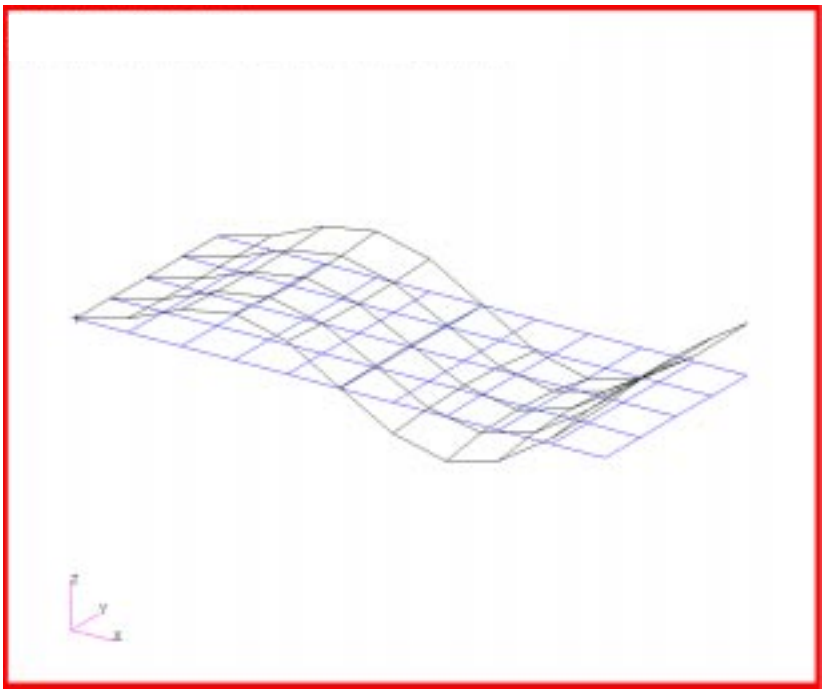
WORKSHOP PROBLEM 2

Modal Analysis of A Flat Plate using Static Reduction



Objectives

- Reduce the dynamic math model, created in Workshop 1, to one with fewer degrees of freedom.
- Produce a MSC/NASTRAN input file.
- Submit the file for analysis in MSC/NASTRAN.
- Find the first five natural frequencies and mode shapes of the flat plate.

Model Description:

For this example, reduce the dynamic math model created in Workshop 1, using static reduction. Then find the first five natural frequencies and mode shapes using the Automatic Givens method. Use the points indicated in Figure 2.2 for the A-set.

Figure 2.1-Grid Coordinates and Element Connectivities

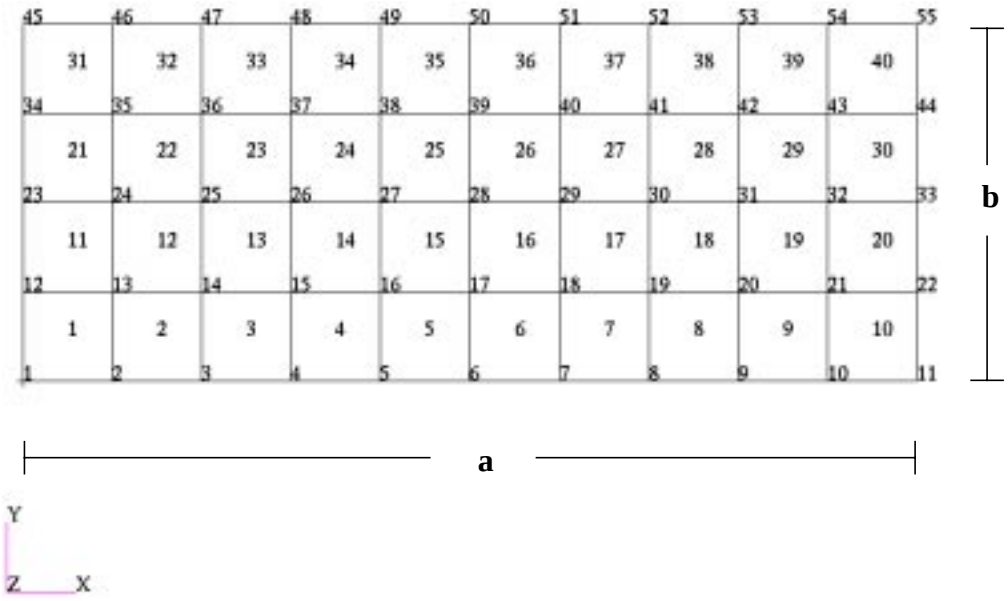


Figure 2.2-Loads and Boundary Conditions

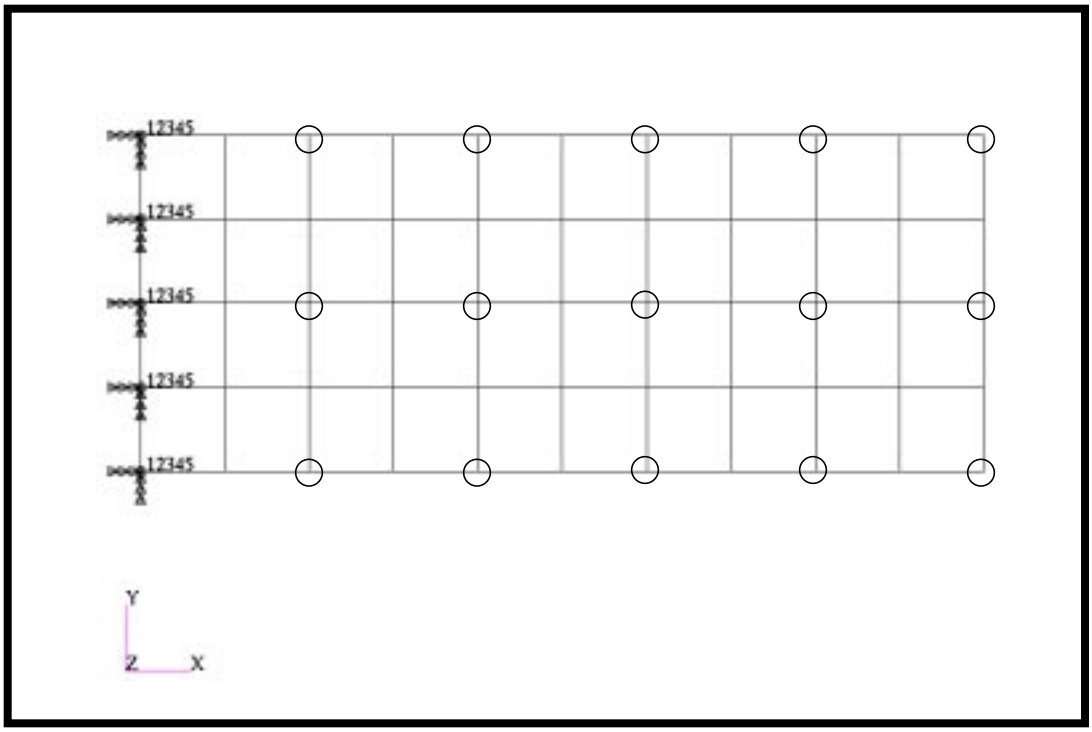


Table 2.1

Length (a)	**5 in**
Height (b)	**2 in**
Thickness	**0.100 in**
Weight Density	**0.282 lbs/in^3**
Mass/Weight Factor	**2.59E-3 sec^2/in**
Elastic Modulus	**30.0E6 lbs/in^2**
Poisson's Ratio	**0.3**

Suggested Exercise Steps

- Reference a previously created dynamic math model, **plate.bdf**, by using the INCLUDE statement.
- Prepare the model for a normal modes analysis (SOL 103 and PARAMs).
  - PARAM, WTMASS, 0.00259
  - PARAM, COUPMASS, 1
- Define degrees of freedom in the analysis set (ASET) for grids indicated in Figure 2.2.
- Generate an input file and submit it to the MSC/NASTRAN solver for normal modes analysis.
- Review the results, specifically the eigenvalues.

```
ID SEMINAR,PROB2
```

```
CEND
```

```
BEGIN BULK
```

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

ENDDATA

Exercise Procedure:

1. Users who are not utilizing MSC/PATRAN for generating an input file should go to Step 7, otherwise, proceed to step 2.

2. Create a new database named **prob2.db**.

   File/New Database

   New Database Name **prob2**

   OK

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

   Tolerance ◆ **Default**

   Analysis Code: **MSC/NASTRAN**

   OK

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

   ◆ **Analysis**

   Action: **Read Input File**

   Object: **Model Data**

   Method **Translate**

   Select Input File...

   Select File **plate.bdf**

   OK

   Apply

   OK

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

    **Show Labels**

5. Add the pre-defined constraints into the **Default** load case.

◆ **Load Cases**

Action: **Modify**

Select Load Case to Modify **Default**
(Highlight the following:)

Assign/Prioritize Loads/BCs

Select Load/BCs to Add to Spreadsheet **Displ_spc1.1**
(Highlight the following:)

OK

Apply

6. Create the new analysis deck.

◆ **Analysis**

Action: **Analyze**

Object: **Entire Model**

Method **Analysis Deck**

Solution Type...

Solution Type: ◆ **NORMAL MODES**

Solution Parameters...

Mass Calculation: **Coupled**

Data Deck Echo: **Unsorted**

Wt. -Mass Conversion = **.00259**

OK

OK

Direct Text Input...

In the ***Bulk Data Section,*** type in the following:

```
ASET1, 345, 3, 5, 7, 9, 11
ASET1, 345, 25, 27, 29, 31, 33
```

```
ASET1, 345, 47, 49, 51, 53, 55
```

OK

Subcase Create...

Available Subcases **Default**

Subcase Parameters...

Extraction Method: **Automatic Givens**

Number of Desired Roots = **5**

OK

Output Requests...

Under ***Output Requests***, highlight:

SPCFORCES(SORT1,Real)=All FEM

Delete

OK

Apply

Cancel

Apply

An MSC/NASTRAN input file called **prob2.bdf** will be generated. This process of translating your model into an input file is called the Forward Translation. The Forward Translation is complete when the Heartbeat turns green. MSC/PATRAN Users should proceed to step 8.

Generating an input file for MSC/NASTRAN Users:

MSC/NASTRAN users can generate an input file using the data from Table 2.1. The result should be similar to the output below.

7. MSC/NASTRAN input file: **prob2.dat**

```
ID SEMINAR, PROB2
SOL 103
TIME 10
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
EIGR,1,AGIV,,,,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
```

Submitting the input file for analysis:

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

   8a. To submit the MSC/PATRAN **.bdf** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob2.bdf scr=yes**. Monitor the run using the UNIX **ps** command.

   8b. To submit the MSC/NASTRAN **.dat** file for analysis, find an available UNIX shell window. At the command prompt enter: **nastran prob2 scr=yes**. Monitor the run using the UNIX **ps** command.

9. When the run is completed, edit the **prob2.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.

10. While still editing **prob2.f06**, search for the word:

R E A L (spaces are necessary)

1st = _____Hz

2nd = _____Hz

3rd = _____Hz

4th = _____Hz

5th = _____Hz

Comparison of Results

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

R E A L E I G E N V A L U E S

MODE NO.	EXTRACTION ORDER	EIGENVALUE	RADIANS	CYCLES	GENERALIZED MASS	GENERALIZED STIFFNESS
1	43	7.057452E+05	8.400864E+02	1.337039E+02	1.000000E+00	7.057452E+05
2	45	1.880877E+07	4.336908E+03	6.902404E+02	1.000000E+00	1.880877E+07
3	44	2.818009E+07	5.308492E+03	8.448727E+02	1.000000E+00	2.818009E+07
4	42	1.956108E+08	1.398609E+04	2.225956E+03	1.000000E+00	1.956108E+08
5	41	2.367820E+08	1.538772E+04	2.449032E+03	1.000000E+00	2.367820E+08

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

13. Proceed with the Reverse Translation process, that is importing the **prob2.op2** results file into MSC/PATRAN. To do this, return to the Analysis form and proceed as follows:

◆ **Analysis**

Action:	**Read Output2**
Object:	**Result Entities**
Method	**Translate**
Select Results File...	
Select Results File	**prob2.op2**
OK	
Apply	

To simplify the view, turn off the entity labels using the toolbar.

 **Hide Labels**

In addition, switch to a 3 view isometric view point.

 **Iso 3 View**

When the translation is complete bring up the ***Results*** form.

◆ **Results**

Form Type:	**Basic**
Select Results Case	**1.1-Default, Mode1**
Select Deformation Result	**1.1 Eigenvectors, Translational**

Apply

Reset the graphics by clicking on this icon:

 **Reset Graphics**

You can go back and select any *Results Case*, *Fringe Results or Deformation Results* you are interested in.

Quit MSC/PATRAN when you are finished with this exercise.