MODAL ANALYSIS OF A RECTANGULAR PLATE VIA THE FINITE ELEMENT METHOD

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A finite element model of a rectangular plate is shown in Figure 1. The model parameters are shown in Table 1.
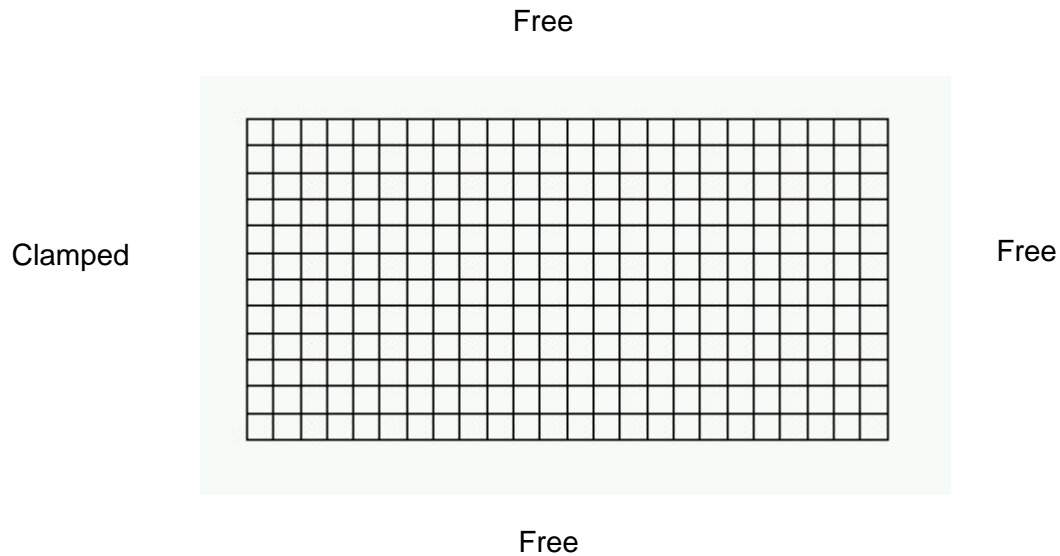

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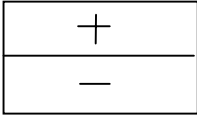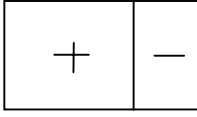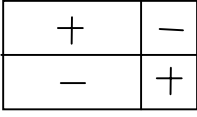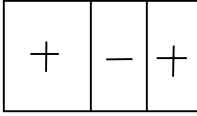Clamped   Free

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Figure 1. Finite Element Model of a Rectangular Plate with Boundary Conditions

Table 1. Model Parameters	
Parameter	Value
Number of Nodes	325
Number of Elements	288
Element Type	CQUADR Plate
Thickness	0.25 inch
Dimensions	6 x 12 inches
Boundary Condition	C-F-F-F (Figure 1)
Material	Aluminum
Mass Density	0.10 lbm/in^3
Elastic Modulus	10.7e+06 lbf/in^2
Software	FEMAP and NE/Nastran

The finite element results are given in Table 2. The theoretical frequencies are calculated from Reference 1.

Mode Number	FEM Frequency (Hz)	Theoretical Frequency (Hz)	Mode Shape Phase Diagram
Table 2. Finite Element Results				

Table 2. Finite Element Results

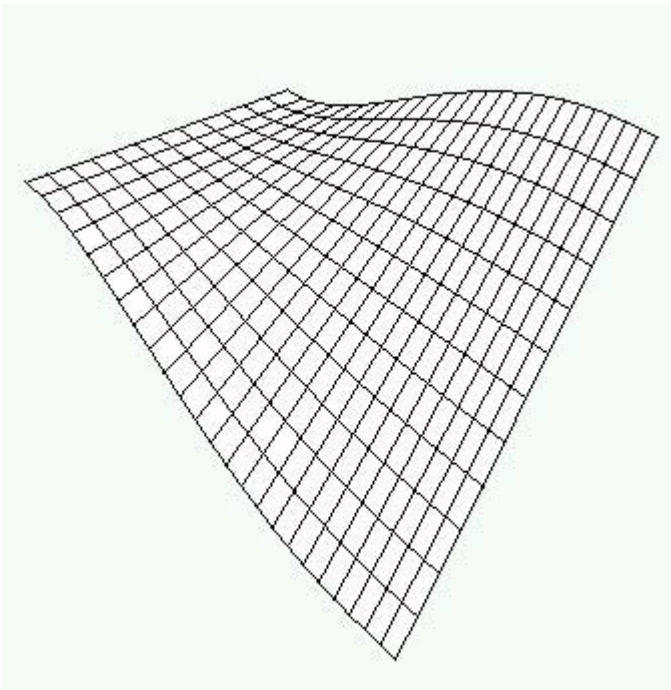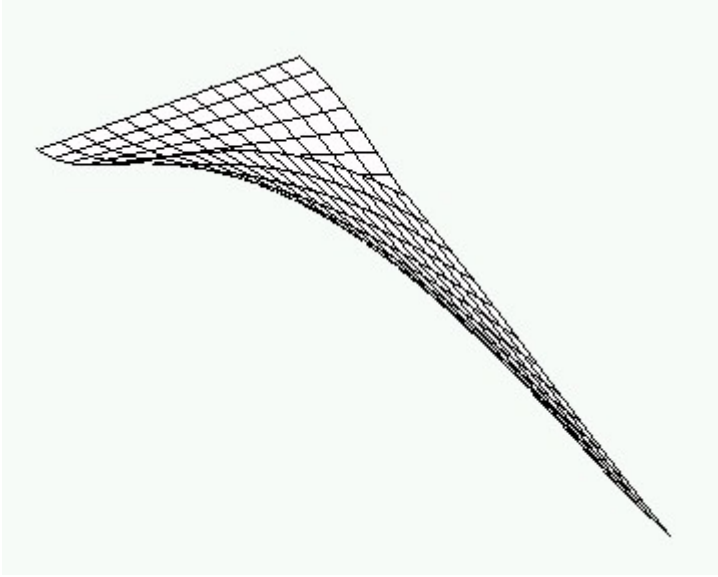| Mode Number	FEM Frequency (Hz)	Theoretical Frequency (Hz)	Mode Shape Phase Diagram
1	57.0	58.4	
2	238.	251.	+ / −
3	353.	363.	+ | −
4	775.	819.	+ − / − +
5	985.	_	+ | − | +
6	1136.	_	In-plane Bending
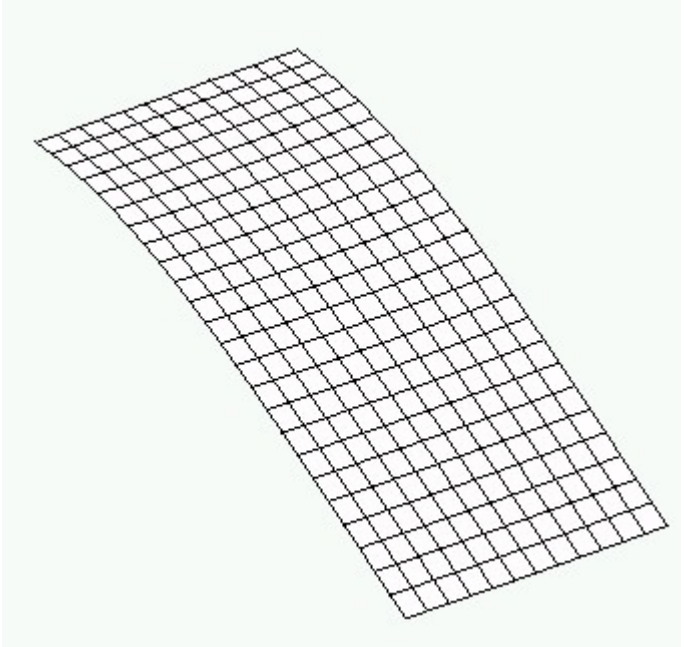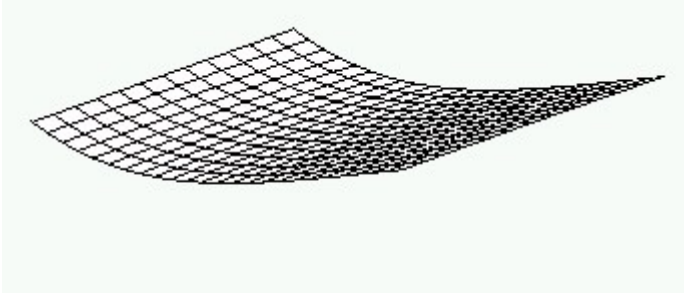
Figure 2. Mode 1, Frequency = 57.0 Hz
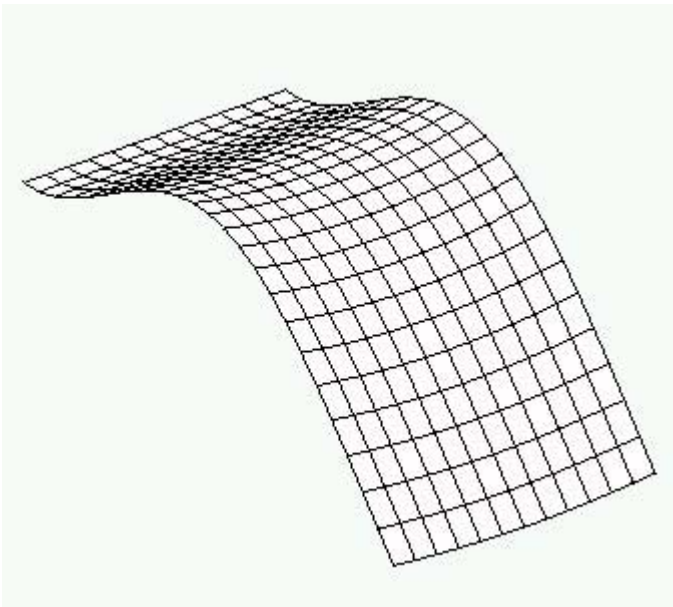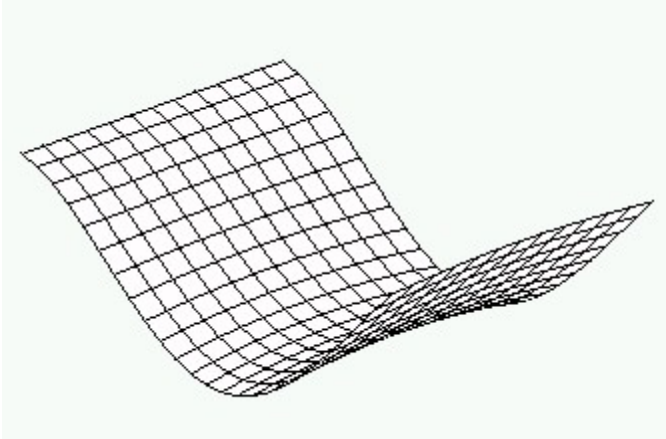
Figure 3. Mode 2, Frequency = 238 Hz
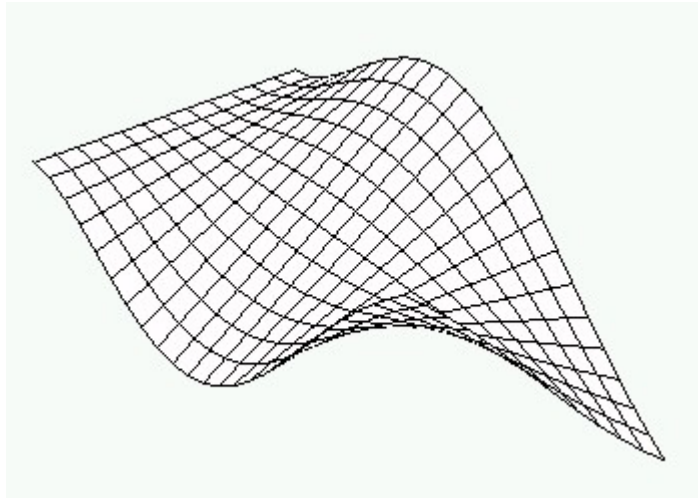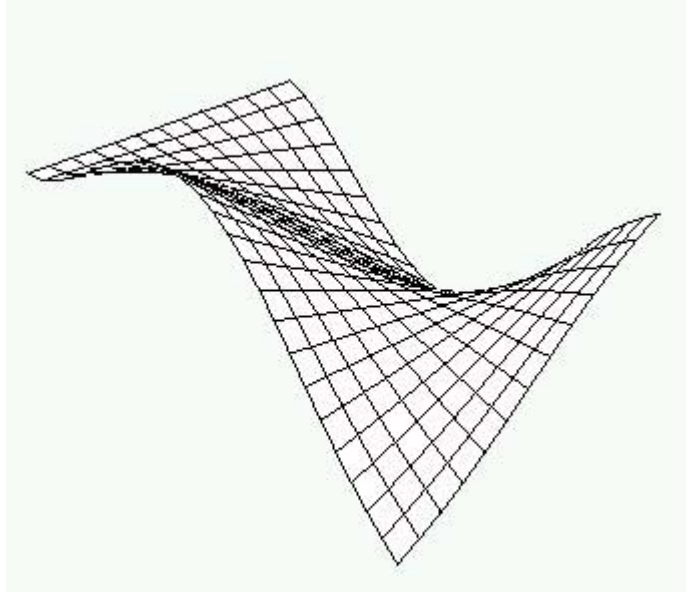
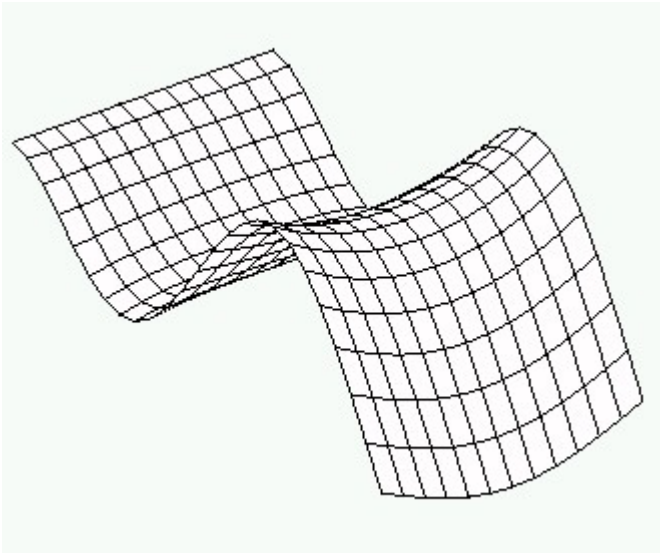Figure 4. Mode 3, Frequency = 353 Hz

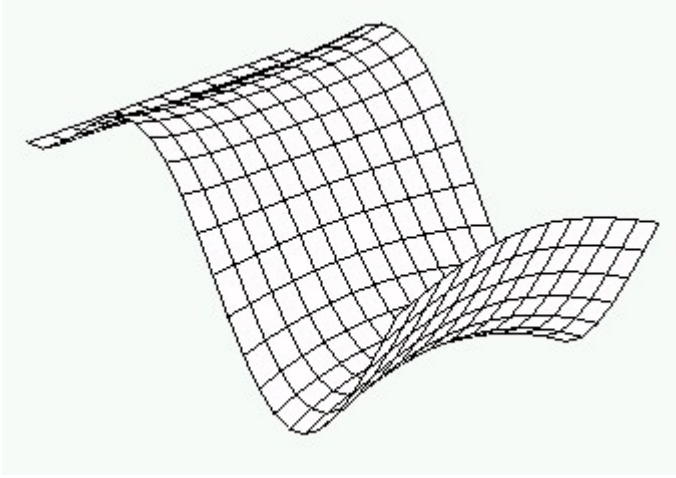Figure 5. Mode 4, Frequency = 775 Hz
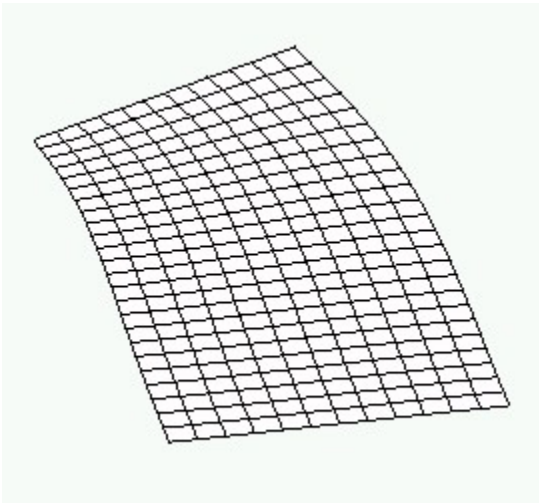
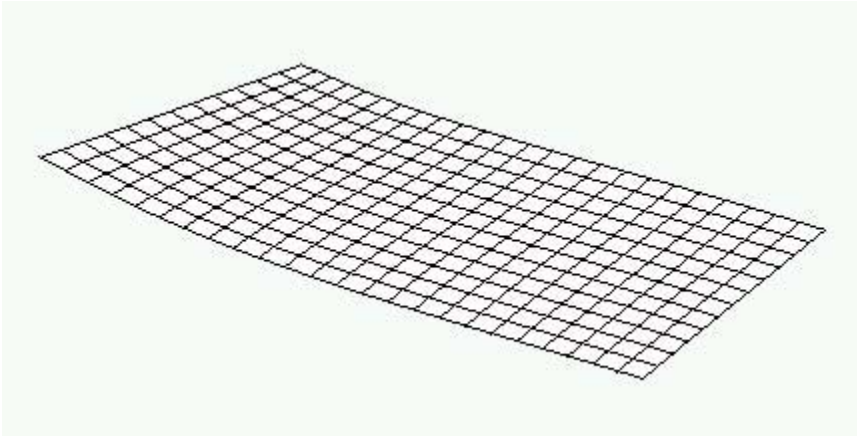Figure 6. Mode 5, Frequency = 985 Hz

Figure 7. Mode 6, Frequency = 1136 Hz

Reference

1. Arthur W. Leissa, Vibration of Plates, NASA SP-160, National Aeronautics and Space Administration, Washington D.C., 1969.