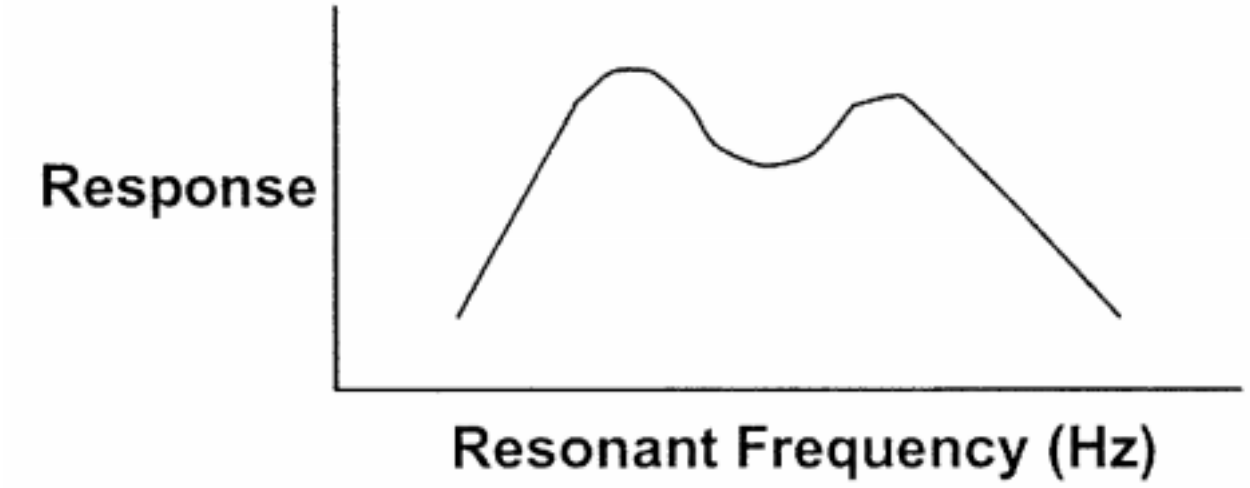
WORKSHOP PROBLEM 9b

Response Spectra (cont.)



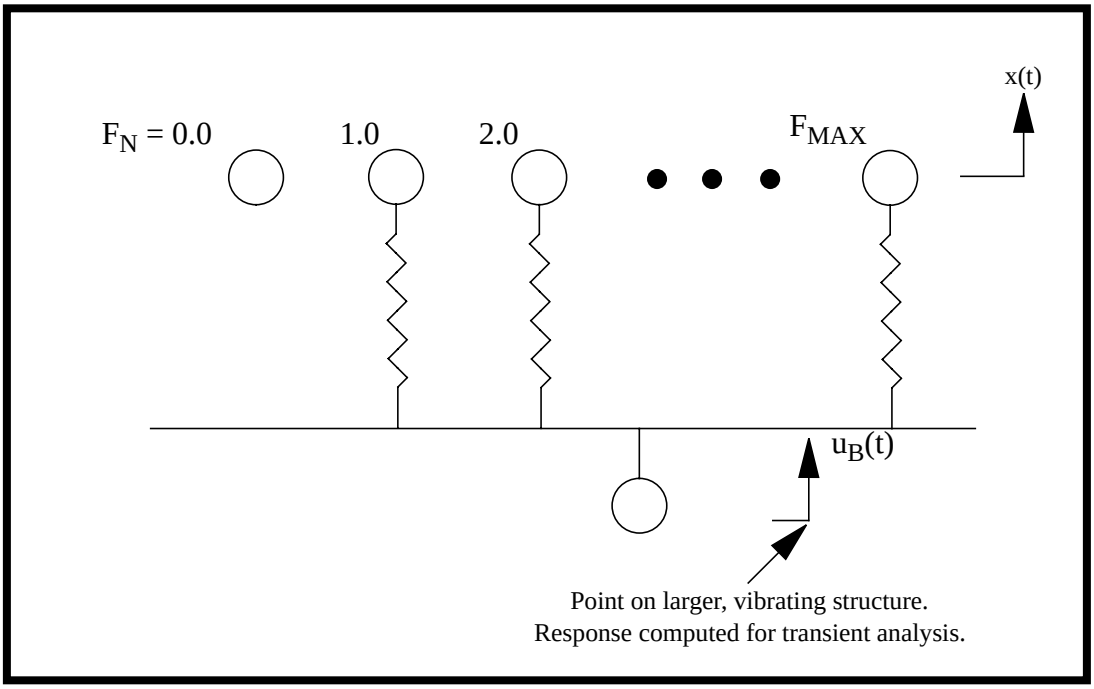
Objectives:

- Apply the shock spectrum.
- Submit the file for analysis in MSC/NASTRAN.
- Calculate the shock response using SOL 103.

Model Description:

Define the shock response of the plate due to a 2.0 in/sec^2 sine pulse applied at the clamped edge. Use modes to a frequency of 1000 Hz with 3% critical damping. Use the SRSS option for model response summation.

Figure 9b.1-Model Description and Loading Diagram



Suggested Exercise Steps:

- Reference a previously created dynamic math model, **plate.bdf**, by using the INCLUDE statement.
- Modify boundary conditions for clamped modes.
- Place big foundation mass (BFM) at base to simulate ‘clamped’ modes (CMASS2).
- RBE mass to remaining base point (RBE2).
- Identify excitation DOFs (SUPORT).
- Specify damping table (TABDMP1).
- Specify shock spectrum to be used (DLOAD).
- Specify shock tables (DTI).
- Insert punch output for shock spectrum calculation.
- Specify the appropriate parameters.
  - PARAM, SCRSPEC, 0
  - PARAM, OPTION, SRSS
  - PARAM, LFREQ, 0.1
  - PARAM, HFREQ, 1000
- Generate an input file and submit it to the MSC/NASTRAN solver (SOL103).
- Review the results.

```
ID SEMINAR,PROB9B
```

```
CEND
```

BEGIN BULK

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

ENDDATA

Generating an input file for MSC/NASTRAN Users:

MSC/NASTRAN users can generate an input file using the data from page 9-3 (Model Description). The result should be similar to the output below.

1. MSC/NASTRAN input file: **prob9b.dat**.

```
ID SEMINAR, PROB9B
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
$
INCLUDE 'plate.bdf'
PARAM,COUPMASS,1
PARAM,WTMASS,0.00259
$
$ BOUNDARY 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
```

```
$
$ SUPPORT CARD TO IDENTIFY EXCITATION DOFS
$
SUPORT, 23, 3
$
$ EIGENVALUE EXTRACTION
$ MUST BE MASS NORMALIZED (DEFAULT)
$
EIGR, 100, MGIV, 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.
$
$ 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
```

Submitting the input file for analysis:

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

   To submit the MSC/NASTRAN **.dat** file, find an available UNIX shell window and at the command prompt enter **nastran prob9b scr=yes**. Monitor the run using the UNIX **ps** command.

3. When the run is completed, edit the **prob9b.f06** file and search for the word **FATAL**. If no matches exist, search for the word **WARNING**. Determine whether existing WARNING messages indicate modeling errors.

Comparison of Results

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

```
*** USER INFORMATION MESSAGE 3035 FOR DATA BLOCK   KLR

   SUPPORT PT.NO.        EPSILON        STRAIN   ENERGY     EPSILONS LARGER THAN 0.001 ARE FLAGGED WITH ASTERISKS
               1     9.5369362E-15       2.2118911E-09
    RESPONSE SPECTRUM ANALYSIS                                JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE    12
     USING CALCULATED SHOCK RESPONSE
  SHOCK WILL BE INPUT IN Z DIRECTION                        SUBCASE 1

*** USER    INFORMATION MESSAGE 4415,
          THE FOLLOWING A-SET DEGREES OF FREEDOM HAVE EITHER NULL MASSES OR NULL MASSES AND STIFFNESS.
    RESPONSE SPECTRUM ANALYSIS                                JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE    13
     USING CALCULATED SHOCK RESPONSE
     SHOCK WILL BE INPUT IN Z DIRECTION                                                          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     101        0.0                0.0               0.0             1.000000E+00       0.0
      2     102        7.058213E+05       8.401317E+02      1.337111E+02    1.000000E+00       7.058213E+05
      3     103        1.878432E+07       4.334088E+03      6.897916E+02    1.000000E+00       1.878432E+07
      4     104        2.811620E+07       5.302471E+03      8.439145E+02    1.000000E+00       2.811620E+07
      5     105        1.931709E+08       1.389859E+04      2.212030E+03    0.0                0.0
      6       1        2.234434E+08       1.494802E+04      2.379052E+03    0.0                0.0
      7     106        2.328846E+08       1.526056E+04      2.428793E+03    0.0                0.0
      8     107        6.845925E+08       2.616472E+04      4.164244E+03    0.0                0.0
      9     108        9.602310E+08       3.098759E+04      4.931829E+03    0.0                0.0
     10     109        1.365612E+09       3.695418E+04      5.881441E+03    0.0                0.0
^^^ USER INFORMATION MESSAGE 9047 (POSTREIG) -  SCALED RESPONSE SPECTRA FOR RESIDUAL STRUCTURE ONLY
   RESPONSE SPECTRUM ANALYSIS                                 JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE    20
     USING CALCULATED SHOCK RESPONSE
     SHOCK WILL BE INPUT IN Z DIRECTION                                                          SUBCASE 1
      MATRIX FN      (GINO NAME 101 ) IS A DB  PREC          1 COLUMN X          3 ROW RECTANG  MATRIX.
COLUMN      1      ROWS      1 THRU      3     ------------------------------------------------
ROW
     1)    1.337111500777D+02  6.897918198043D+02  8.439147827213D+02
THE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN =       3
THE DENSITY OF THIS MATRIX IS 100.00 PERCENT.
```

```
RESPONSE SPECTRUM ANALYSIS                                     JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE
USING CALCULATED SHOCK RESPONSE
SHOCK WILL BE INPUT IN Z DIRECTION                                                                    SUBCAS
           PSIT
POINT          VALUE     POINT      VALUE     POINT       VALUE     POINT       VALUE     POINT          VALU

COLUMN        1
    23 T3 -2.11560E-02
COLUMN        2
    23 T3 -4.40398E-16
COLUMN        3
    23 T3  1.18599E-02
RESPONSE SPECTRUM ANALYSIS                                     JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE
USING CALCULATED SHOCK RESPONSE
SHOCK WILL BE INPUT IN Z DIRECTION                                                                    SUBCAS
            U S E T   D E F I N I T I O N   T A B L E   ( I N T E R N A L   S E Q U E N C E ,   R O W   S O R
                                                R    DISPLACEMENT SET
          -1-        -2-        -3-        -4-        -5-        -6-        -7-        -8-        -9-        -

     1=       23-3
  SCALED SPECTRAL RESPONSE, SRSS OPTION, DLOAD =        500  CLOSE =       1.00

RESPONSE SPECTRUM ANALYSIS                                     JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE
USING CALCULATED SHOCK RESPONSE
SHOCK WILL BE INPUT IN Z DIRECTION                                                                    SUBCAS
      MATRIX UHVR     (GINO NAME 101 ) IS A REAL               3 COLUMN X          3 ROW SQUARE   MATRIX.
COLUMN      1      ROWS      1 THRU      3     --------------------------------------------------
ROW
     1)    7.6201E-08  0.0000E+00  4.8912E-10
COLUMN      2      ROWS      1 THRU      3     --------------------------------------------------
ROW
     1)    6.4019E-05  0.0000E+00  2.5935E-06
COLUMN      3      ROWS      1 THRU      3     --------------------------------------------------
ROW
     1)    5.3784E-02  0.0000E+00  1.3752E-02
THE NUMBER OF NON-ZERO TERMS IN THE DENSEST COLUMN =       2
THE DENSITY OF THIS MATRIX IS  66.67 PERCENT.
RESPONSE SPECTRUM ANALYSIS                                     JULY   5, 1997  MSC/NASTRAN   1/23/97   PAGE
```

USING CALCULATED SHOCK RESPONSE
SHOCK WILL BE INPUT IN Z DIRECTION SUBCASE 1
TIME = 0.000000E+00

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	6.222643E-10	0.0	0.0	0.0
2	G	0.0	0.0	7.374101E-08	8.308994E-08	3.059527E-07	0.0
3	G	0.0	0.0	3.173752E-07	1.214202E-07	6.616859E-07	0.0
4	G	0.0	0.0	7.194814E-07	1.167081E-07	9.376687E-07	0.0
5	G	0.0	0.0	1.246589E-06	1.039592E-07	1.160147E-06	0.0
6	G	0.0	0.0	1.870825E-06	8.258849E-08	1.326412E-06	0.0
7	G	0.0	0.0	2.565942E-06	6.149954E-08	1.444516E-06	0.0
8	G	0.0	0.0	3.308983E-06	4.203442E-08	1.519611E-06	0.0
9	G	0.0	0.0	4.080410E-06	2.671514E-08	1.559985E-06	0.0
10	G	0.0	0.0	4.865109E-06	1.691765E-08	1.575028E-06	0.0
11	G	0.0	0.0	5.653596E-06	1.301237E-08	1.577945E-06	0.0
12	G	0.0	0.0	6.222643E-10	0.0	0.0	0.0
13	G	0.0	0.0	9.569825E-08	1.430303E-08	3.703413E-07	0.0
14	G	0.0	0.0	3.577567E-07	4.357941E-08	6.684602E-07	0.0
15	G	0.0	0.0	7.614155E-07	5.321706E-08	9.362424E-07	0.0
16	G	0.0	0.0	1.284521E-06	4.871796E-08	1.147647E-06	0.0
17	G	0.0	0.0	1.901587E-06	4.101944E-08	1.312728E-06	0.0
18	G	0.0	0.0	2.589113E-06	3.141624E-08	1.430590E-06	0.0
19	G	0.0	0.0	3.325147E-06	2.263403E-08	1.507938E-06	0.0
20	G	0.0	0.0	4.091029E-06	1.555984E-08	1.551409E-06	0.0
21	G	0.0	0.0	4.872190E-06	1.101371E-08	1.570698E-06	0.0
22	G	0.0	0.0	5.659176E-06	8.953050E-09	1.576591E-06	0.0
23	G	0.0	0.0	6.222643E-10	0.0	0.0	0.0
24	G	0.0	0.0	9.883527E-08	0.0	3.798185E-07	0.0
25	G	0.0	0.0	3.680177E-07	0.0	6.836093E-07	0.0
26	G	0.0	0.0	7.745986E-07	0.0	9.334775E-07	0.0
27	G	0.0	0.0	1.296574E-06	0.0	1.145700E-06	0.0
28	G	0.0	0.0	1.911807E-06	0.0	1.307858E-06	0.0
29	G	0.0	0.0	2.596946E-06	0.0	1.426281E-06	0.0
30	G	0.0	0.0	3.330809E-06	0.0	1.503975E-06	0.0

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