

圖 2-1 複合材料積層板座標系統

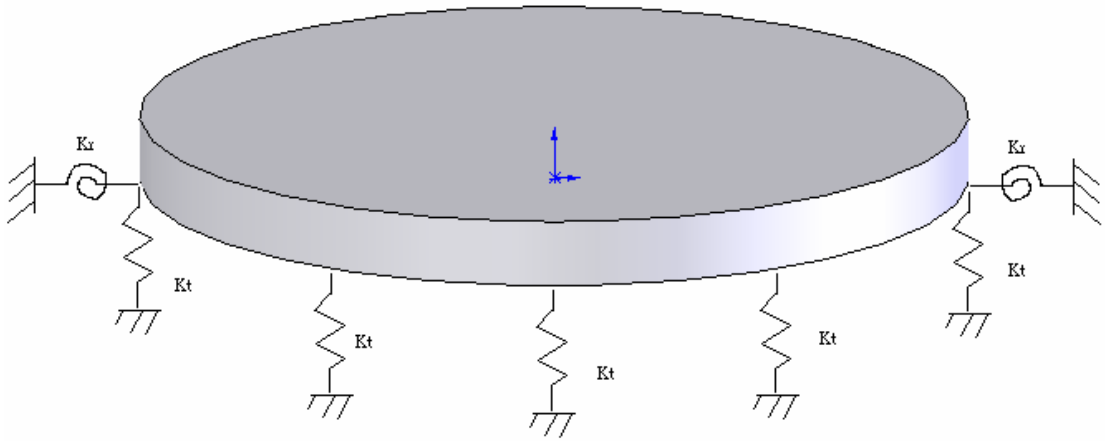


圖 2-2 半徑為  $a$  公尺之具彈性支撐圓形複合積層板

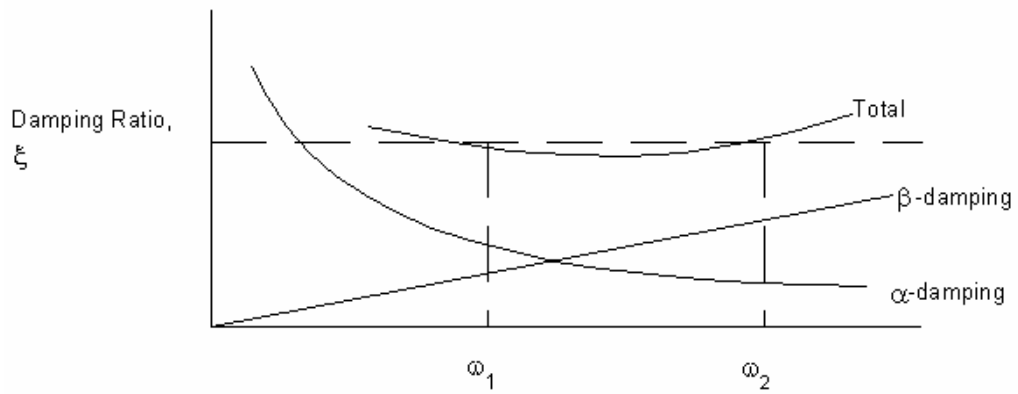


圖 3-1 Rayleigh Damping

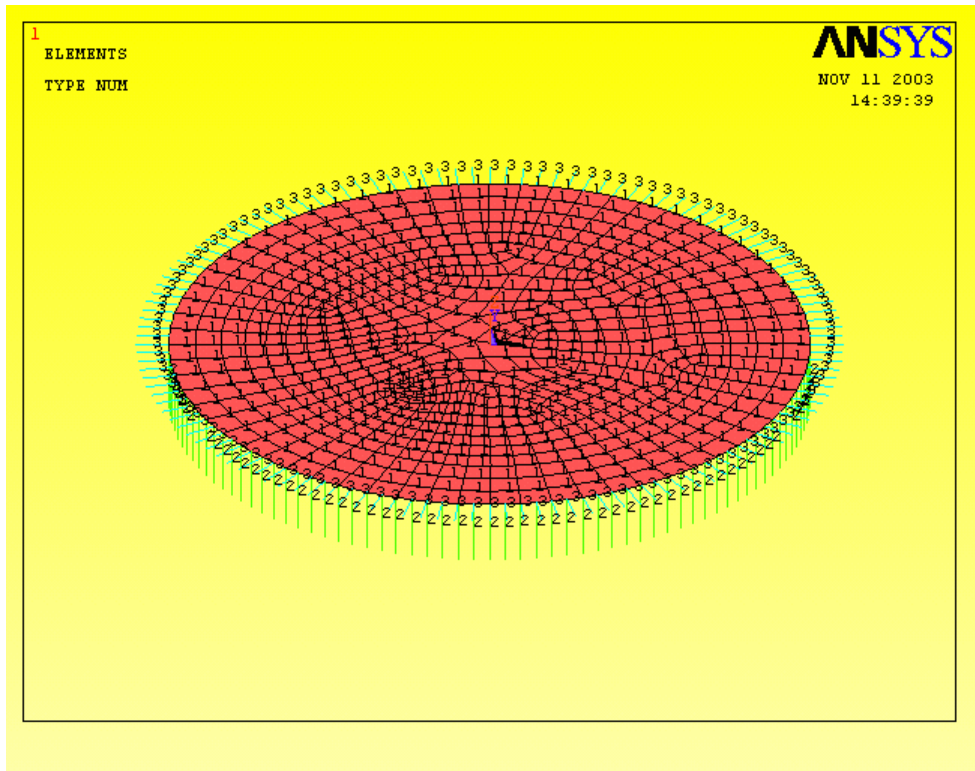


圖 4-1 ANSYS 模型圖

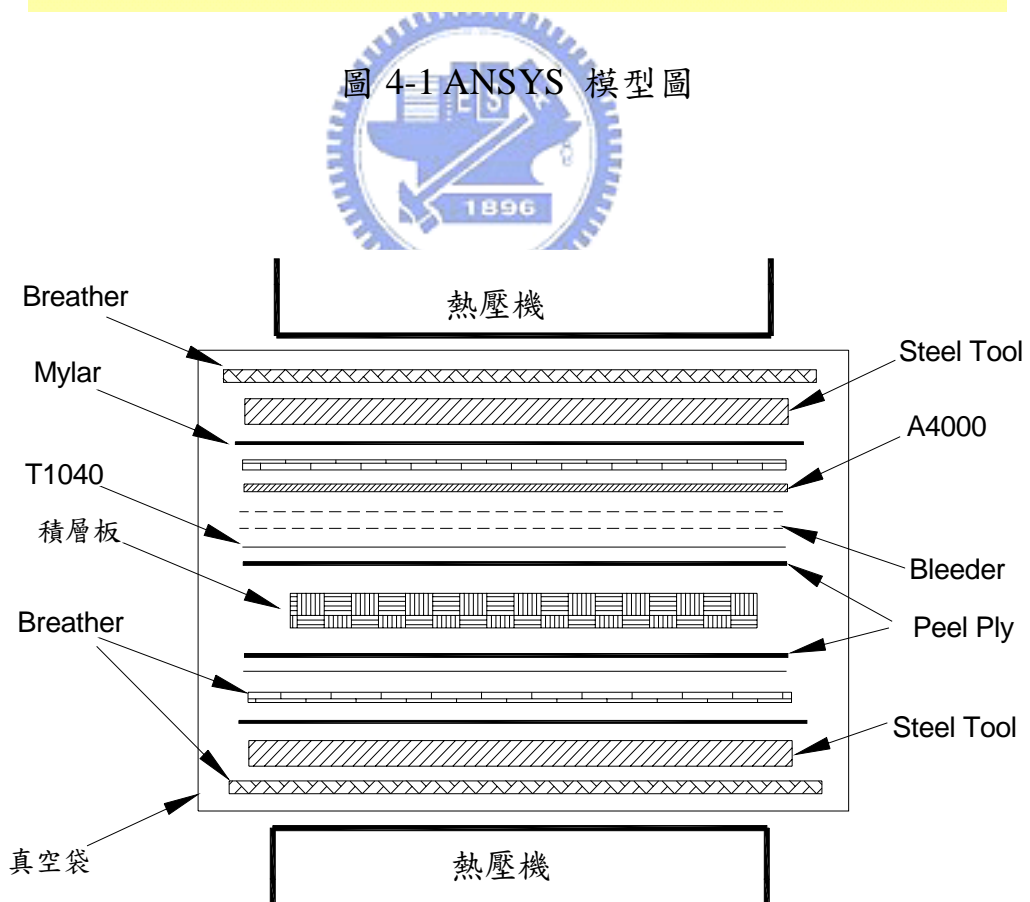


圖 5-1 積層板製作及輔助材料疊層順序



圖 5-2 熱壓機

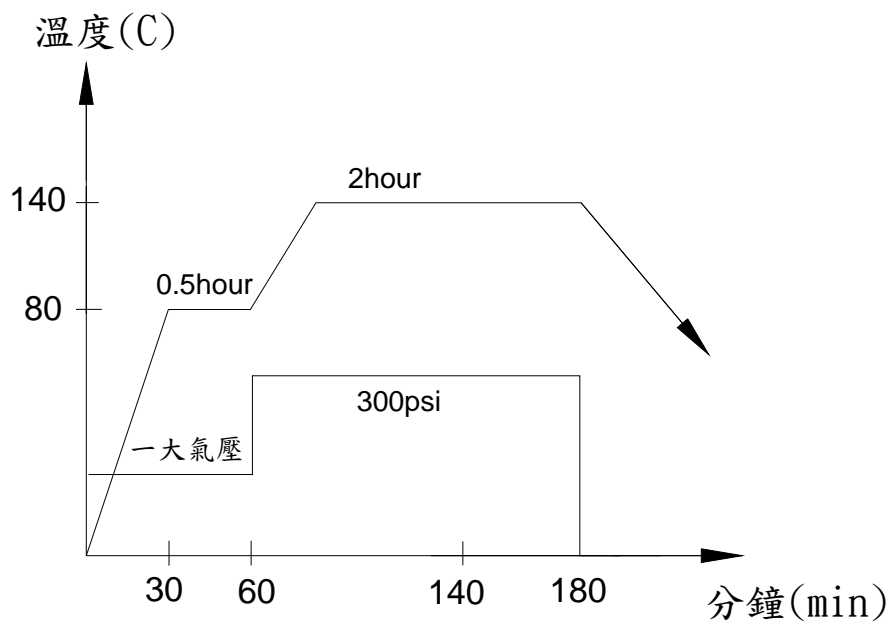


圖 5-3 複合材料積層板之加熱加壓硬化成型製程圖



圖 5-4 圓形複合材料三明治板



圖 5-5 HT-9102 電腦伺服控制材料試驗機



圖 5-6 PULSE 頻譜分析儀

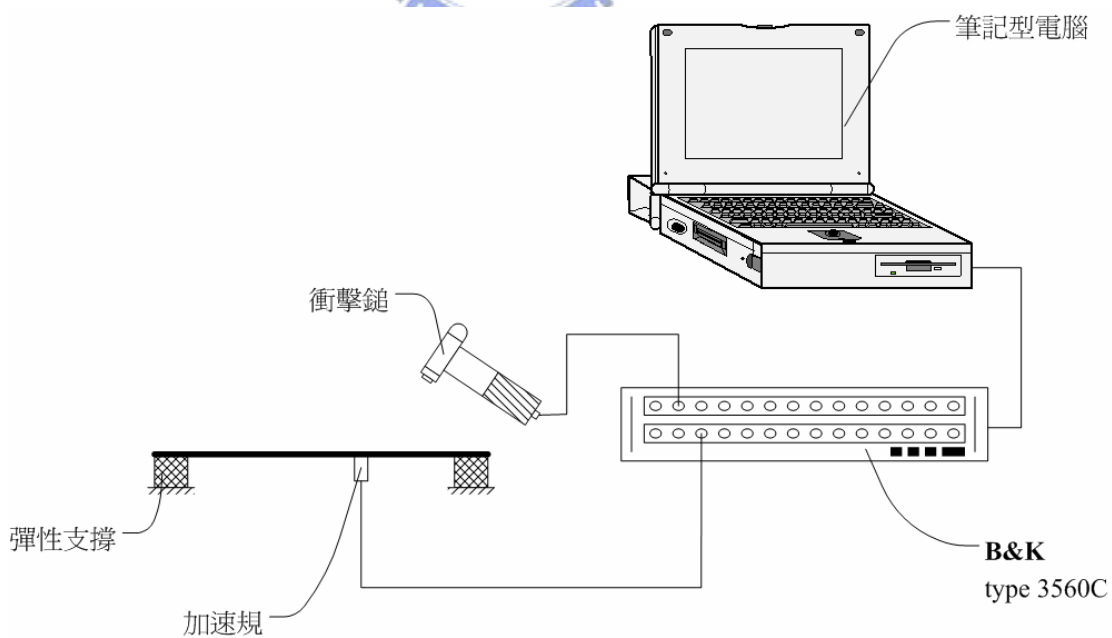


圖 5-7 振動實驗架設圖



圖 5-8 阻尼比量測實驗架設圖

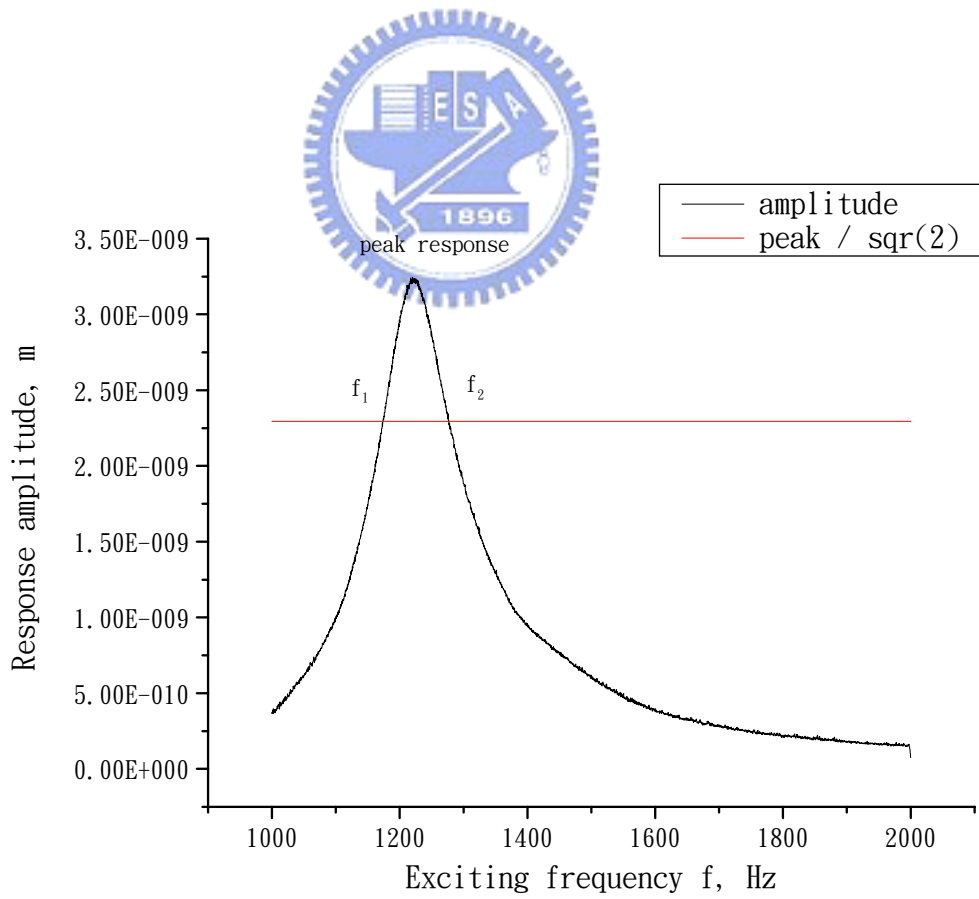
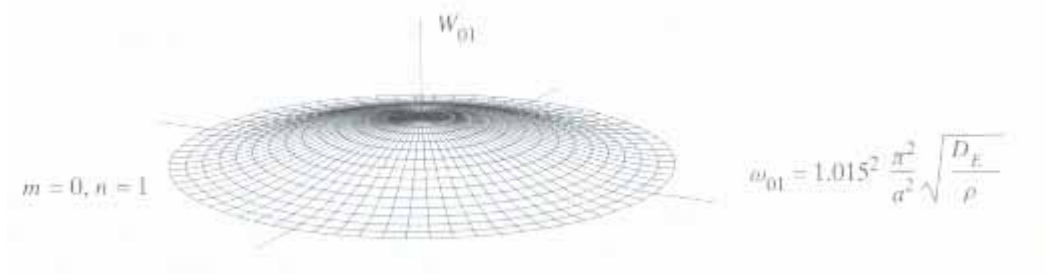
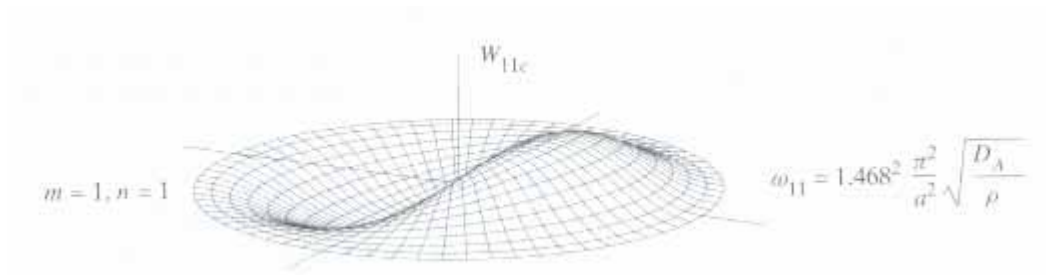


圖 5-9 頻率響應圖

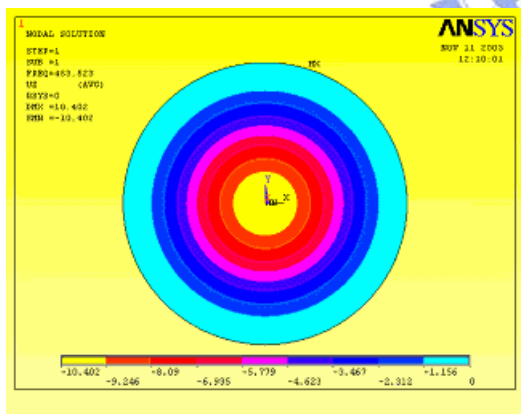


Mode 1

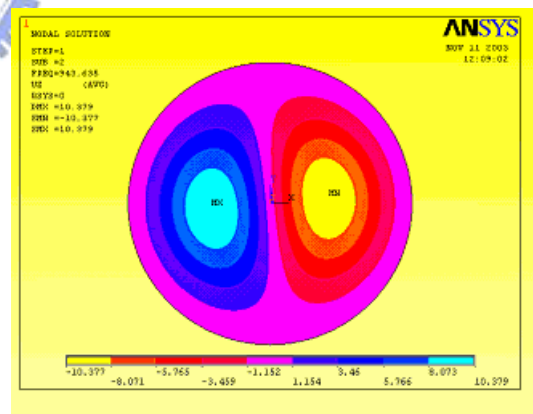


Mode 2

圖 6-1 Leonard [10]中邊界為 Clamped 之圓形振動板之第一、第二模態



Mode 1



Mode 2

圖 6-2 ANSYS 模態分析邊界為 Clamped 之圓形振動板之第一、第二模態



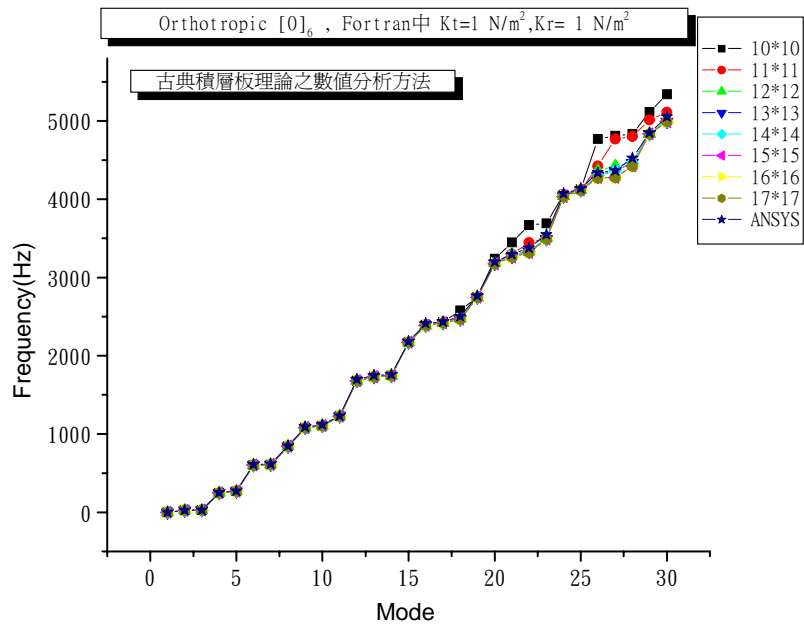


圖 6-3 數值分析方法 shape function 項次與 ANSYS 模擬分析之收斂情況關

係圖-1

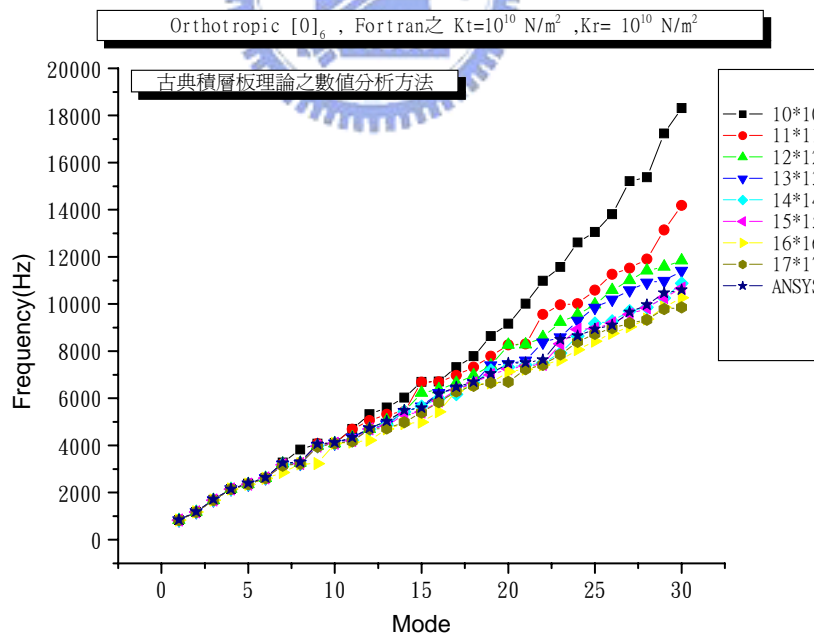


圖 6-4 數值分析方法 shape function 項次與 ANSYS 模擬分析之收斂情況關

係圖-2

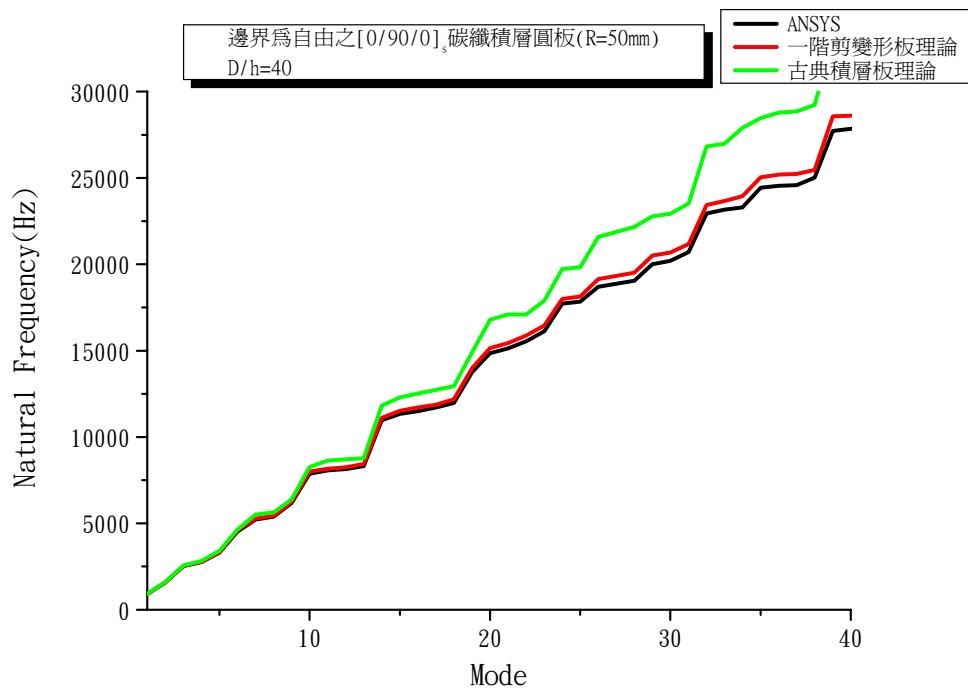


圖 6-5-1 ANSYS 和數值分析之收斂性(寬厚比=40，邊界為自由)

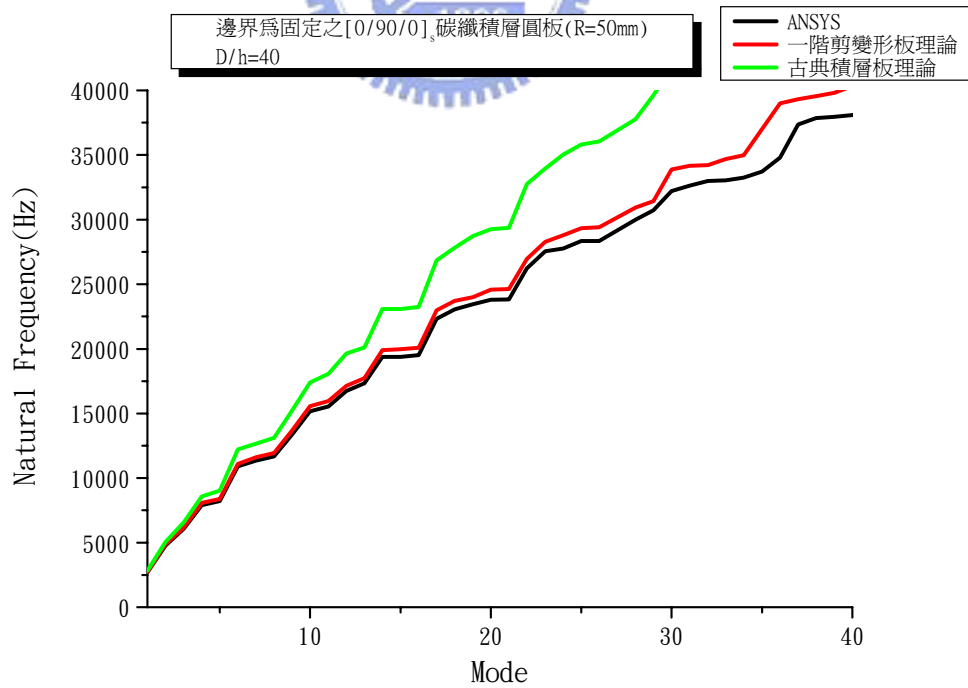


圖 6-5-2 ANSYS 和數值分析之收斂性(寬厚比=40，邊界為固定)

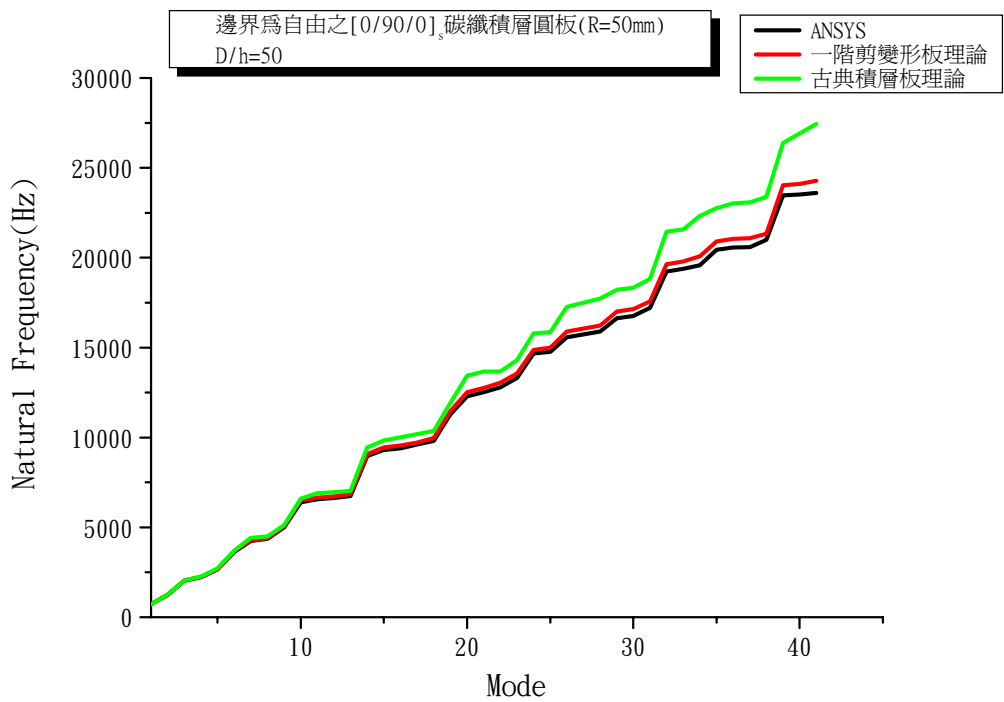


圖 6-5-3 ANSYS 和數值分析之收斂性(寬厚比=50，邊界為自由)

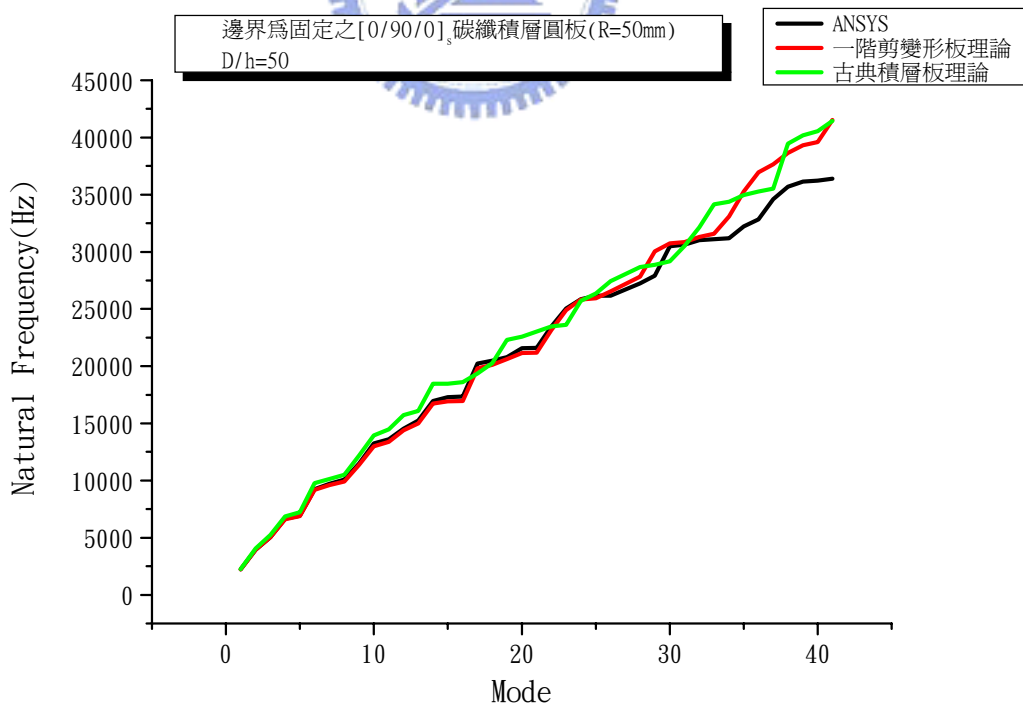


圖 6-5-4 ANSYS 和數值分析之收斂性(寬厚比=50，邊界為固定)

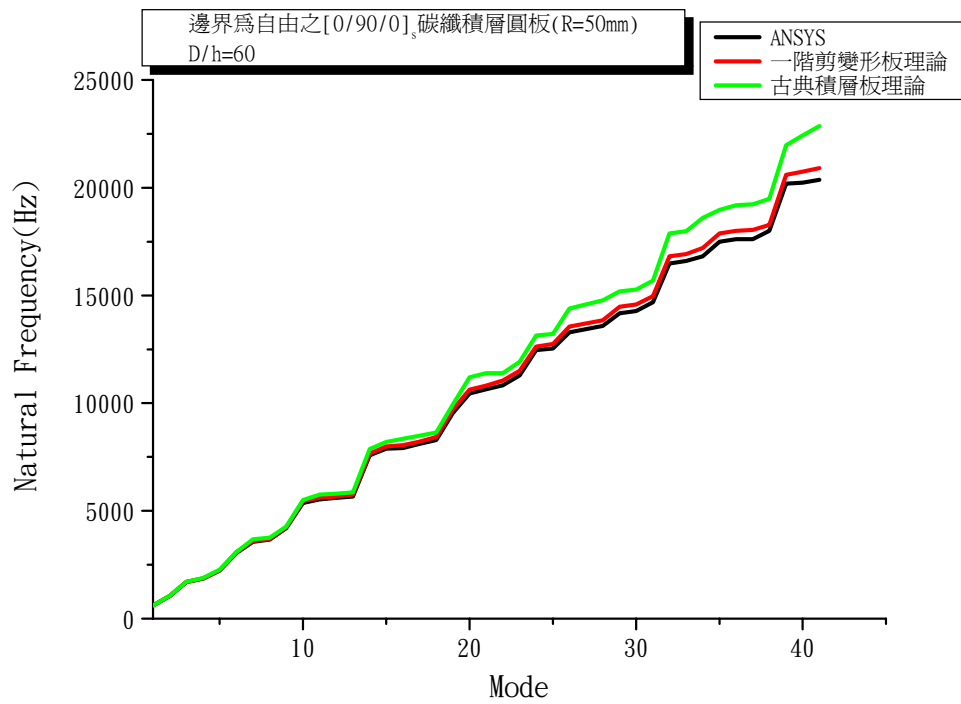


圖 6-5-5 ANSYS 和數值分析之收斂性(寬厚比=60，邊界為自由)

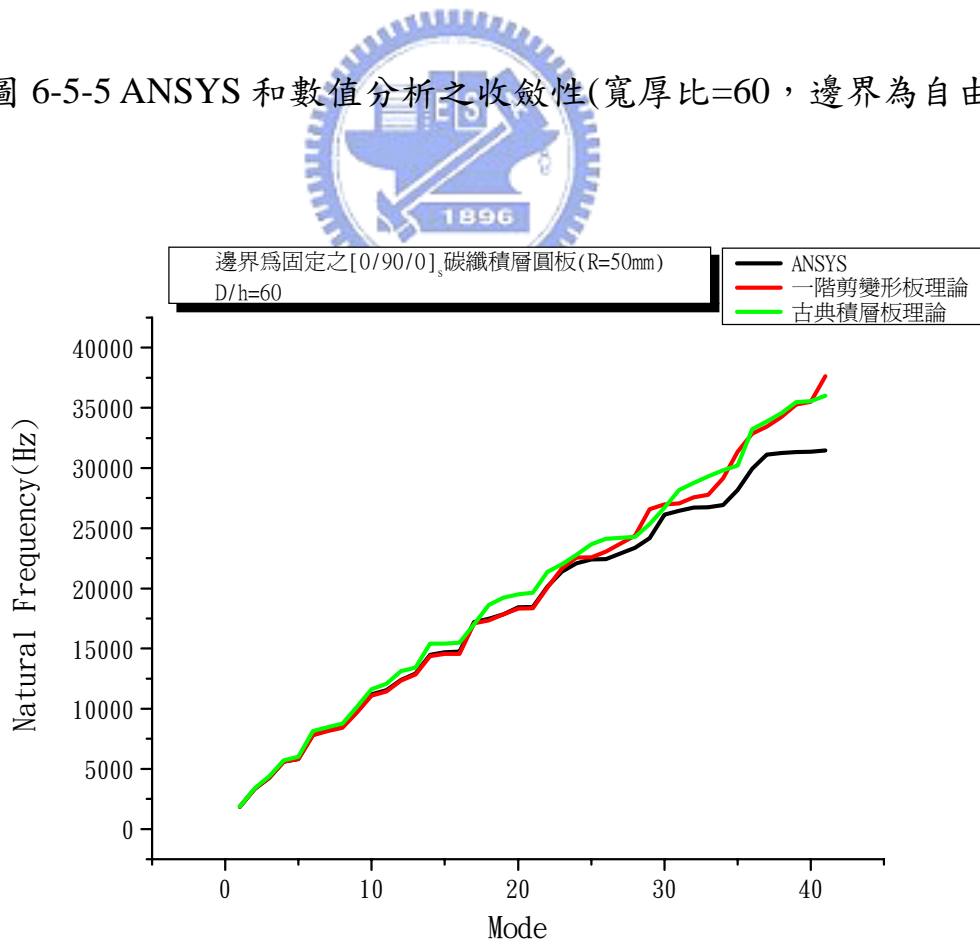


圖 6-5-6 ANSYS 和數值分析之收斂性(寬厚比=60，邊界為固定)

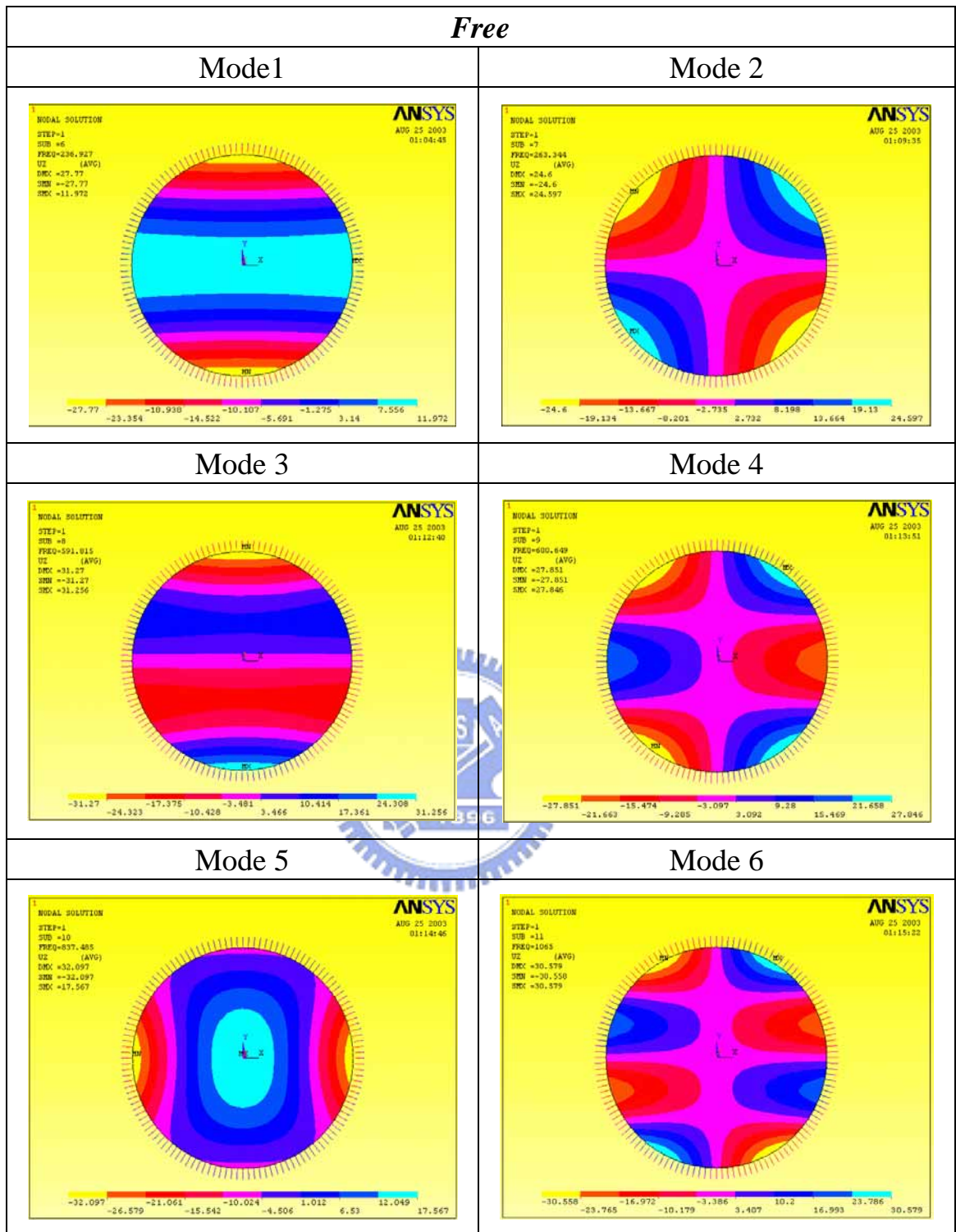


圖 6-6a-1 ANSYS模擬分析邊界為自由之圓形振動板(orthotropic[0]<sub>6</sub>)之模態

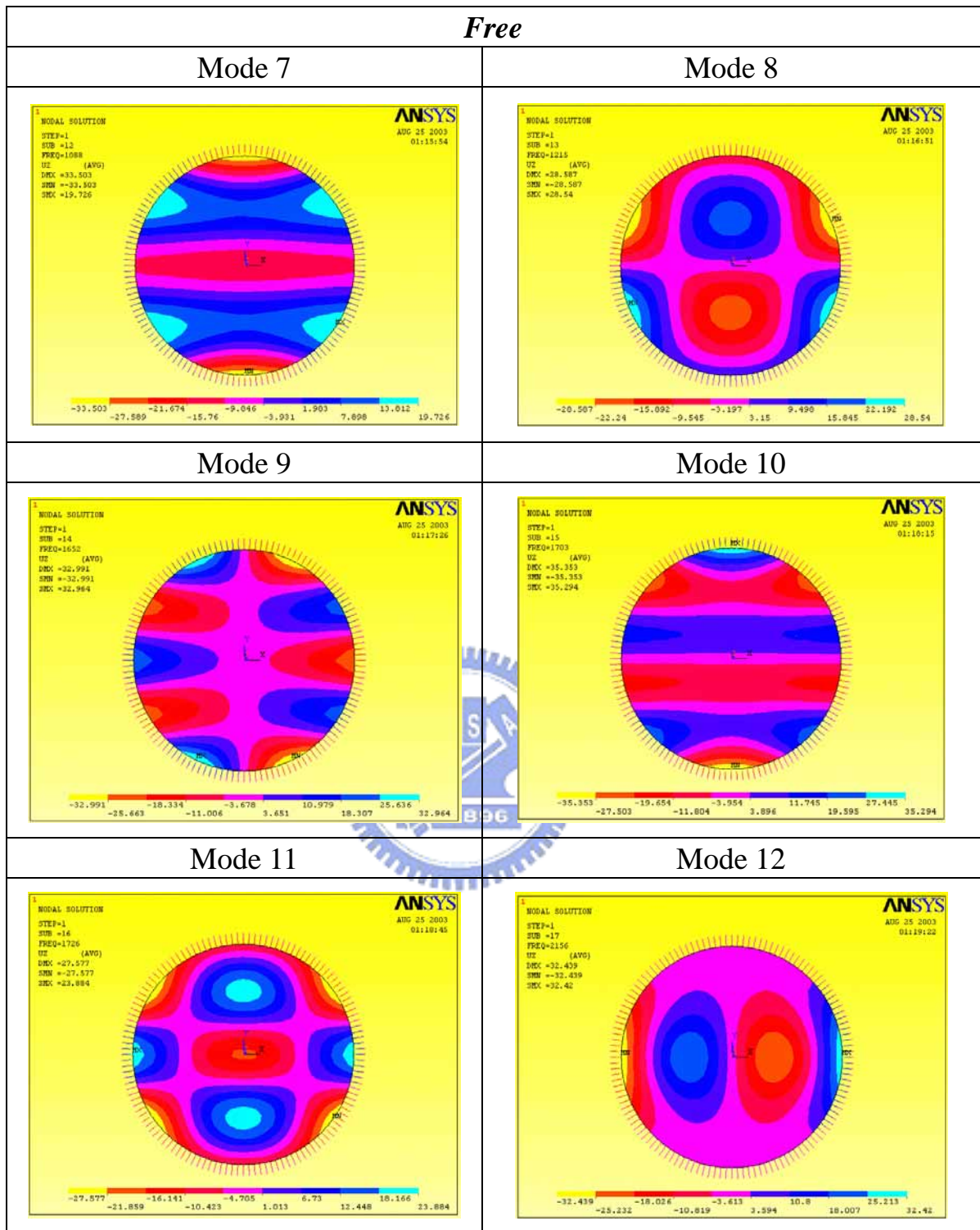


圖 6-6a-2 ANSYS模擬分析邊界為自由之圓形振動板(orthotropic[0]<sub>6</sub>)之模態

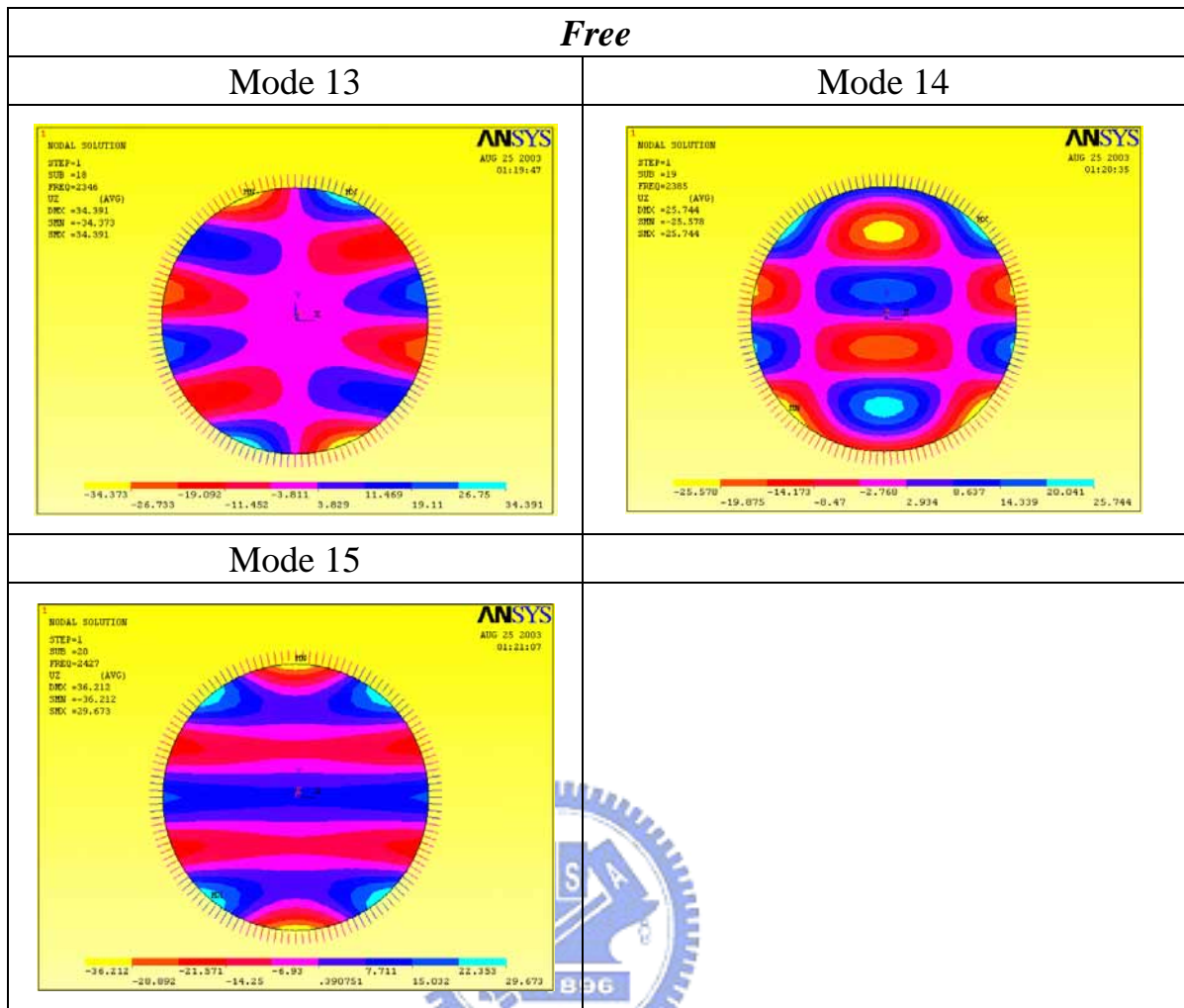


圖 6-6a-3 ANSYS模擬分析邊界為自由之圓形振動板(orthotropic[0]<sub>6</sub>)之模態

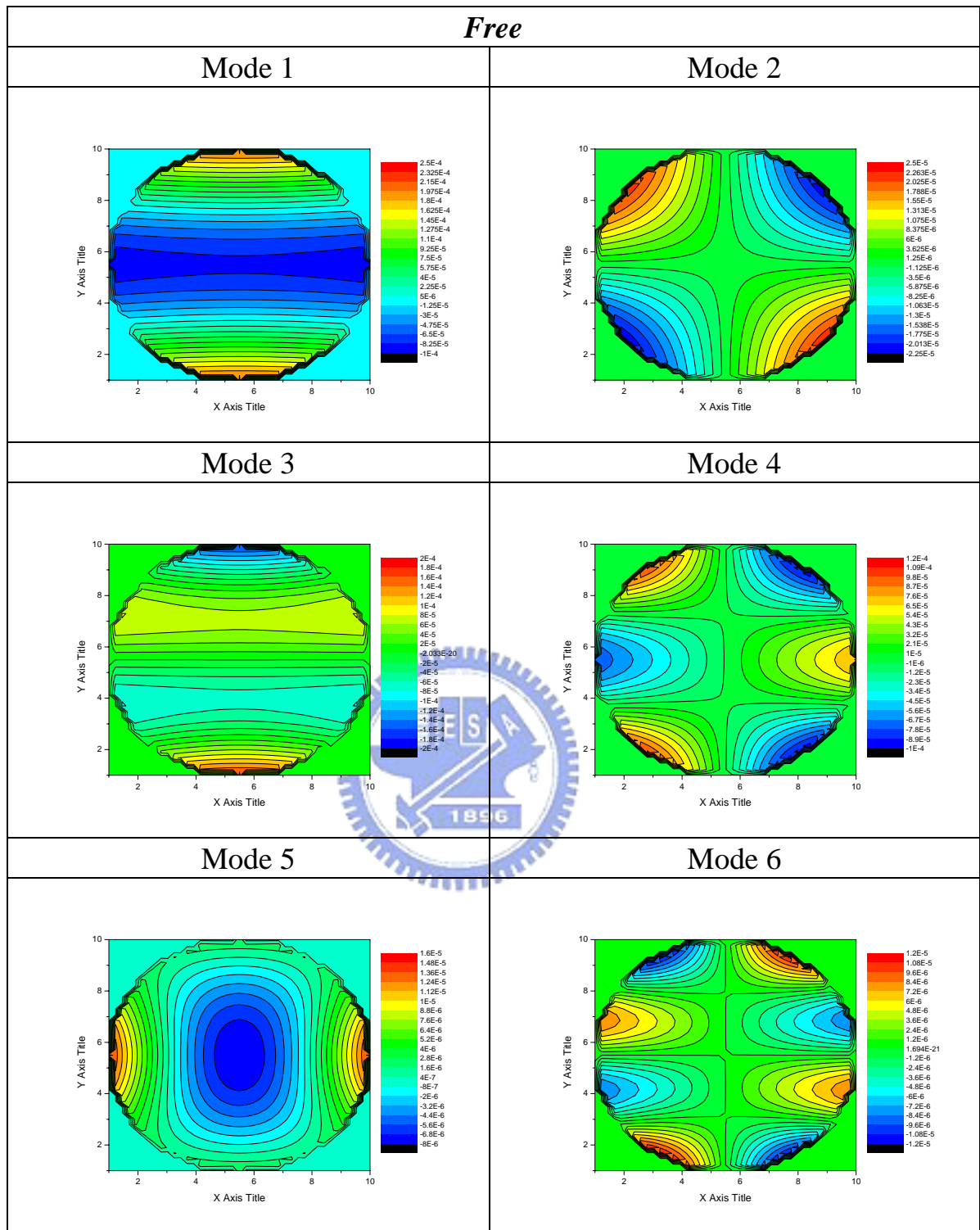


圖 6-6b-1 Fortran 數值分析描繪邊界為自由之 orthotropic  $[0]_6$  圓形積層板的模態



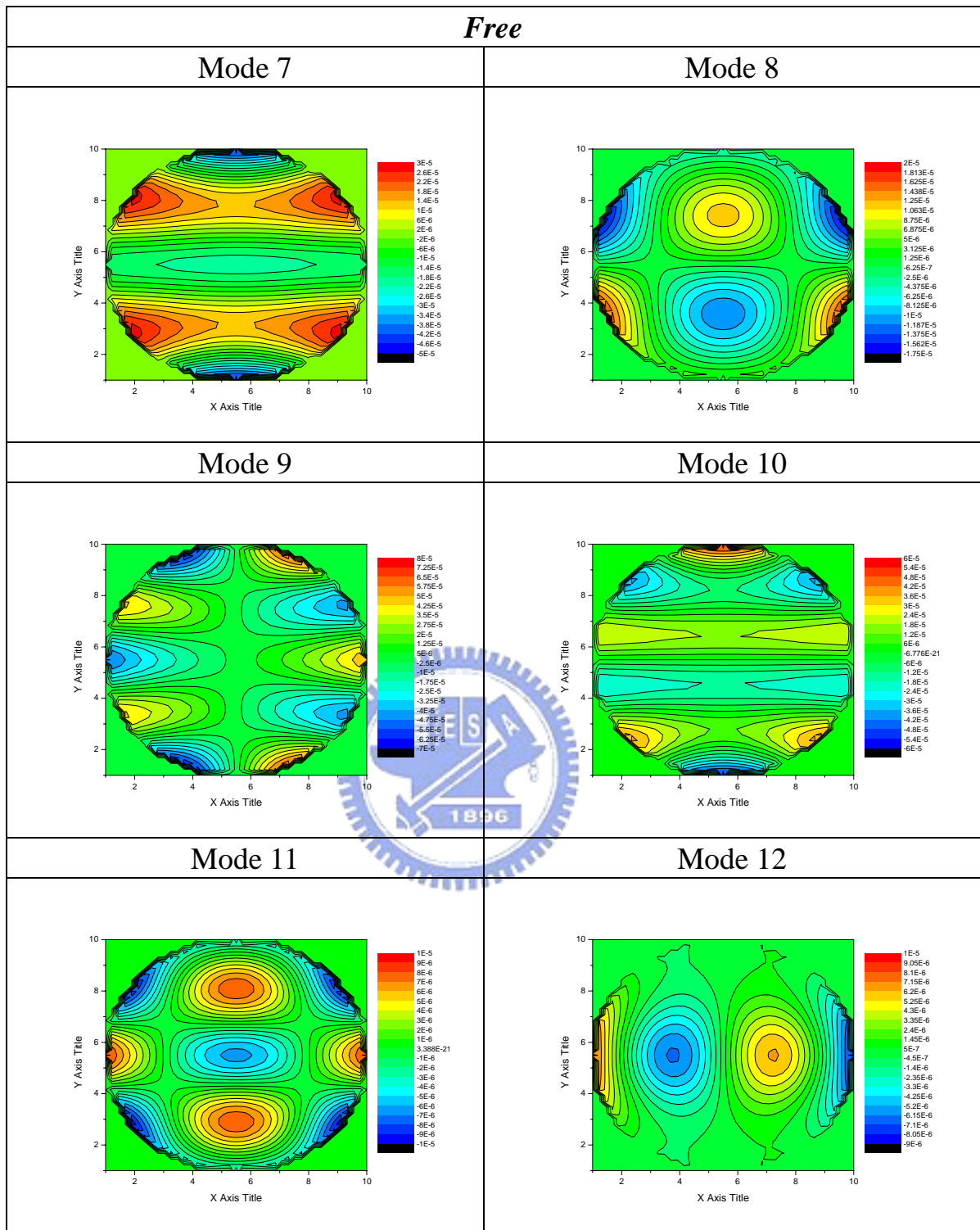


圖 6-6b-2 Fortran 數值分析描繪邊界為自由之 orthotropic  $[0]_6$  圓形積層板的模態

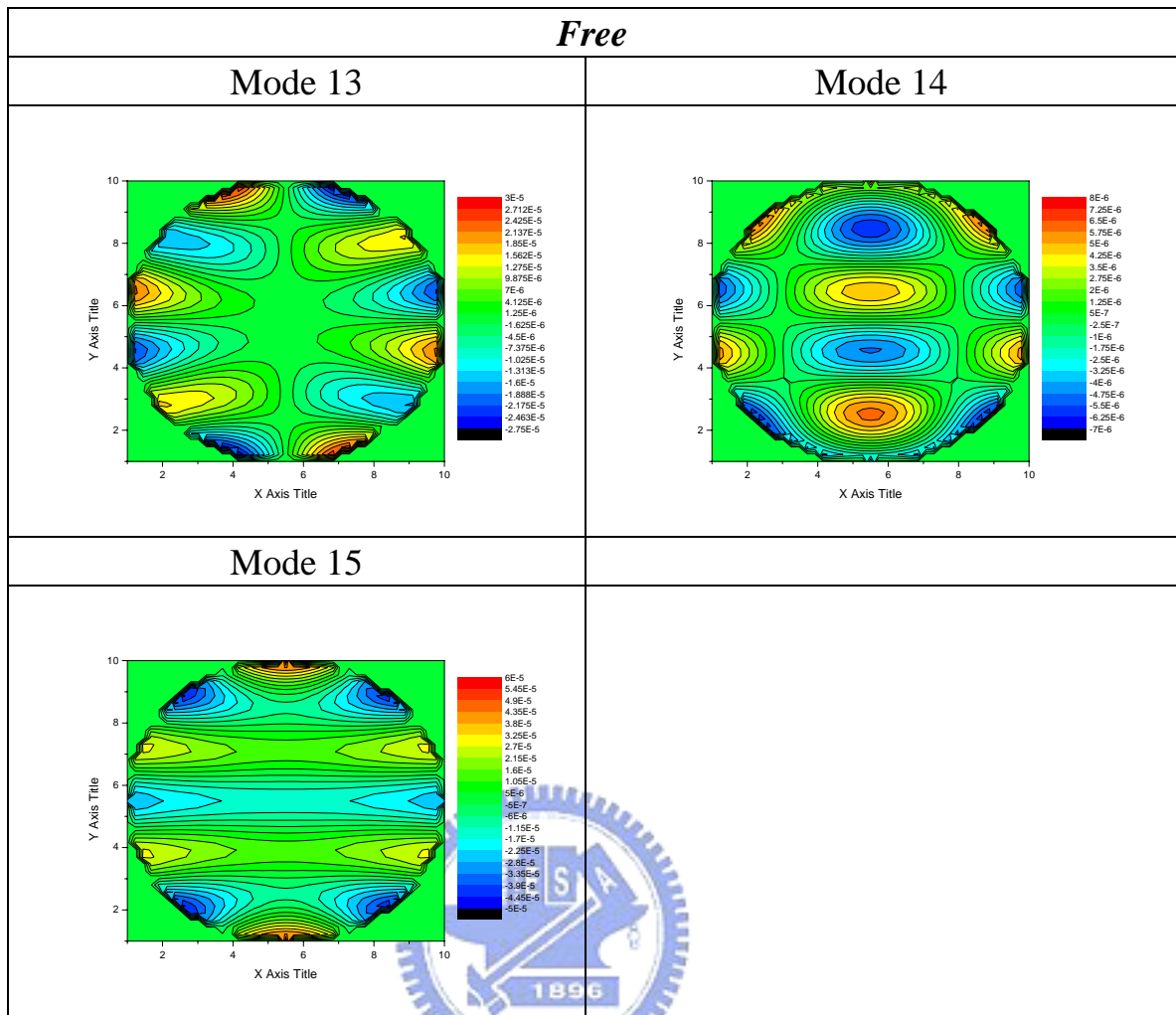


圖 6-6b-3 Fortran 數值分析描繪邊界為自由之 orthotropic  $[0]_6$  圓形積層板的模態

ANSYS  $K_T = 1N/m, K_R = 1Nm/radian$

Fortran  $K_T = 407.4366543N/m^2, K_R = 407.4366543N/radian$

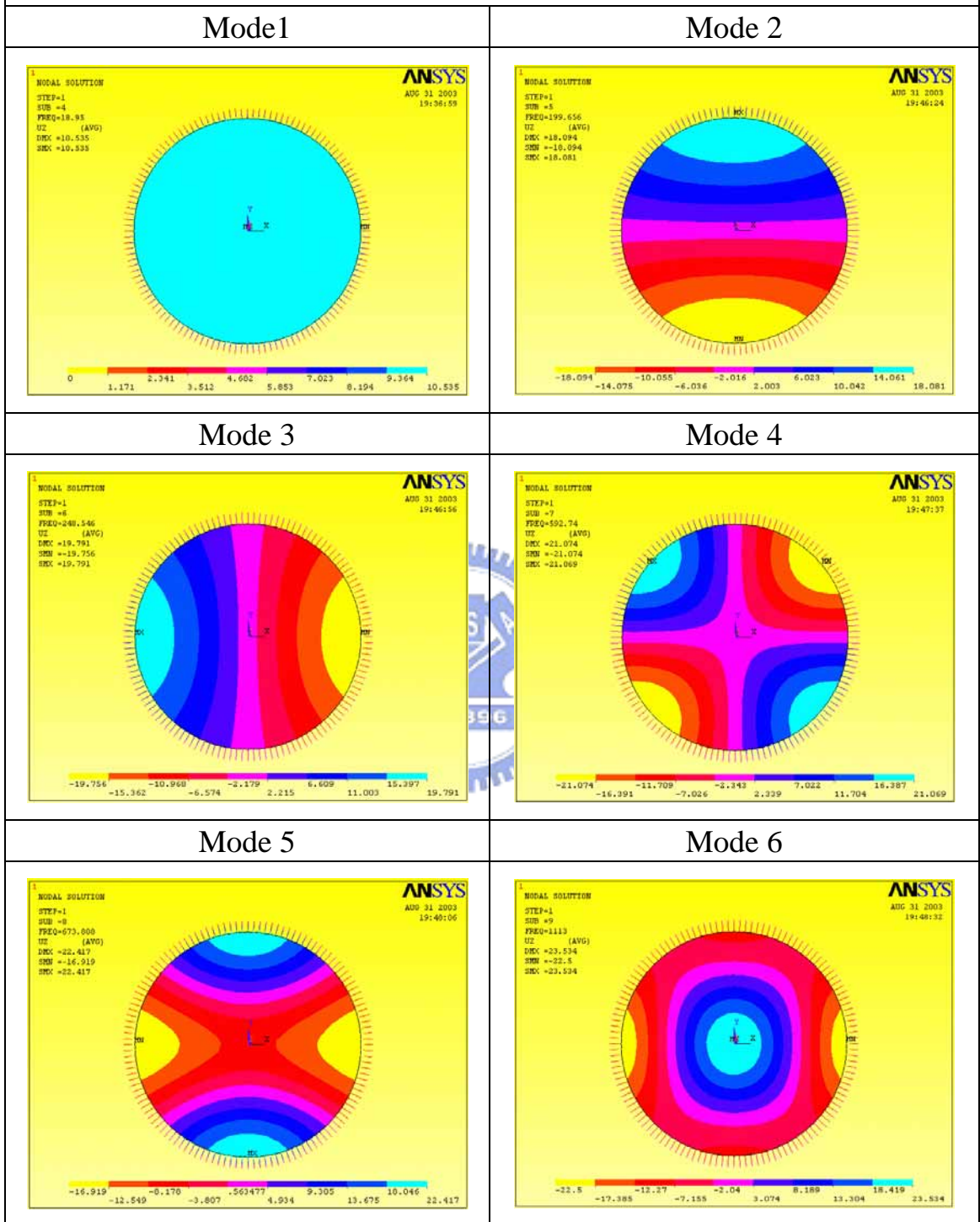


圖 6-6c-1 ANSYS 模擬分析具彈性支撐

圓形振動板(orthotropic[0/90/0]<sub>s</sub>)之模態

ANSYS  $K_T = 1N/m, K_R = 1Nm/radian$

Fortran  $K_T = 407.4366543N/m^2, K_R = 407.4366543N/radian$

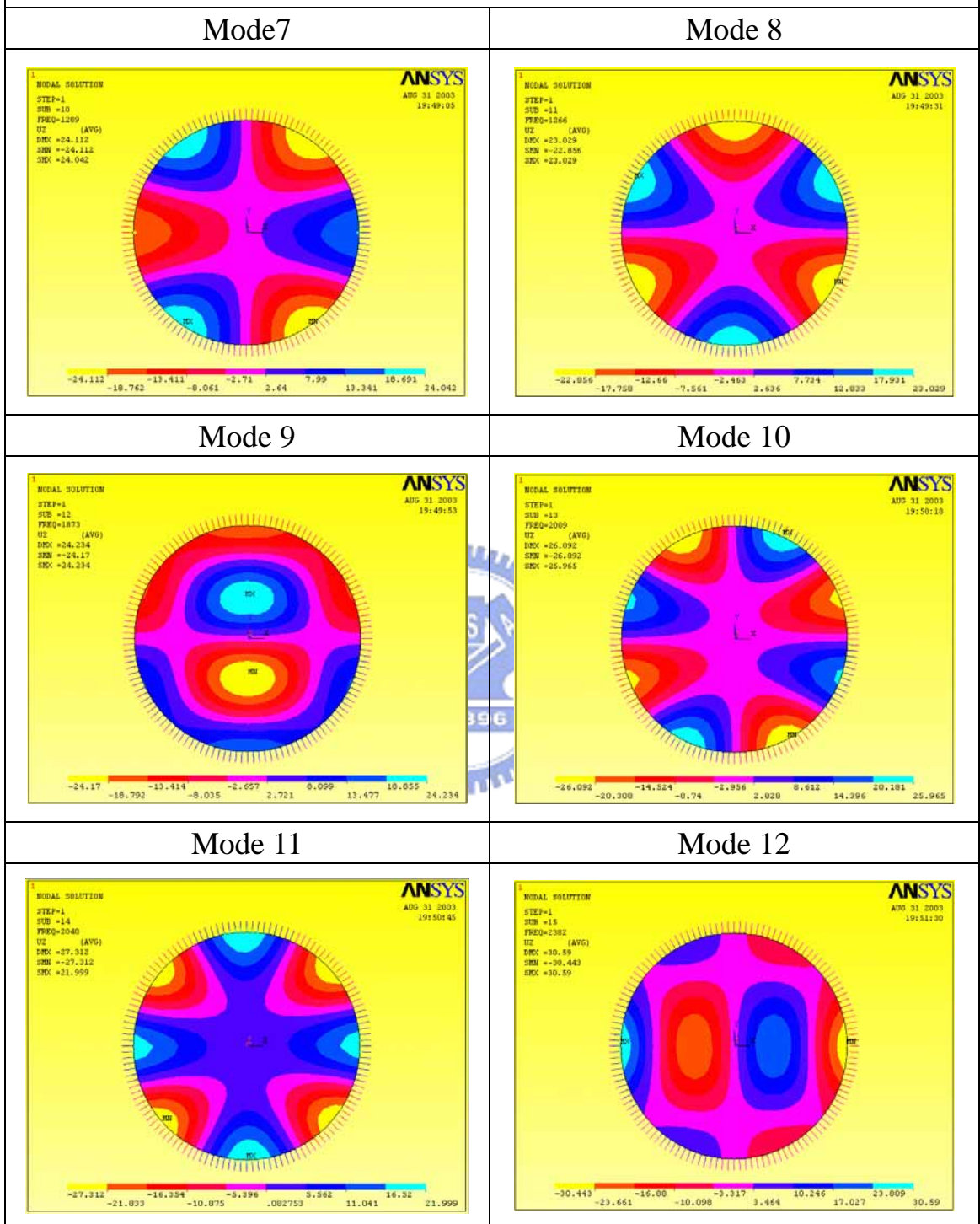


圖 6-6c-2 ANSYS 模擬分析具彈性支撐

圓形振動板(orthotropic[0/90/0]<sub>s</sub>)之模態

ANSYS  $K_T = 1N/m, K_R = 1Nm/radian$

Fortran  $K_T = 407.4366543N/m^2, K_R = 407.4366543N/radian$

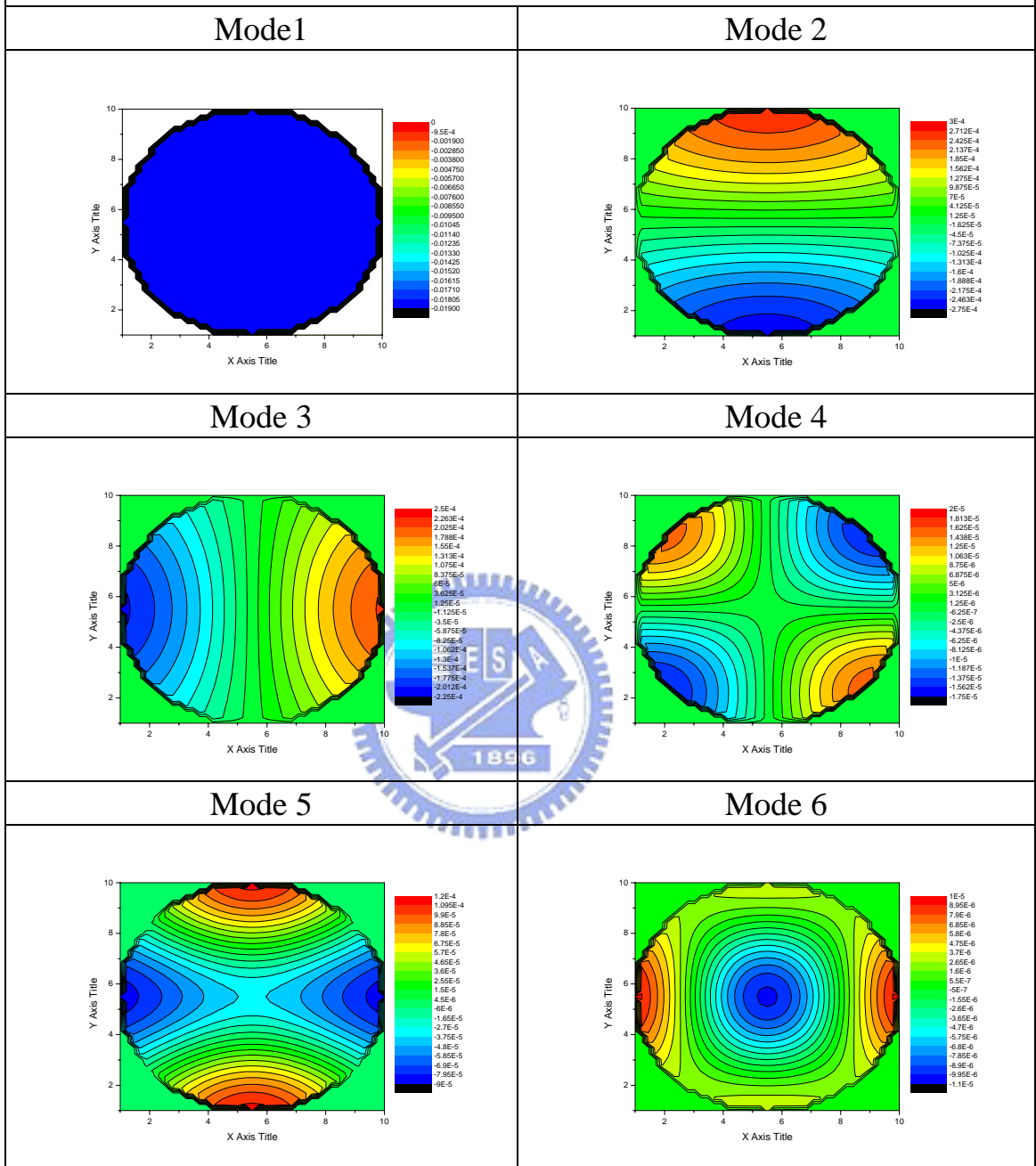


圖 6-6d-1 Fortran 數值模擬分析具彈性支撐

圓形振動板(orthotropic[0/90/0]<sub>s</sub>)之模態

ANSYS  $K_T = 1N/m, K_R = 1Nm/radian$

Fortran  $K_T = 407.4366543N/m^2, K_R = 407.4366543N/radian$

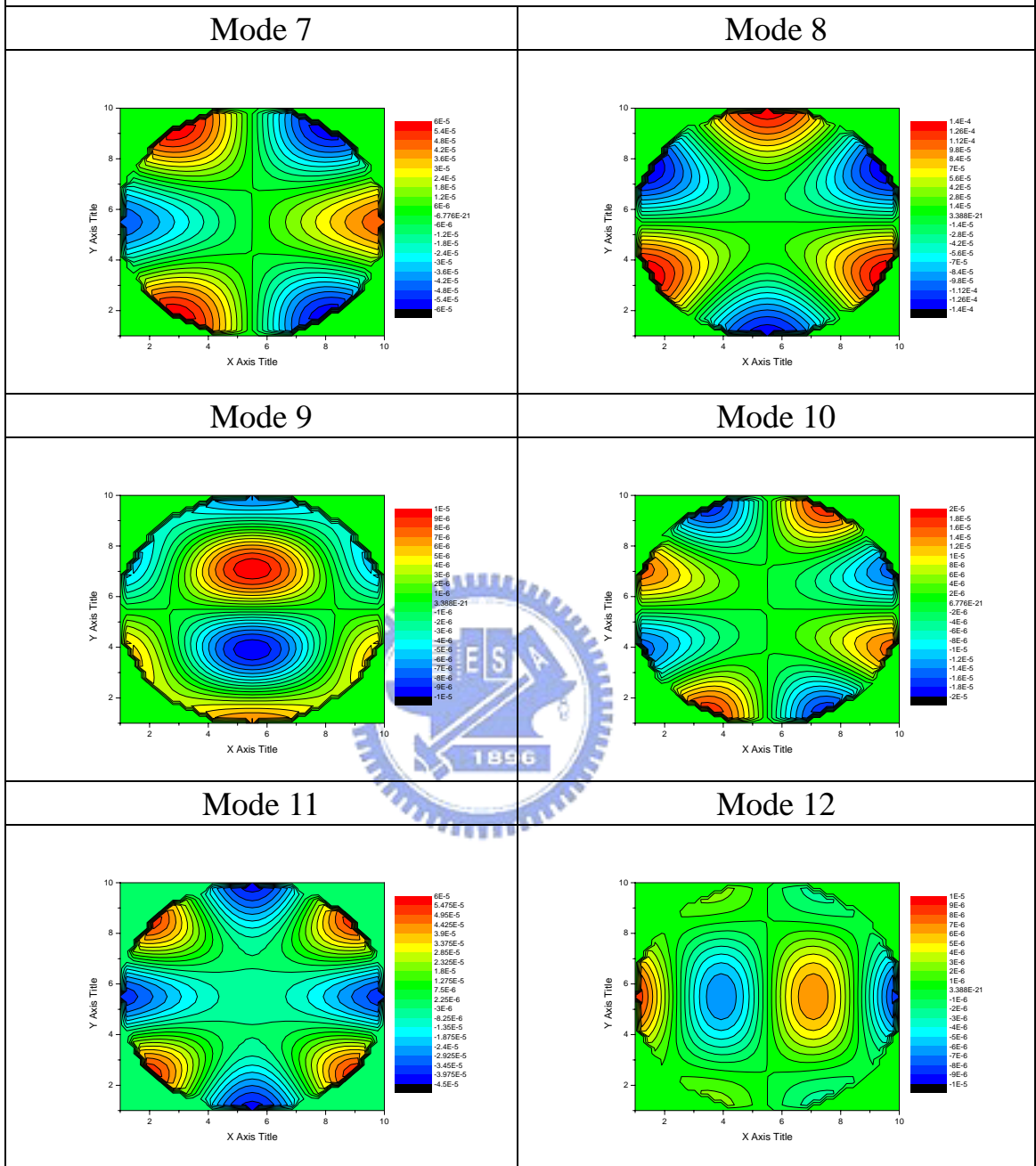


圖 6-6d-2 Fortran 數值模擬分析具彈性支撐

圓形振動板(orthotropic[0/90/0]<sub>s</sub>)之模態



圖 6-7 聲壓位準實驗所使用之激振器



圖 6-8 半圓形泡綿製懸邊



圖 6-9 具彈性支撐之圓形振動板

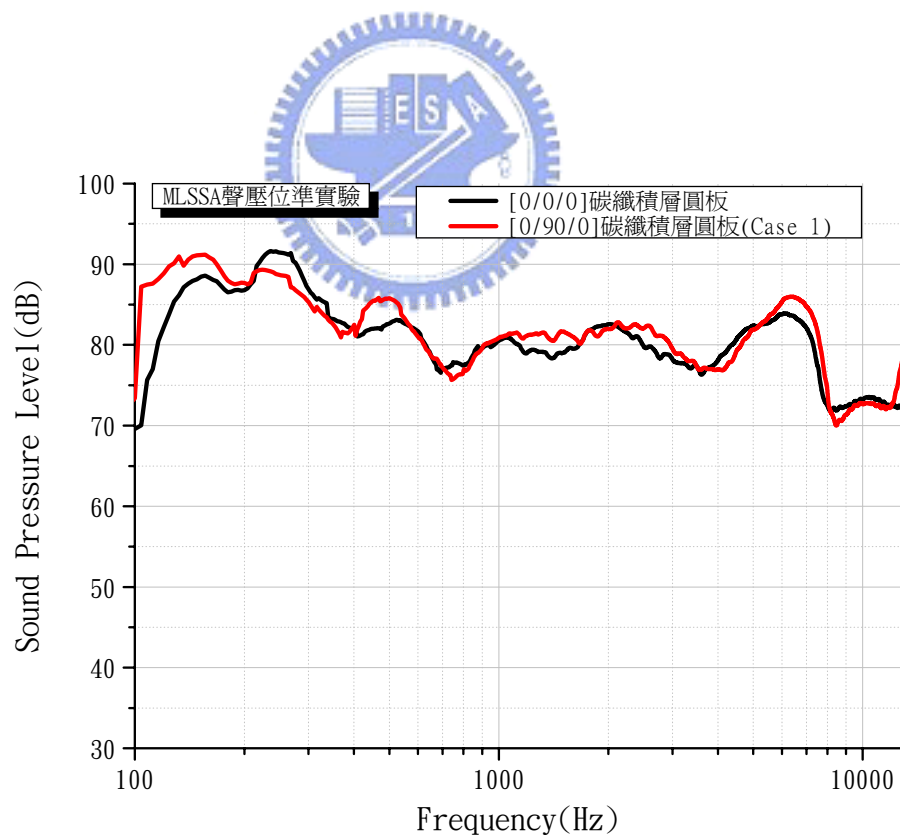


圖 6-10 [0/90/0]與[0/0/0]碳纖積層圓板之聲壓曲線圖



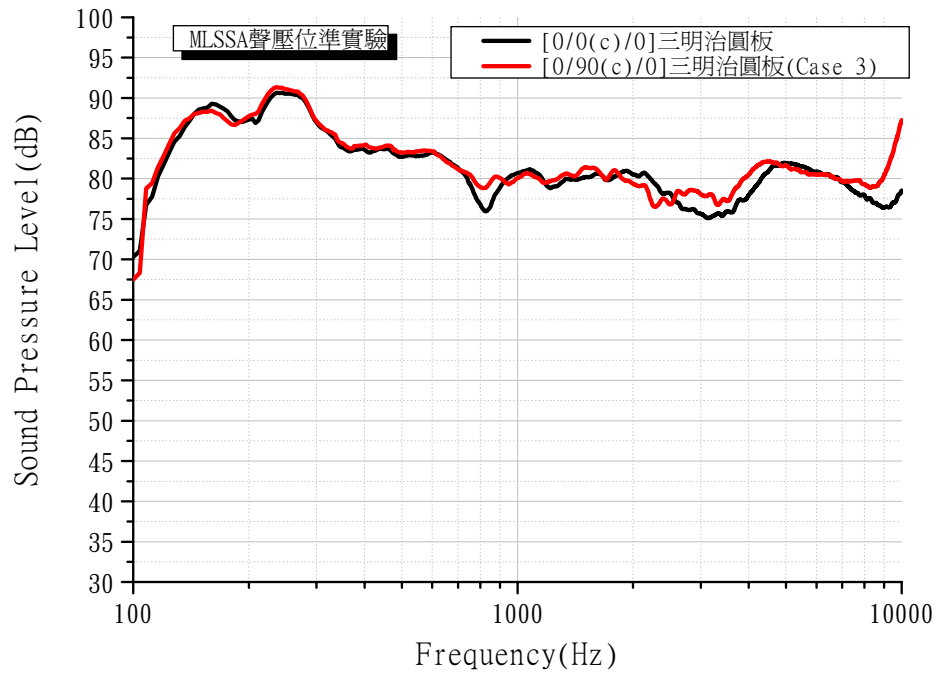


圖 6-11 [0/90(C)/0]與[0/0(C)/0]三明治圓板之 MLSSA 聲壓位準圖

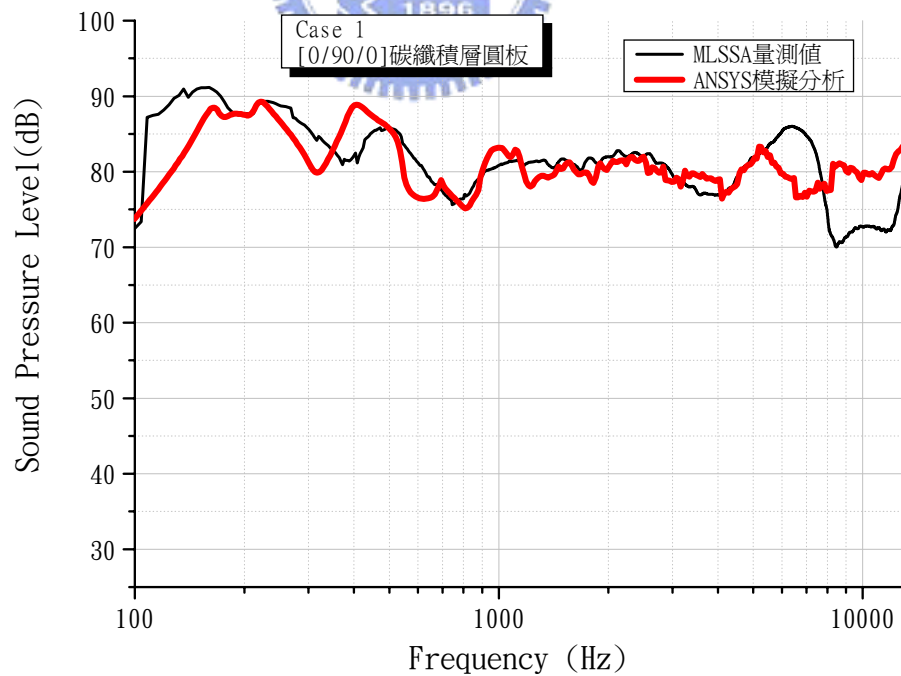


圖 6-12 [0/90/0]碳纖積層圓板之 SPL 實驗與模擬(Case 1)

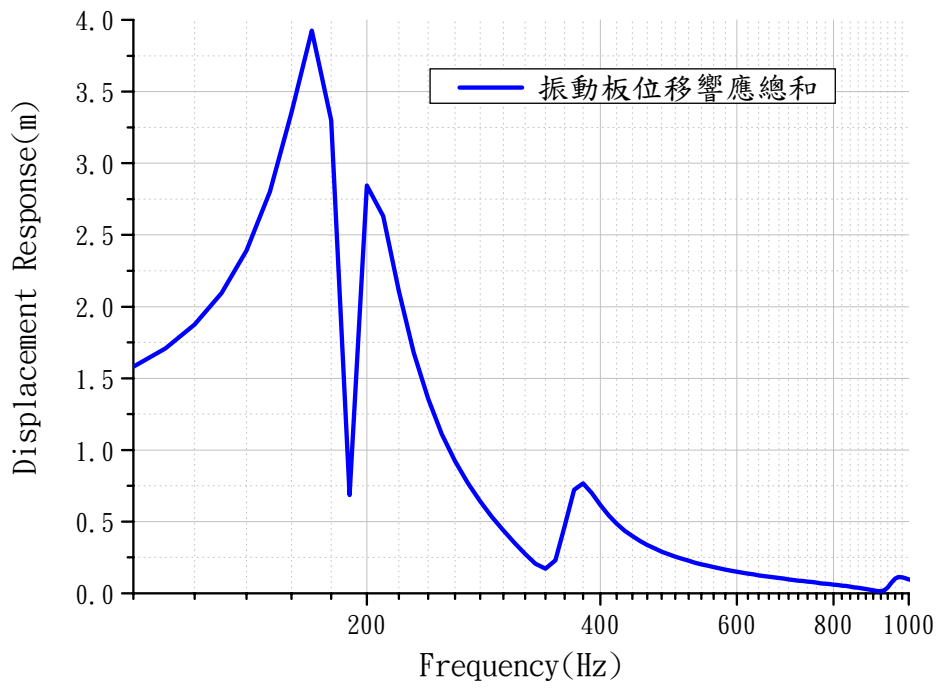


圖 6-13a [0/90/0]圓形碳纖積層板之位移響應

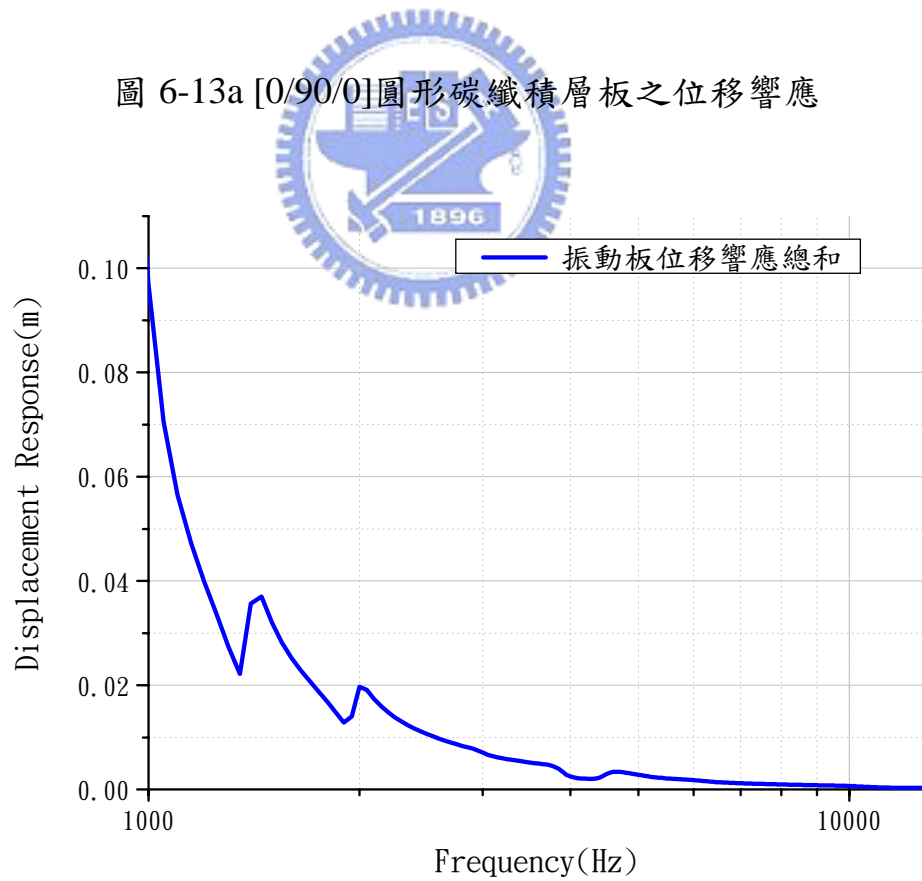


圖 6-13b [0/90/0]圓形碳纖積層板之位移響應

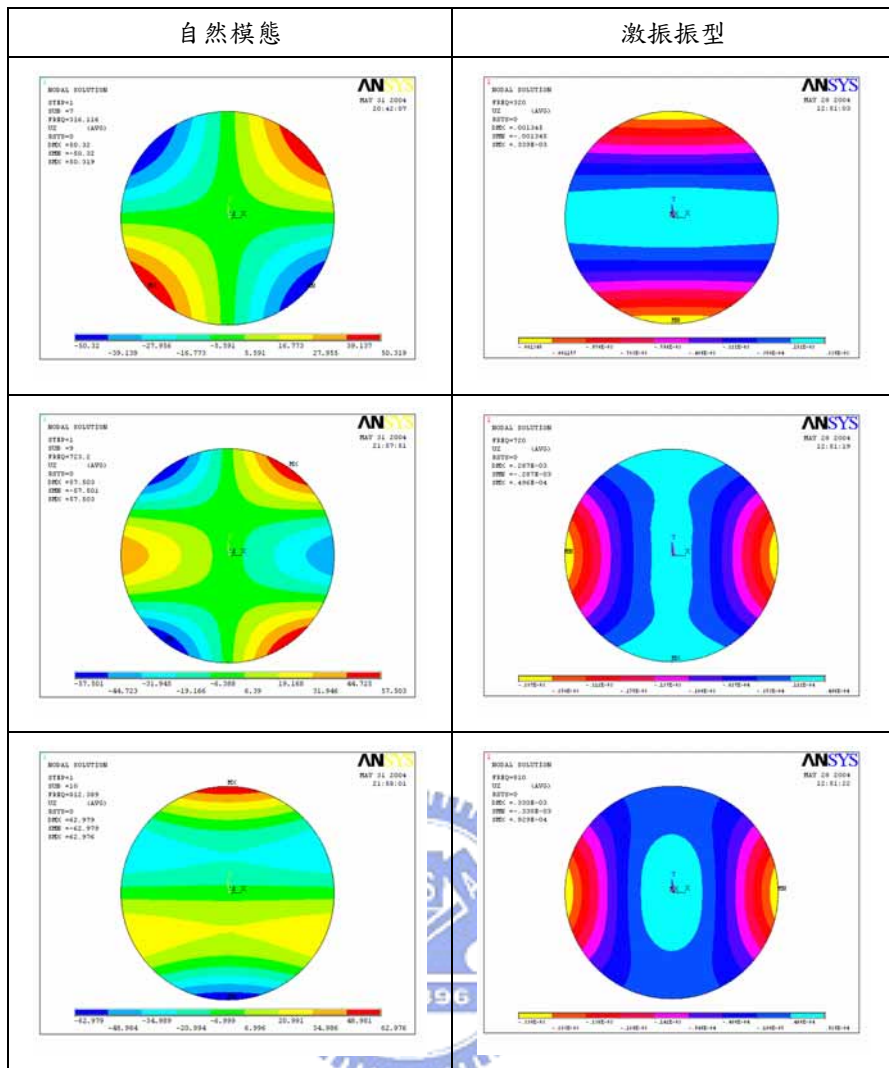


圖 6-14 [0/90/0]圓形碳纖積層板的自然模態和激振振型

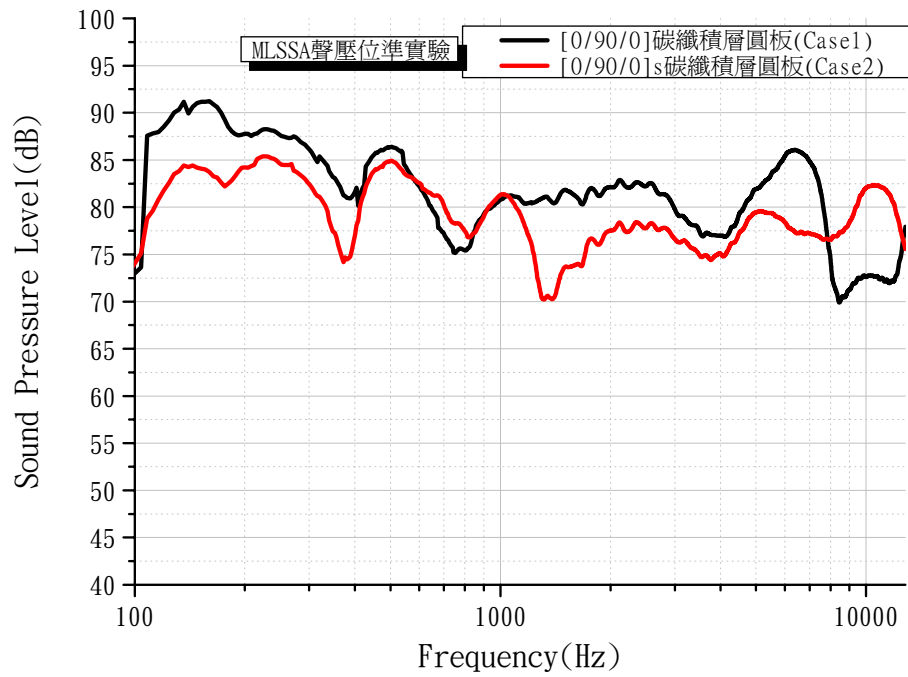


圖 6-15 聲壓位準與疊層層數的關係

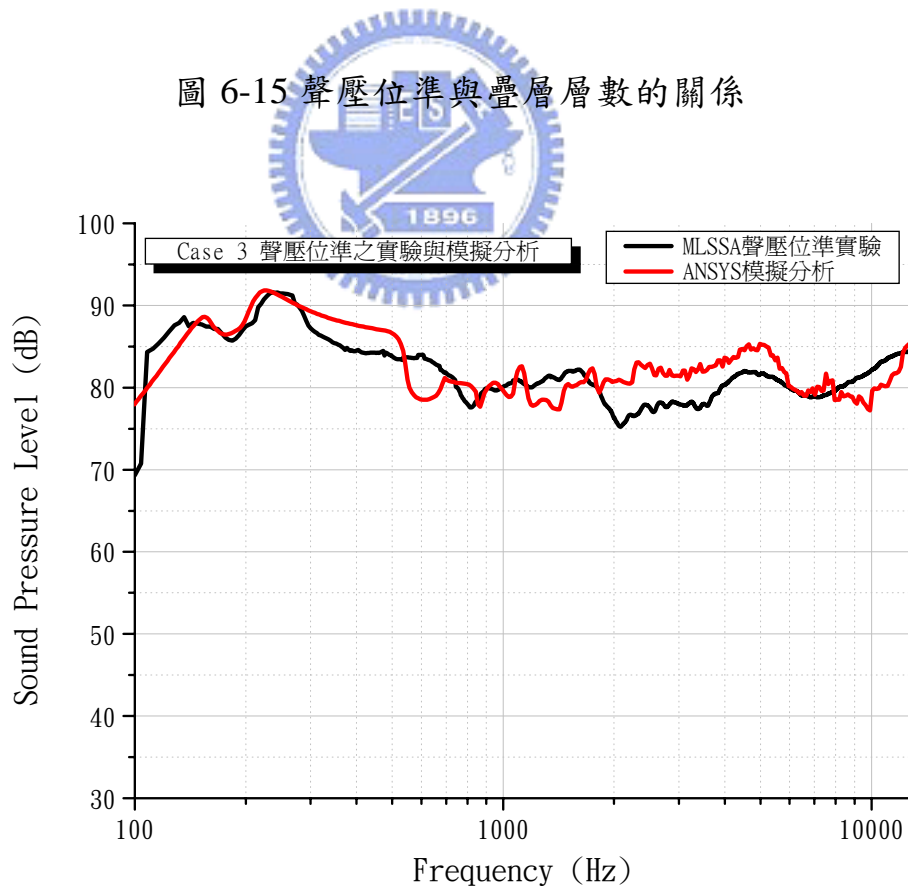


圖 6-16 [0/90(c)/0]三明治圓板(Case 3)ANSYS 模擬分析和 MLSSA 聲壓實驗

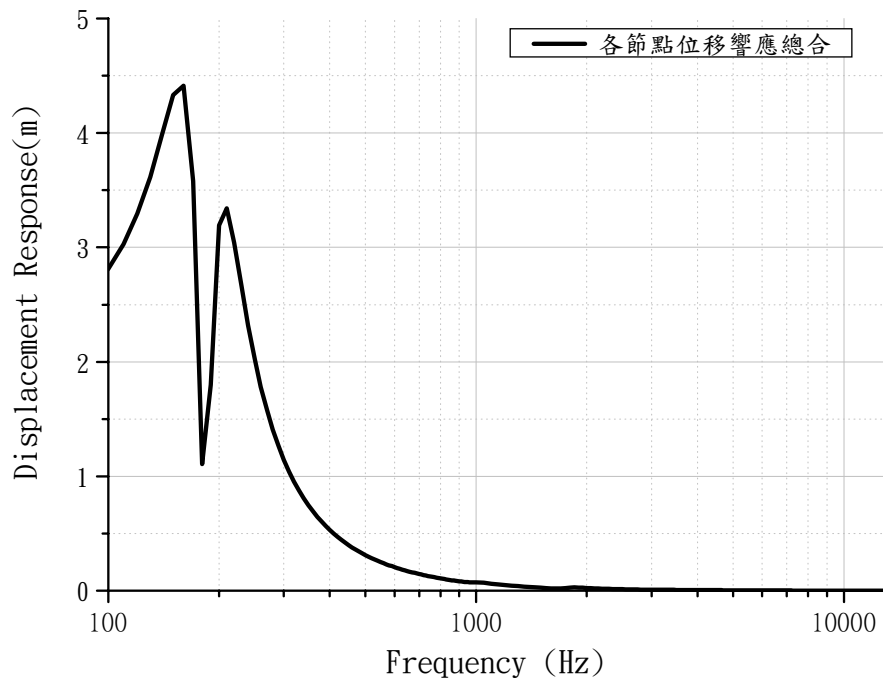


圖 6-17a 激振頻率與位移響應(Case3)

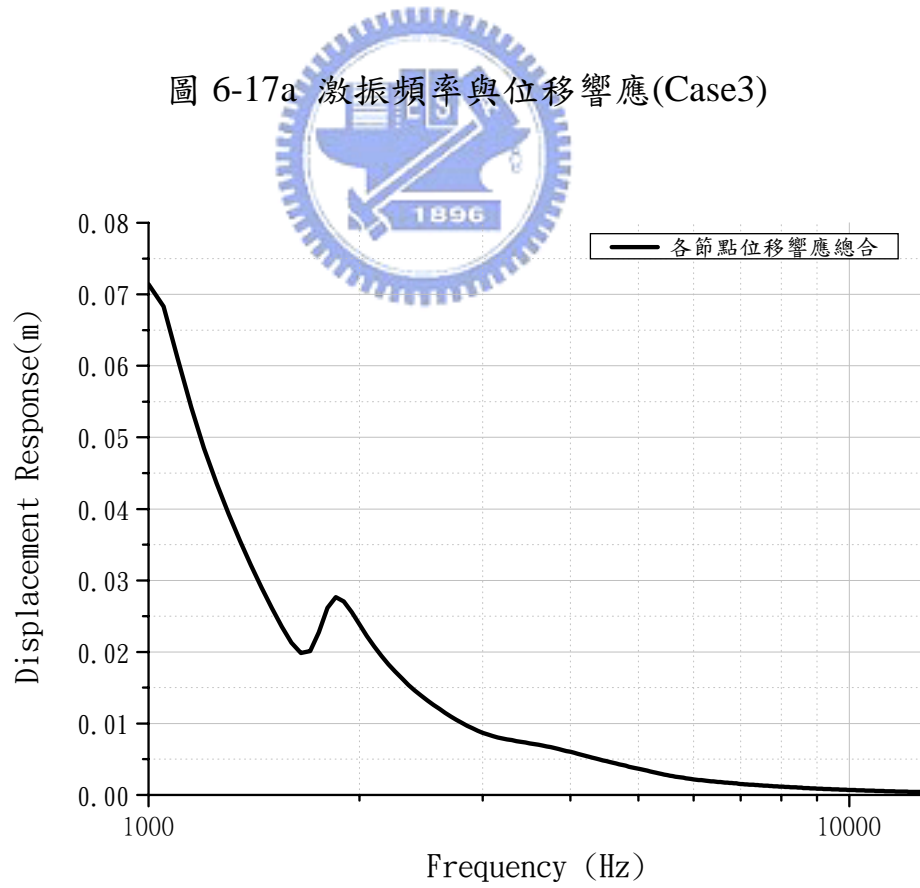


圖 6-17b 激振頻率與位移響應(Case3)

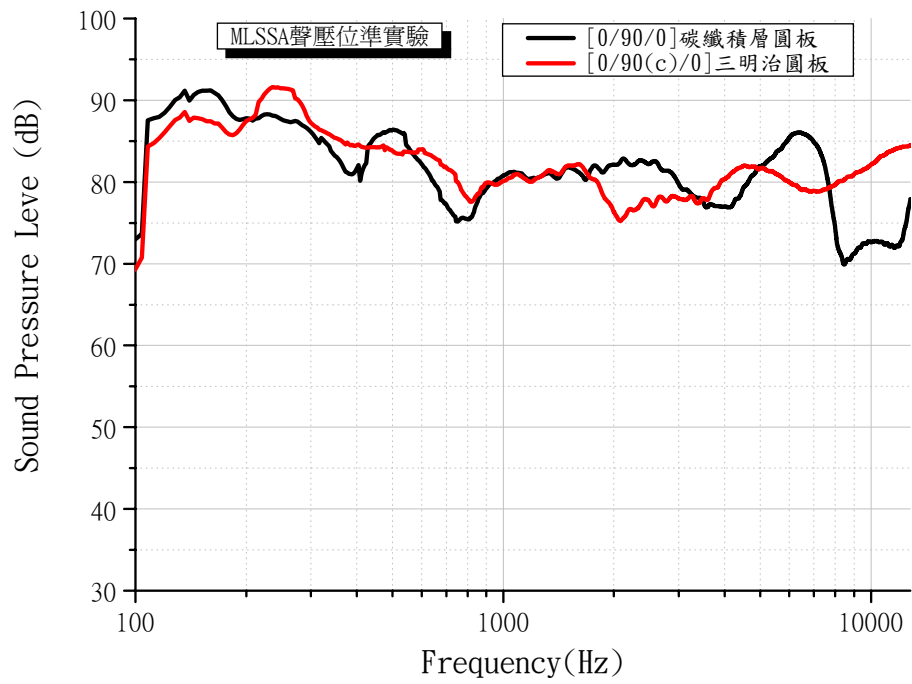


圖 6-18 碳纖積層圓板與三明治圓板之聲壓趨勢圖

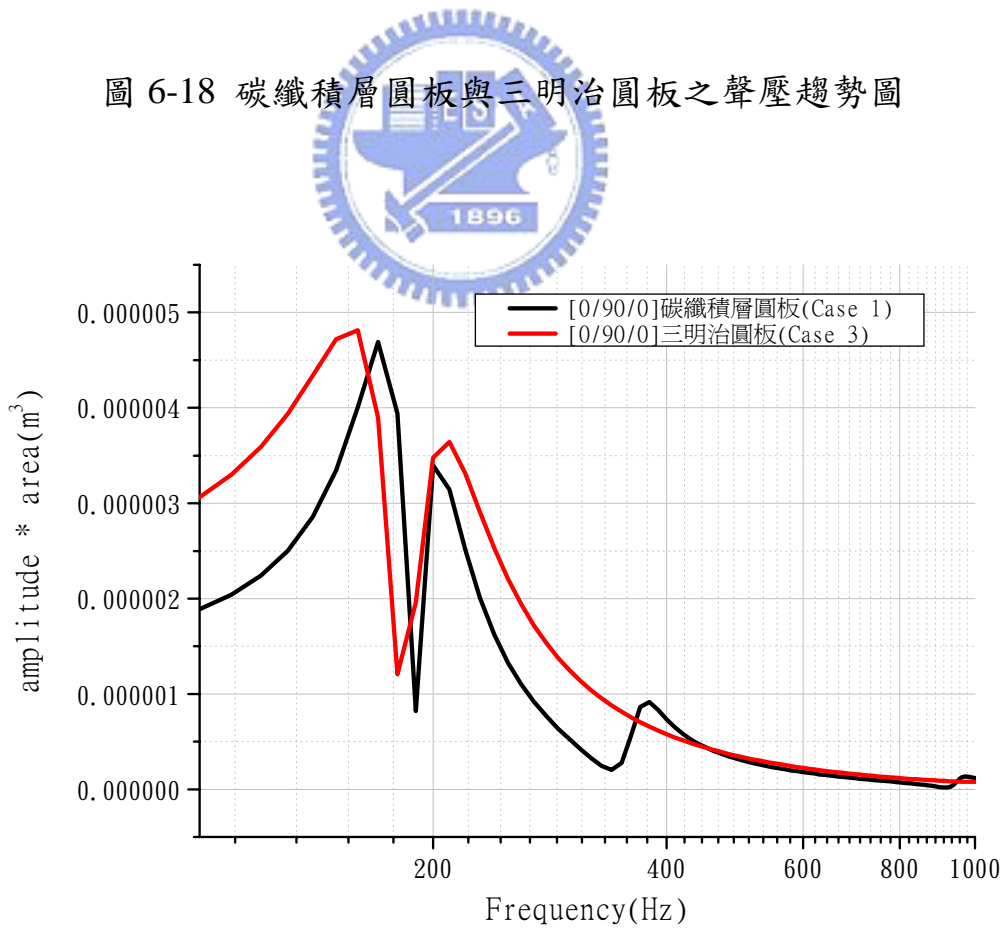


圖 6-19a 碳纖積層圓板與三明治圓板之聲壓趨勢圖

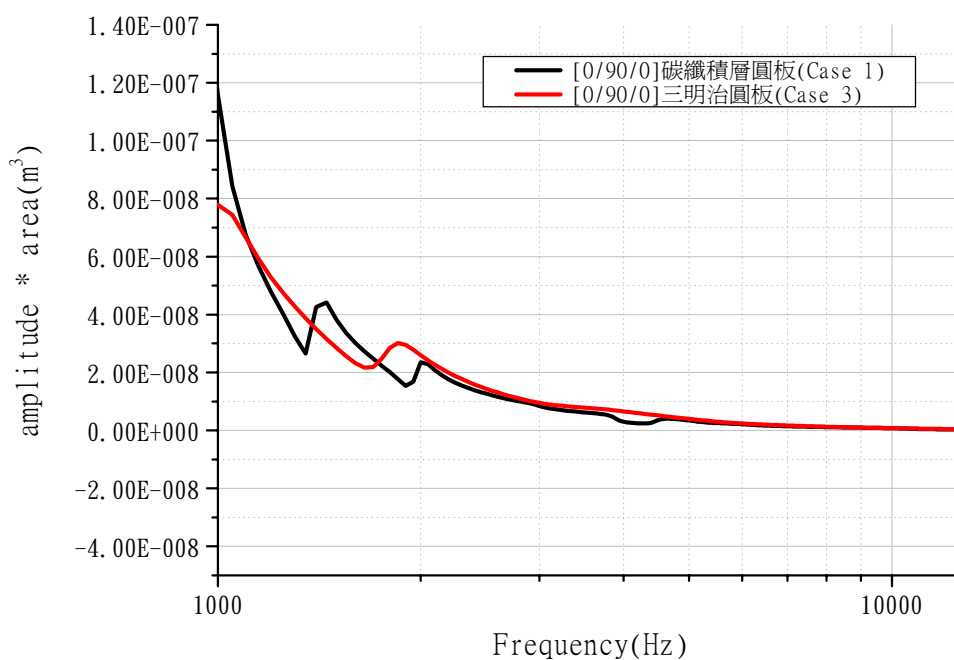


圖 6-19b 碳纖積層圓板與三明治圓板之聲壓趨勢圖

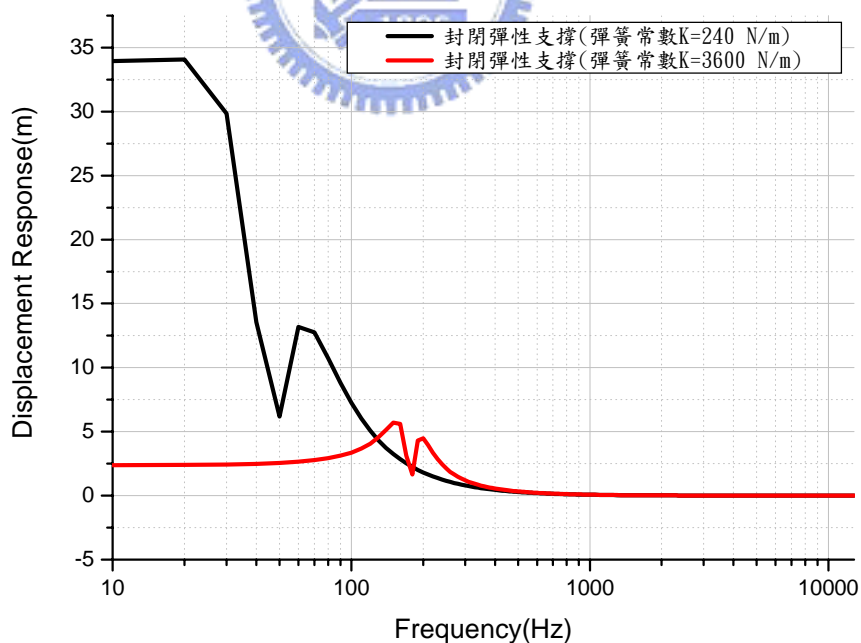


圖 6-20 利用 ANSYS 模擬分析彈性支撐強度與位移響應之關係

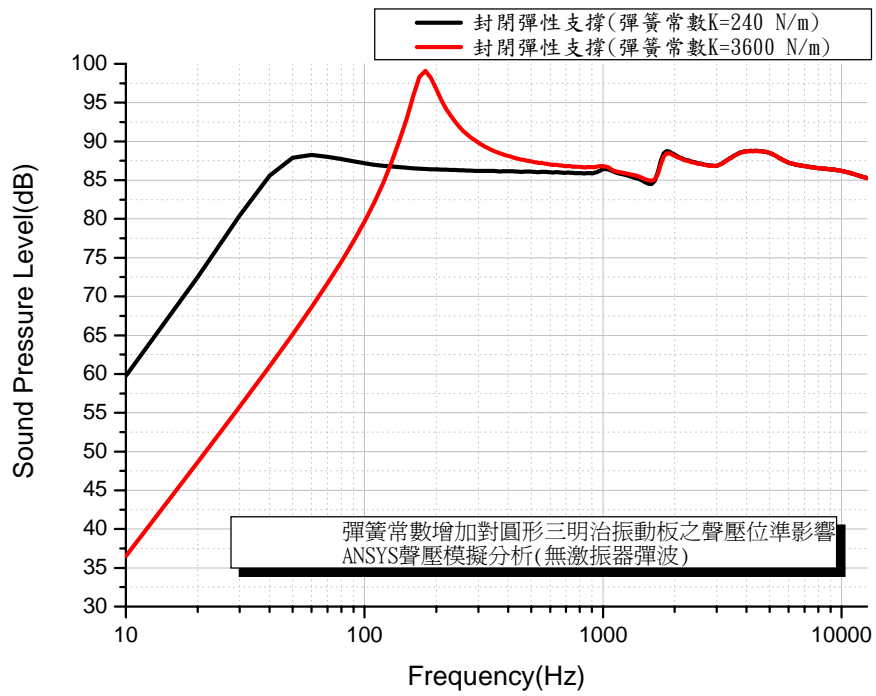


圖 6-21 利用 ANSYS 模擬分析彈性支撐強度對圓形三明治振動板之聲壓位

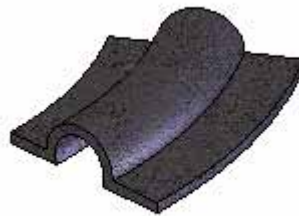


圖 6-22 非封閉半圓形彈性支撐



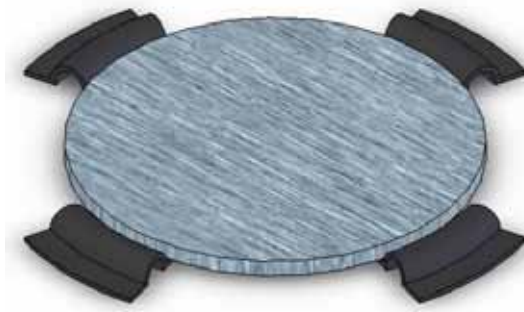


圖 6-23 具非封閉彈性支撐三明治圓板

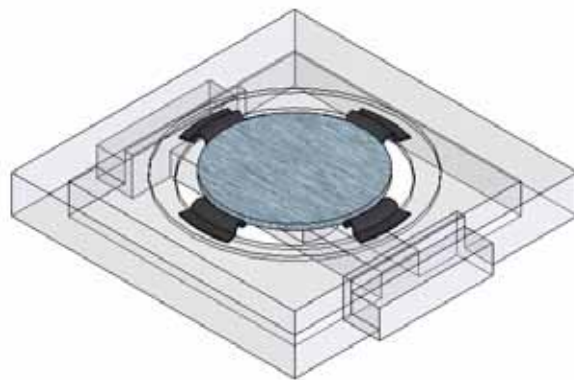


圖 6-24a 具非封閉彈性支撐三明治圓板(Case 4)

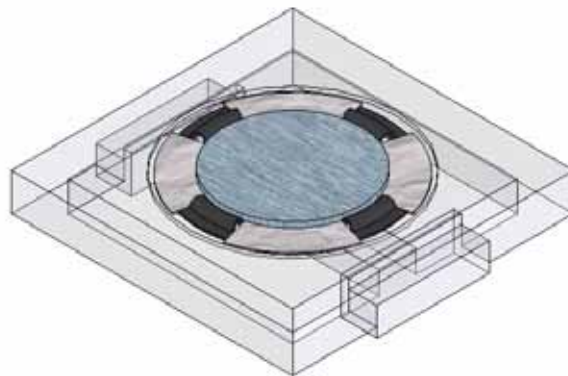


圖 6-24b 加上厚紙片之具非封閉彈性支撐三明治圓板(Case 4)

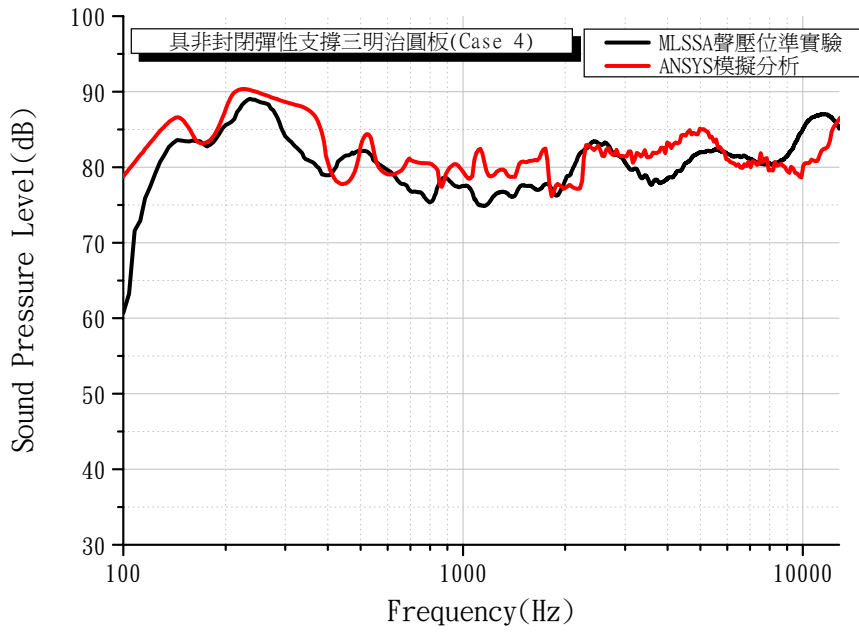


圖 6-25 具非封閉彈性支撐[0/90(c)/0]三明治圓板(Case 4)

之 ANSYS 模擬分析和 MLSSA 聲壓實驗比較

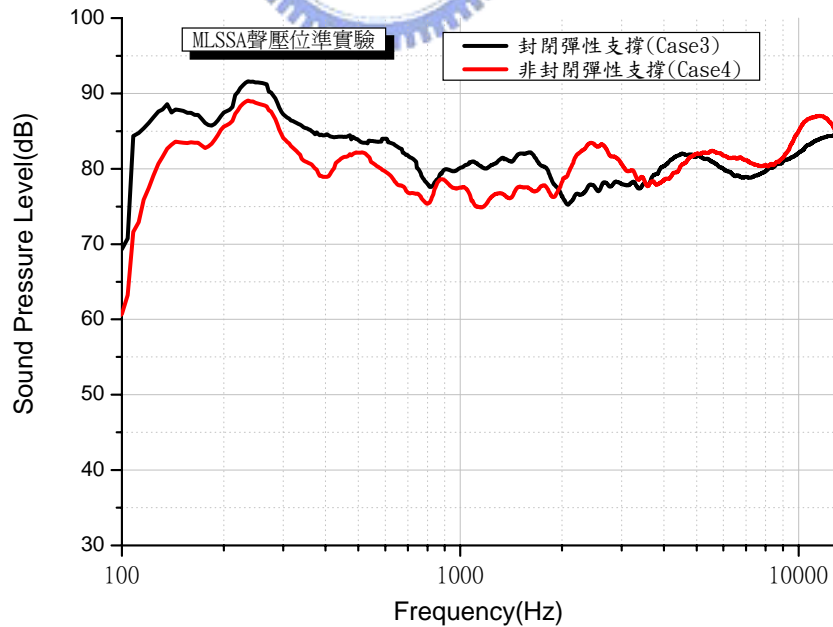


圖 6-26 封閉與非封閉彈性支撐[0/90(c)/0]三明治板的 MLSSA 聲壓位準實驗

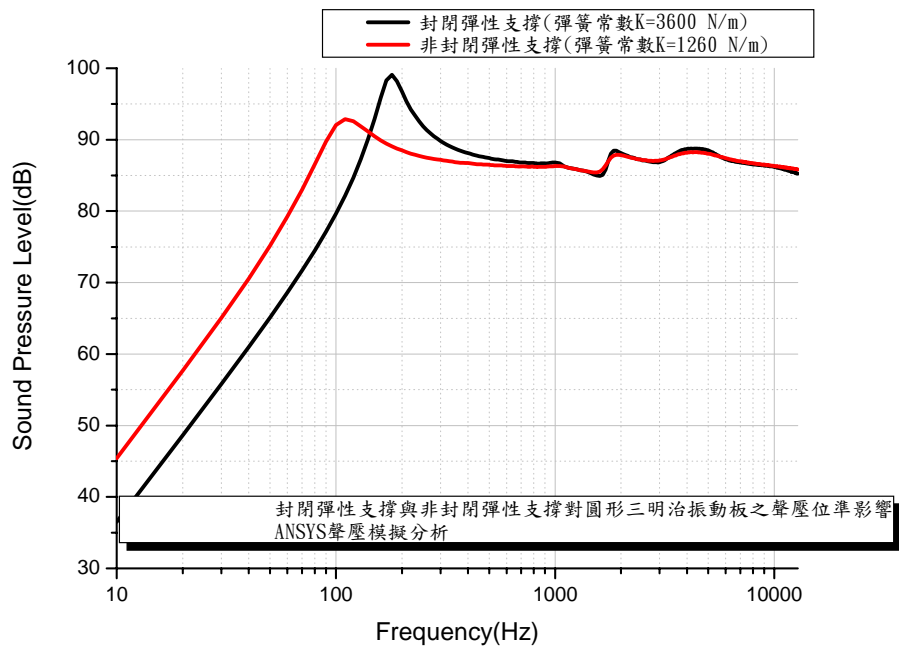


圖 6-27 不具彈波之封閉與非封閉彈性支撐[0/90(c)/0]三明治圓板

ANSYS 聲壓模擬比較

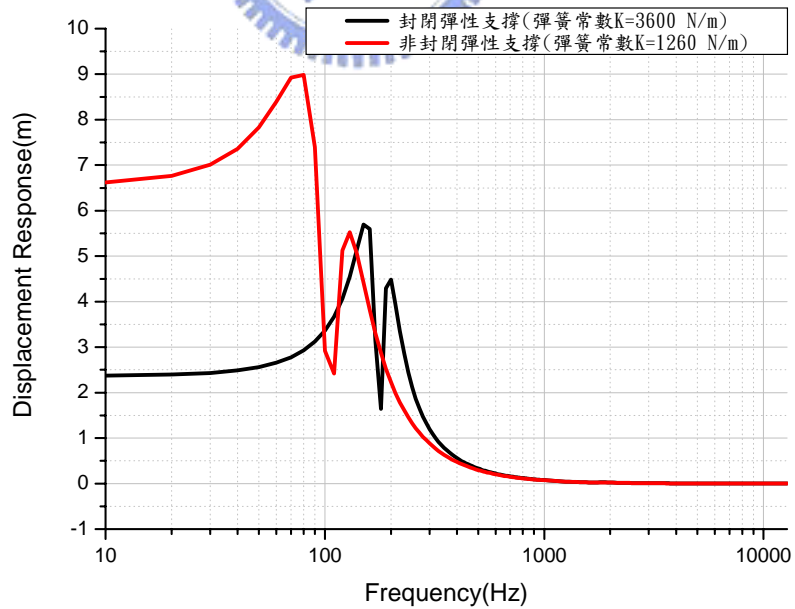


圖 6-28 不具彈波之封閉與非封閉彈性支撐[0/90(c)/0]三明治圓板

ANSYS 位移響應比較

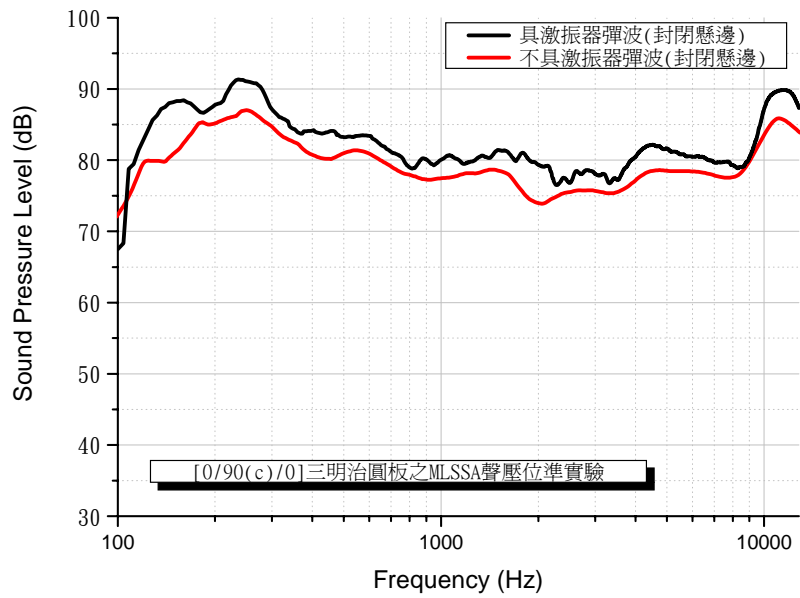


圖 6-29 具激振器彈波封閉懸邊與不具激振器彈波封閉懸邊[0/90(c)/0]三

治板的 MLSSA 聲壓位準實驗比較

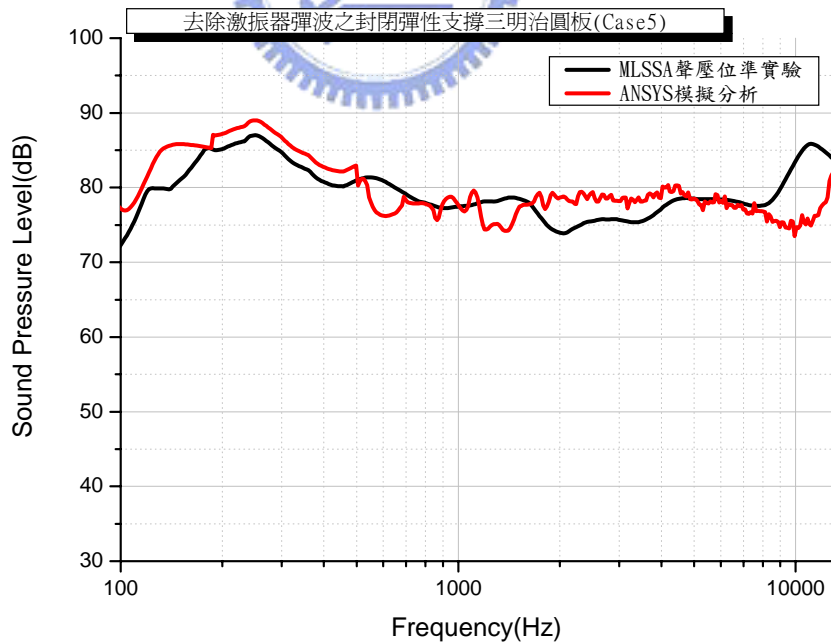


圖 6-30 去除激振器彈波之封閉彈性支撐[0/90(c)/0]三明治圓板(Case 5)

之 ANSYS 模擬分析和 MLSSA 聲壓實驗比較

MLSSA SPO 4WA #000608-4031-4036 for GESTION TAYCAN

Line	Parameter	Measured Parameters			QC Limits		Result
		Value	Units	Nominal	Min	Max	
1	RMSE-free	0.17	Ohms	0.12	0.00	0.00	
2	Fs	73.69	Hz	531.38	0.00	0.00	
3	Re	3.42	Ohms[dc]	3.62	0.00	0.00	
4	Res	6.65	Ohms	0.87	0.00	0.00	
5	Qms	4.94		3.87	0.00	0.00	
6	Qes	2.54		16.16	0.00	0.00	
7	Qts	1.68		3.12	0.00	0.00	
8	L1	0.02	mH	0.02	0.00	0.00	
9	L2	0.02	mH	0.01	0.00	0.00	
10	R2	1.52	Ohms	1.62	0.00	0.00	
11	RMSE-load	0.15	Ohms	0.11	0.00	0.00	
12	Vas(Sd)	2.07	liters	0.21	0.00	0.00	
13	Mms	5.85	grams	1.77	0.00	0.00	
14	Cms	797	$\mu$ M/Newton	50.55	0.00	0.00	
15	B1	1.91	Tesla-M	1.15	0.00	0.00	
16	SPLref(Sd)	61.6	dB[0 ohms]	69.24	0.00	0.00	
17	Rub-index	0.00		0.50	0.00	0.00	

Method: Mass-loaded (6.990 grams)      Area (Sd): 43.01 sq cm  
DCR mode: Measure (-0.70 ohms)      QC file: CLOSED

.....

Analysis successful. Shift in Fs = -36.3% (-20% to -50% is recommended).  
LIB PARAMETERS: Go Calc Method DCR-mode Area Synth QC Export Z-ref Print dUmp  
F1 for Help or ESC to exit      MLSSA: Parameters

圖 6-31 無彈波激振器之 MLSSA 參數量測

MLSSA SPO 4WA #000608-4031-4036 for GESTION TAYCAN

Line	Parameter	Measured Parameters			QC Limits		Result
		Value	Units	Nominal	Min	Max	
1	RMSE-free	0.20	Ohms	0.20	0.00	0.00	
2	Fs	141.07	Hz	141.96	0.00	0.00	
3	Re	3.11	Ohms[dc]	3.13	0.00	0.00	
4	Res	8.93	Ohms	8.71	0.00	0.00	
5	Qms	9.56		9.15	0.00	0.00	
6	Qes	3.33		3.29	0.00	0.00	
7	Qts	2.47		2.42	0.00	0.00	
8	L1	0.02	mH	0.02	0.00	0.00	
9	L2	0.02	mH	0.02	0.00	0.00	
10	R2	1.82	Ohms	1.78	0.00	0.00	
11	RMSE-load	0.16	Ohms	0.15	0.00	0.00	
12	Vas(Sd)	5871.50	liters	5844.99	0.00	0.00	
13	Mms	5.63	grams	5.59	0.00	0.00	
14	Cms	226	$\mu$ M/Newton	224.99	0.00	0.00	
15	B1	2.16	Tesla-M	2.18	0.00	0.00	
16	SPLref(Sd)	103.8	dB[0 ohms]	103.93	0.00	0.00	
17	Rub-index	0.00		0.03	0.00	0.00	

Method: Mass-loaded (3.635 grams)      Area (Sd): 4300.80 sq cm  
DCR mode: Measure (-0.88 ohms)      QC file: CLOSED

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Analysis successful. Shift in Fs = -22.2% (-20% to -50% is recommended).  
LIB PARAMETERS: Go Calc Method DCR-mode Area Synth QC Export Z-ref Print dUmp  
F1 for Help or ESC to exit      MLSSA: Parameters

圖 6-32 具彈波激振器之 MLSSA 參數量測