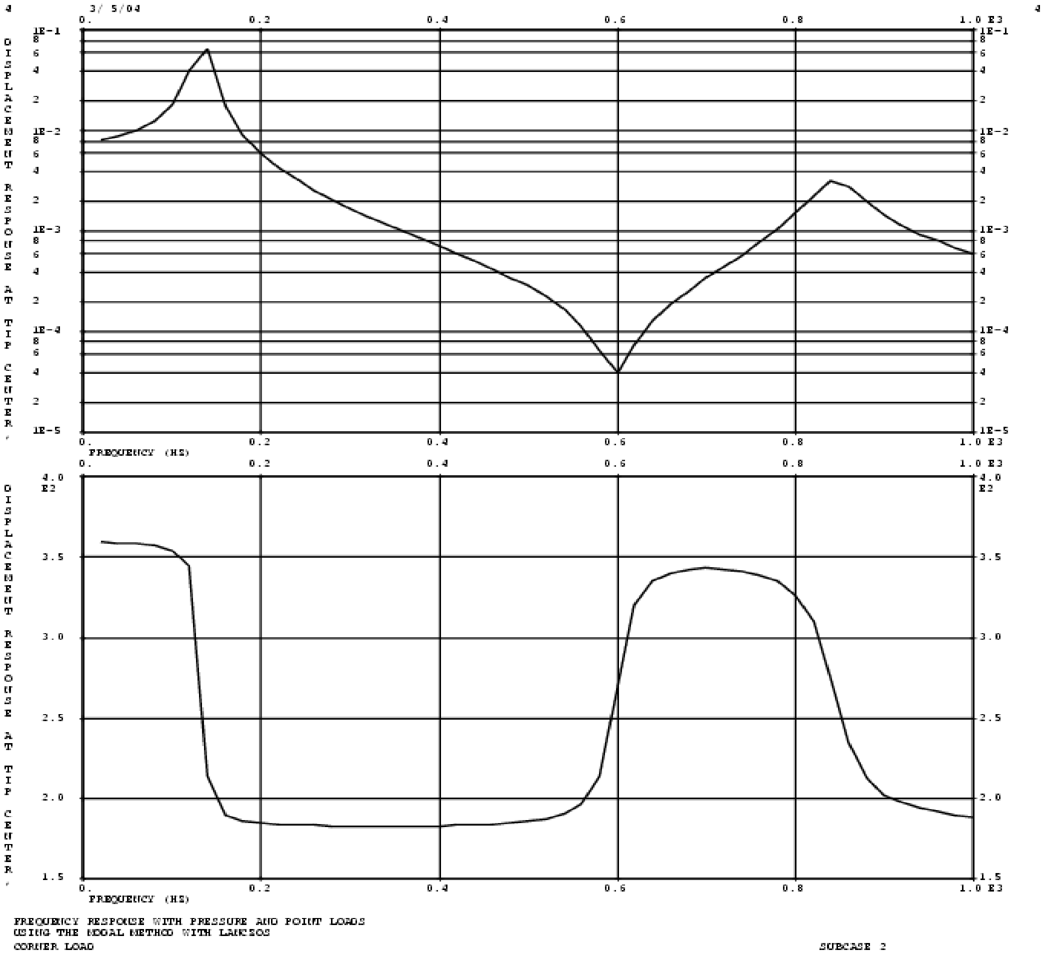
Step 7. Review the Graph Results (Cont.)

Pressure load displacement response at center tip, grid point 33



Step 7. Review the Graph Results (Cont.)

Point load displacement response at center tip, grid point 33

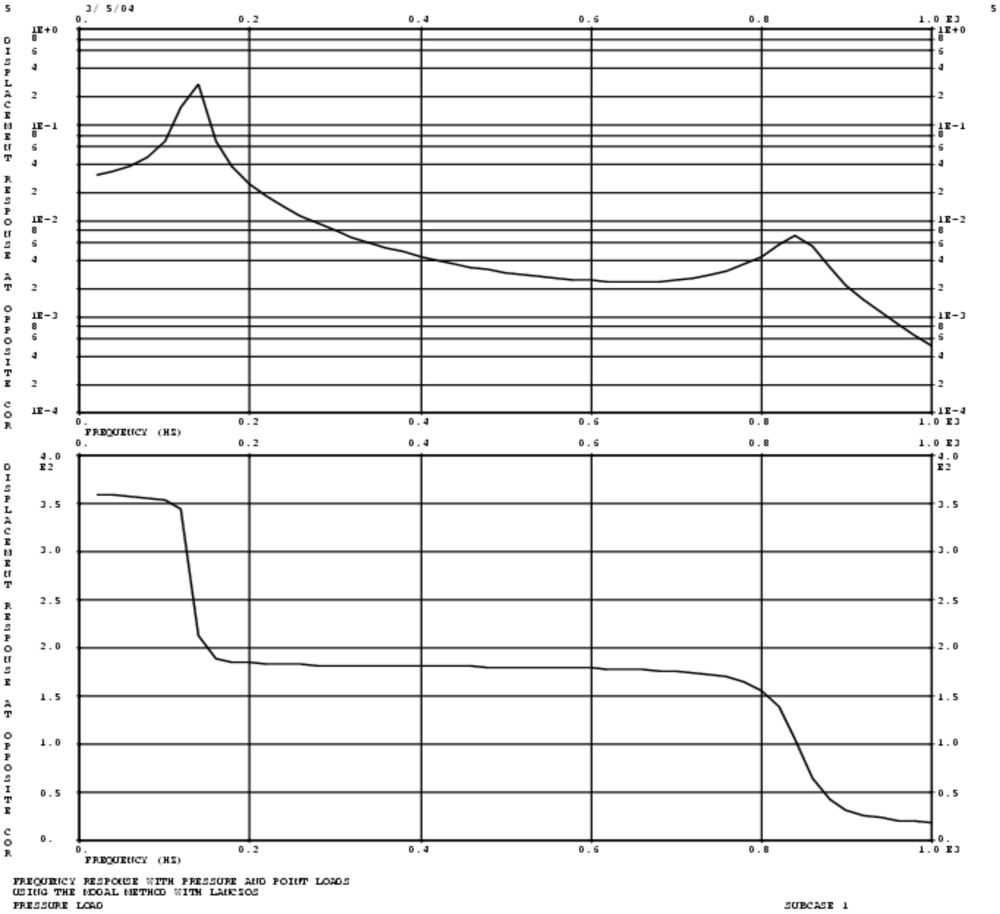


FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
USING THE MODAL METHOD WITH LANCZOS
CORNER LOAD

SUBCASE 2

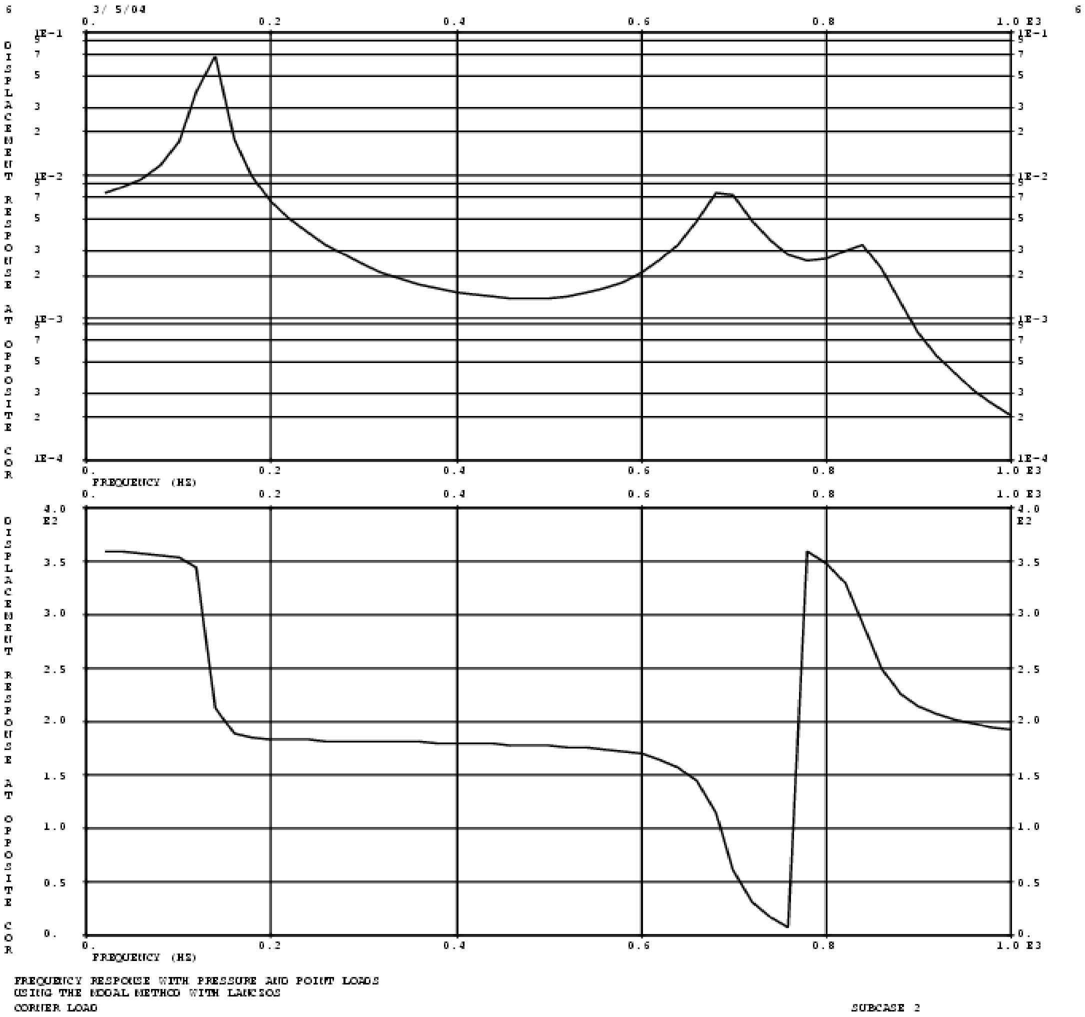
Step 7. Review the Graph Results (Cont.)

Pressure load displacement response at opposite corner, grid point 55



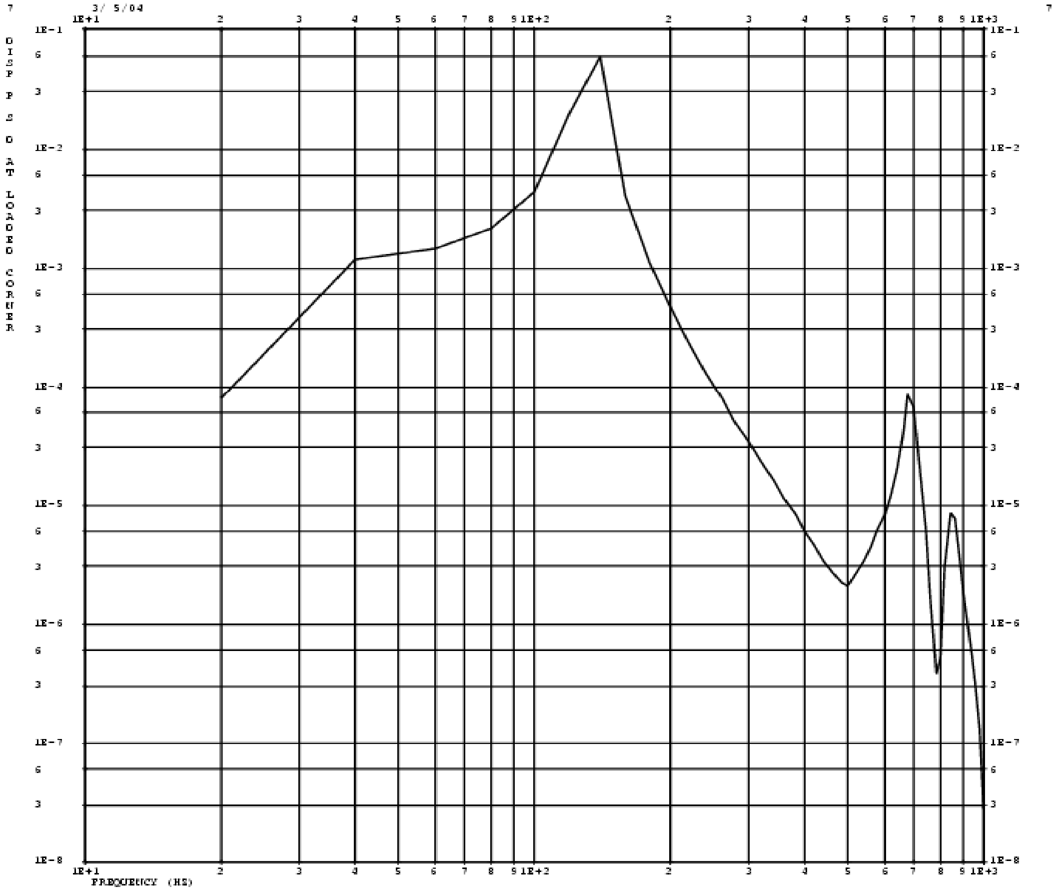
Step 7. Review the Graph Results (Cont.)

Point load displacement response at opposite corner, grid point 55



Step 7. Review the Graph Results (Cont.)

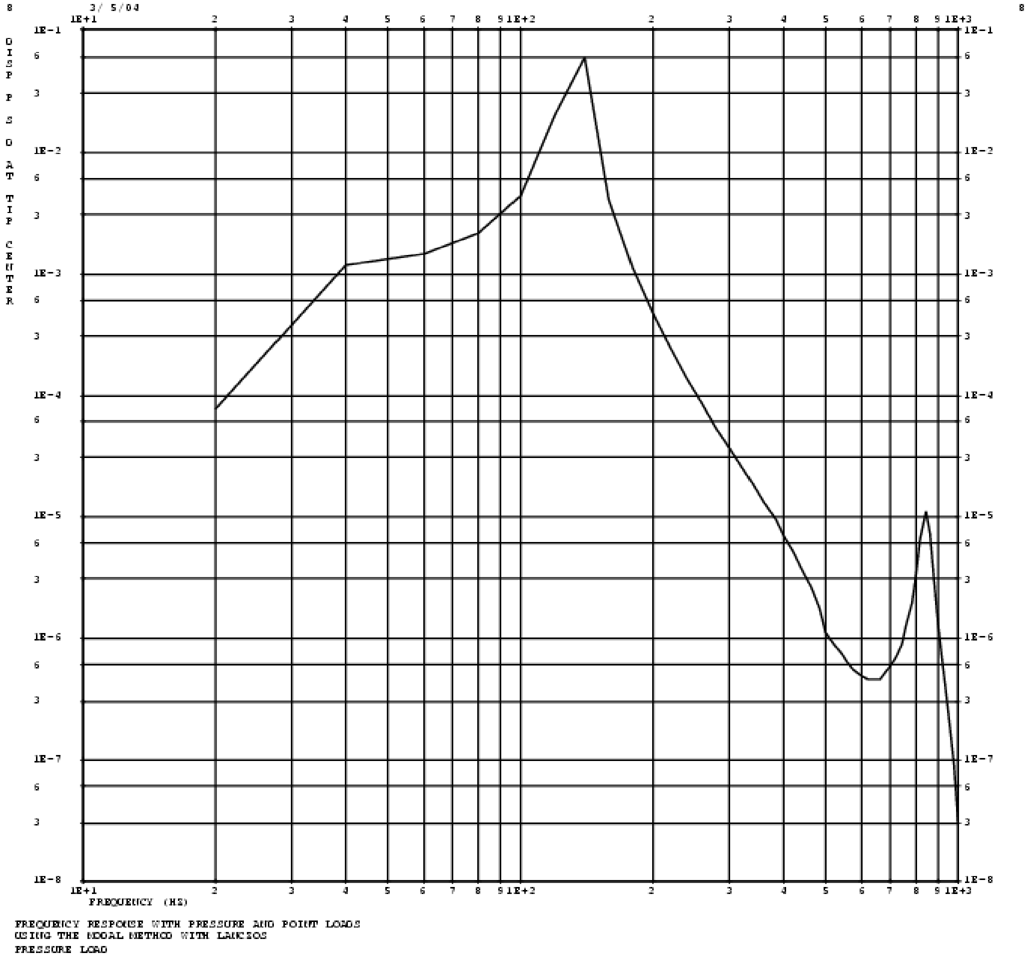
Displacement PSD response at loaded corner, grid point 11



FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
USING THE MODAL METHOD WITH LANCZOS
PRESSURE LOAD

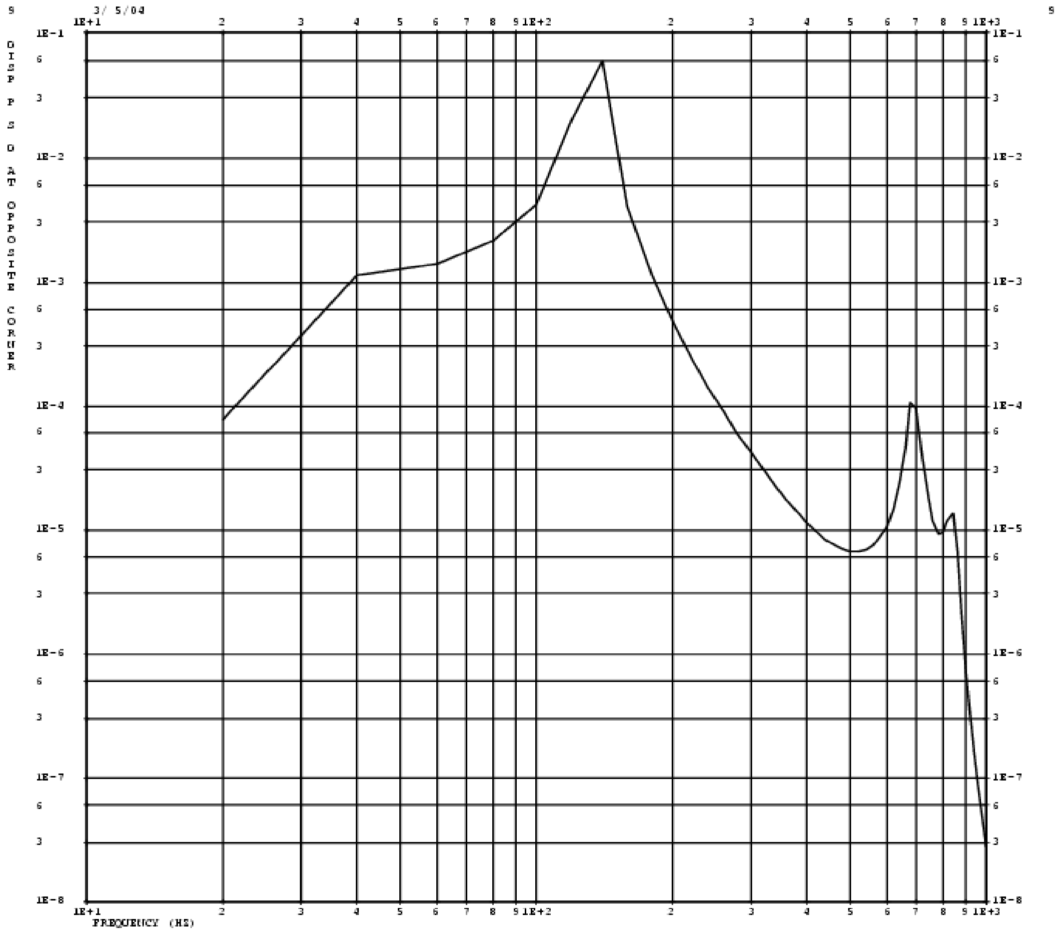
Step 7. Review the Graph Results (Cont.)

Displacement PSD response at tip center, grid point 33



Step 7. Review the Graph Results (Cont.)

Displacement PSD response at opposite corner, grid point 55



FREQUENCY RESPONSE WITH PRESSURE AND POINT LOADS
USING THE MODAL METHOD WITH LANCZOS
PRESSURE LOAD