VIBRATION RESPONSE BEHAVIOUR OF GLASS FIBRE/EPOXY LAMINATES AT VARIOUS VOLUME FRACTIONS

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INTRODUCTION

- Composite materials are extensively used for different types of structures because of their lower weight to volume ratio when compared to conventional materials.
- The response of composite materials under dynamic loading has received much attention recently.
- The impact absorption capability of composite materials is dependent upon the interfacial strength between fiber and matrix.
- Also the mechanical behavior including impact behavior of composites is much dependent on the fiber volume fraction.

LITERATURE REVIEW

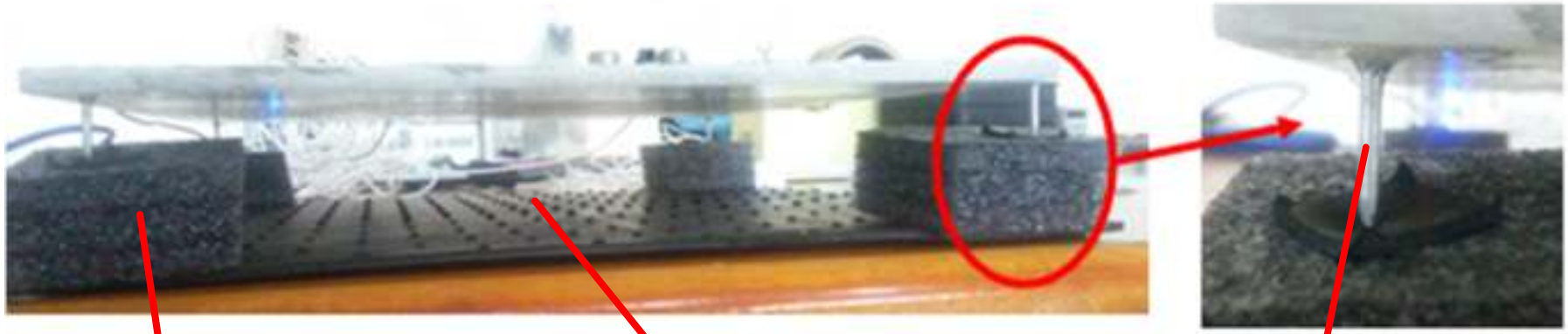
Title	Year	Author	Discussion	Argument
Impact behavior of glass fibers reinforced composite laminates at different temperatures	2012	Amal A.M. Badawy	The effect of exposure temperature and fiber volume fraction on impact strength of GFRP composite depends on the parameter controlling the mode of failure, i.e. matrix or fiber.	• hand lay-up technique •The 6709 (Avery-Denison limited) machine was used to conduct the impact test.
The impact damage response of plain woven natural silk/epoxy laminated composite plates	2010	A. U. Ude*, A. K. Ariffin, K. Sopian, A. Arifin and C. H. Azhari	The energy absorption capability also increased with increase in the number of WNS ply.	Used drop weight impact test
The influence of fibre length, and concentration on the impact performances of glass-fibre	2009	Thomason JL	• The increase in the fibre content introduced increasing in impact resistance.	• used Charpy test method

PLATE WITH 5MM IN THICKNESS

PREPARATION OF EXPERIMENTAL PLATE

fabricated by SIRIM using **COMPRESSION MOULDING MACHINE**

SUPPORTING STRUCTURE



Foam

- Less bouncing foam since so much bouncing will lead to noise
- To absorb the force exerted
- The effects of vibrations in the sponge are likely to be small.

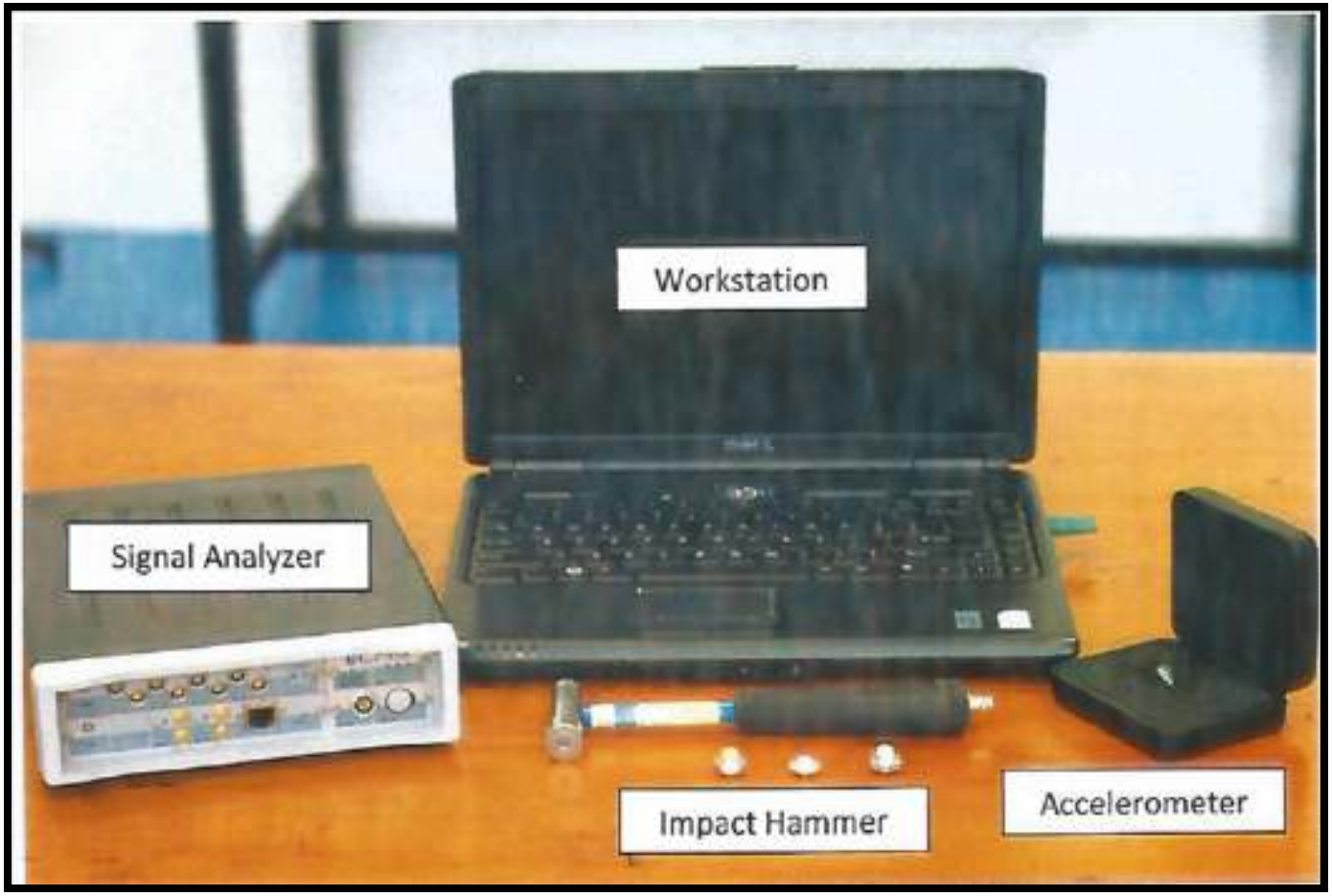
Rubber Mat

-To provide suspension and to avoid external interference due to environment, the structures is placed over a rubber mattress.

Nail

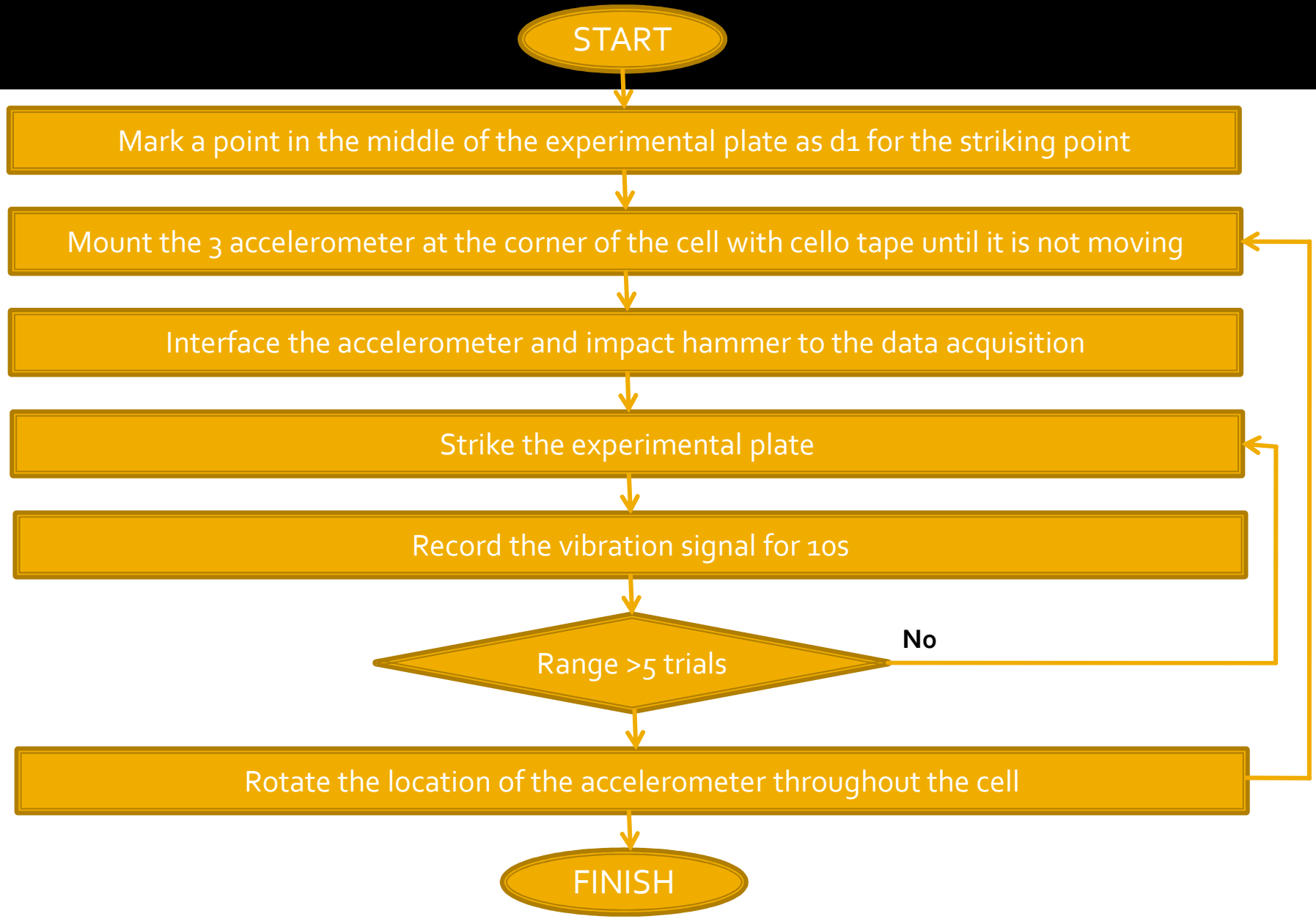
- Will support the plate in pivot form
-The load will be acting downward
- The vibration should be distributed uniformly
-The nail size should be as minimal as possible so that the contact area will be small.

DATA ACQUISITION SYSTEM

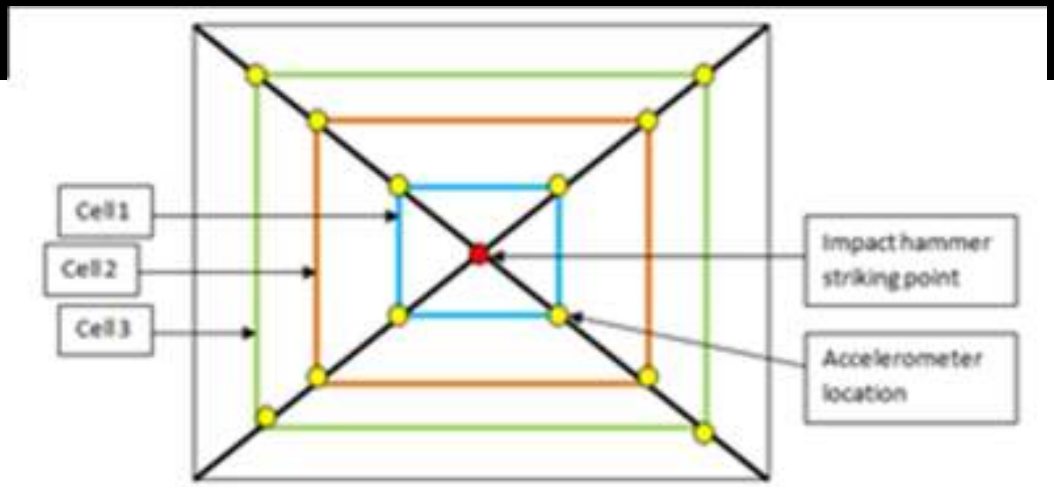


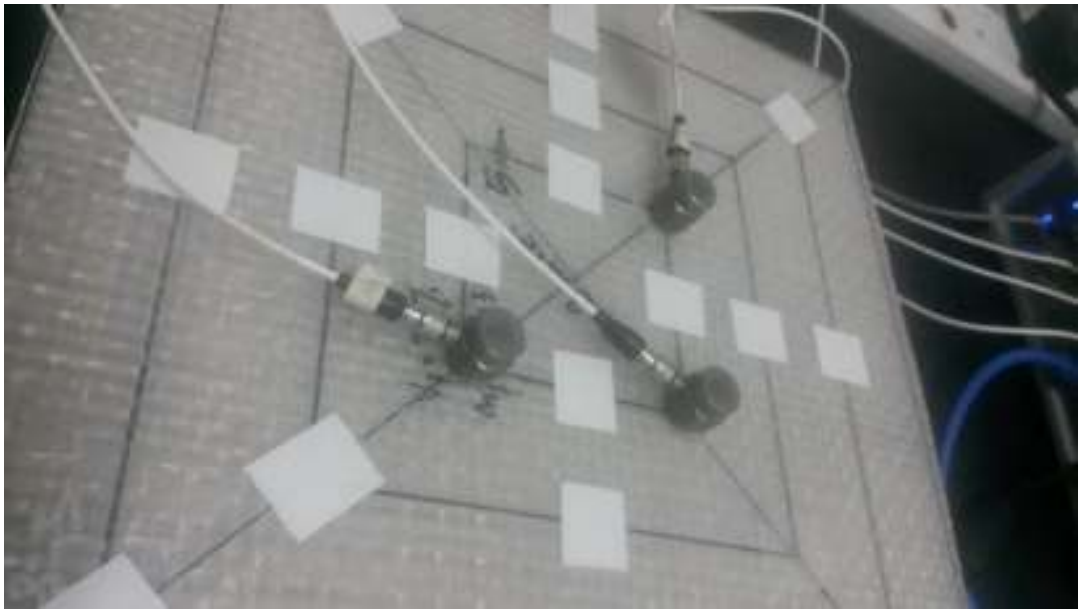
LMS SCADA SOFTWARE SYSTEM

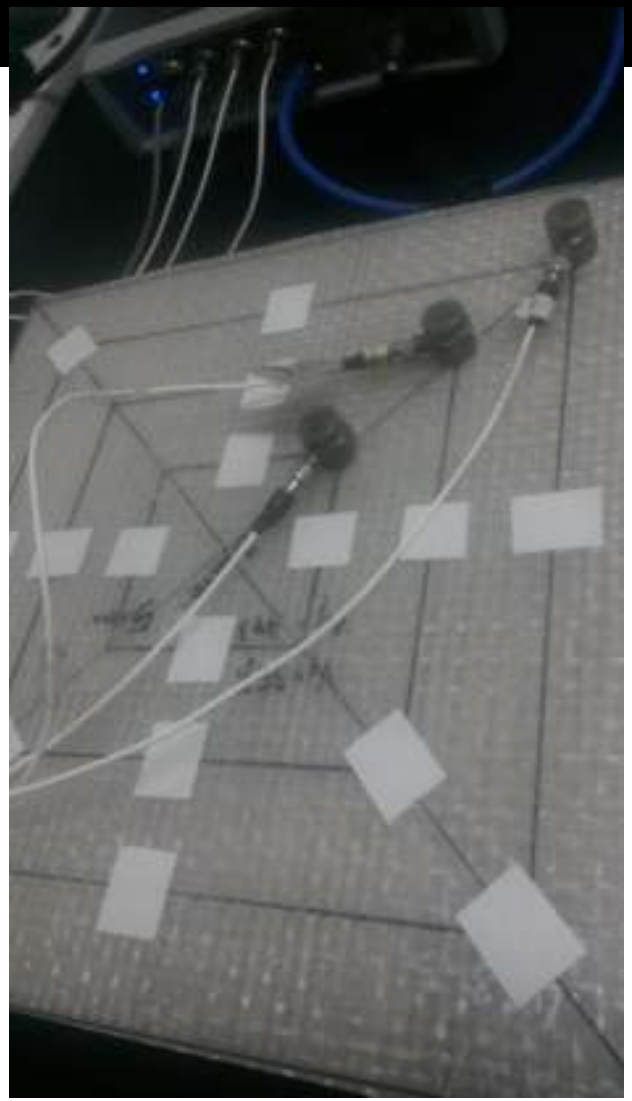
FLOW ON DATA ACQUISITION SYSTEM



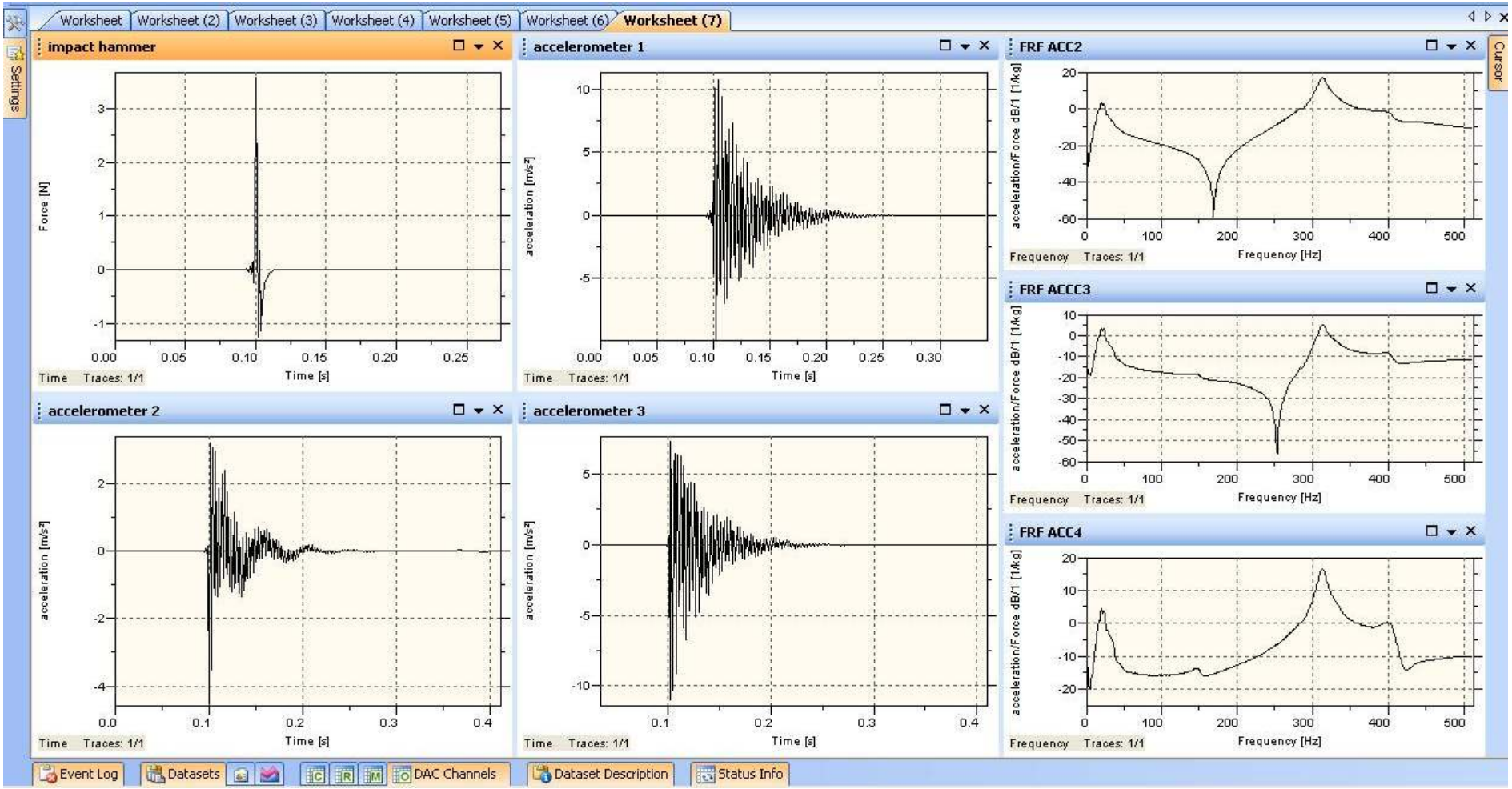
DATA ACQUISITION SYSTEM



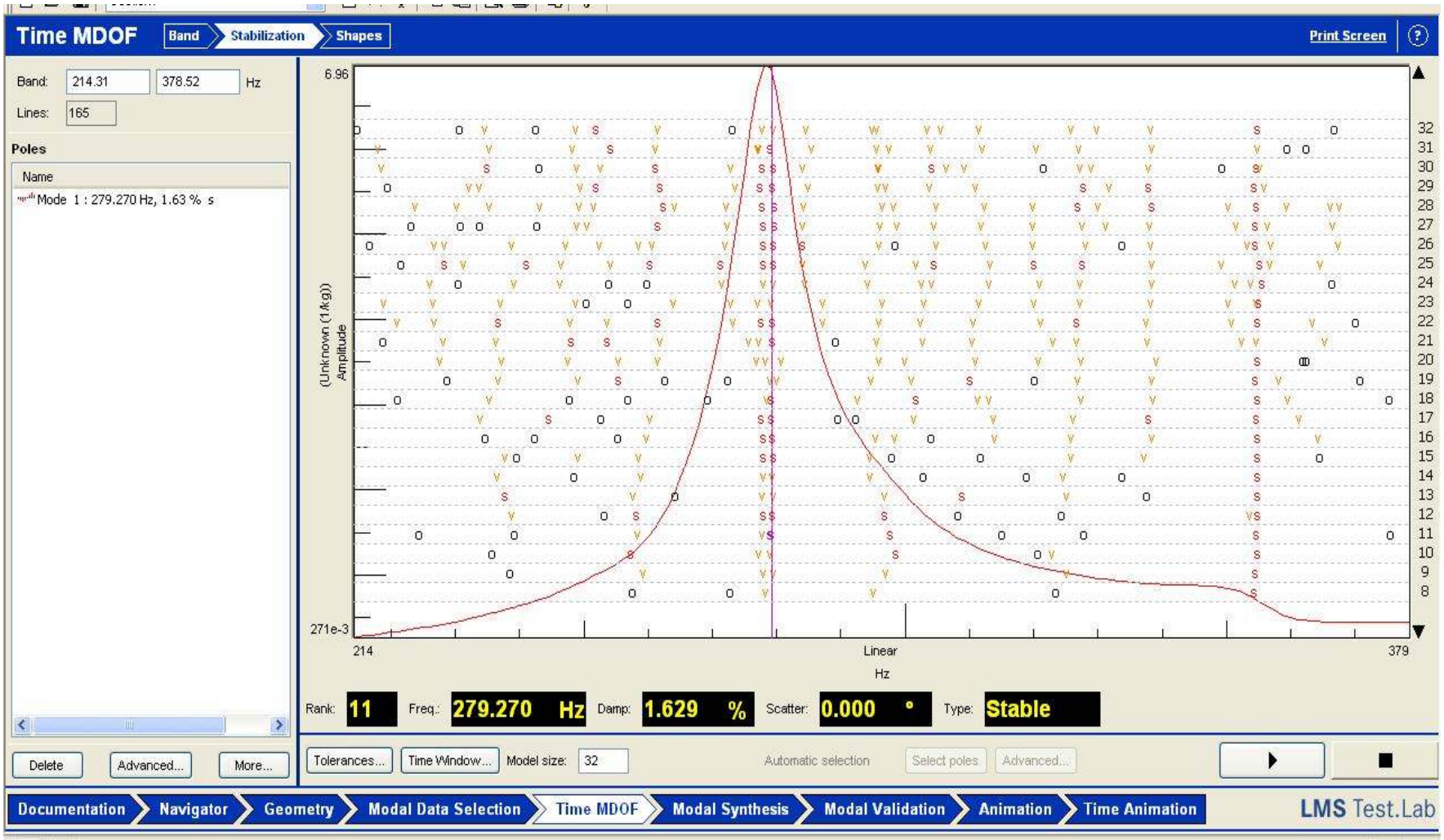




The signals acquired by the accelerometers were displayed on the monitor with the frequency response function (FRF) as shown.



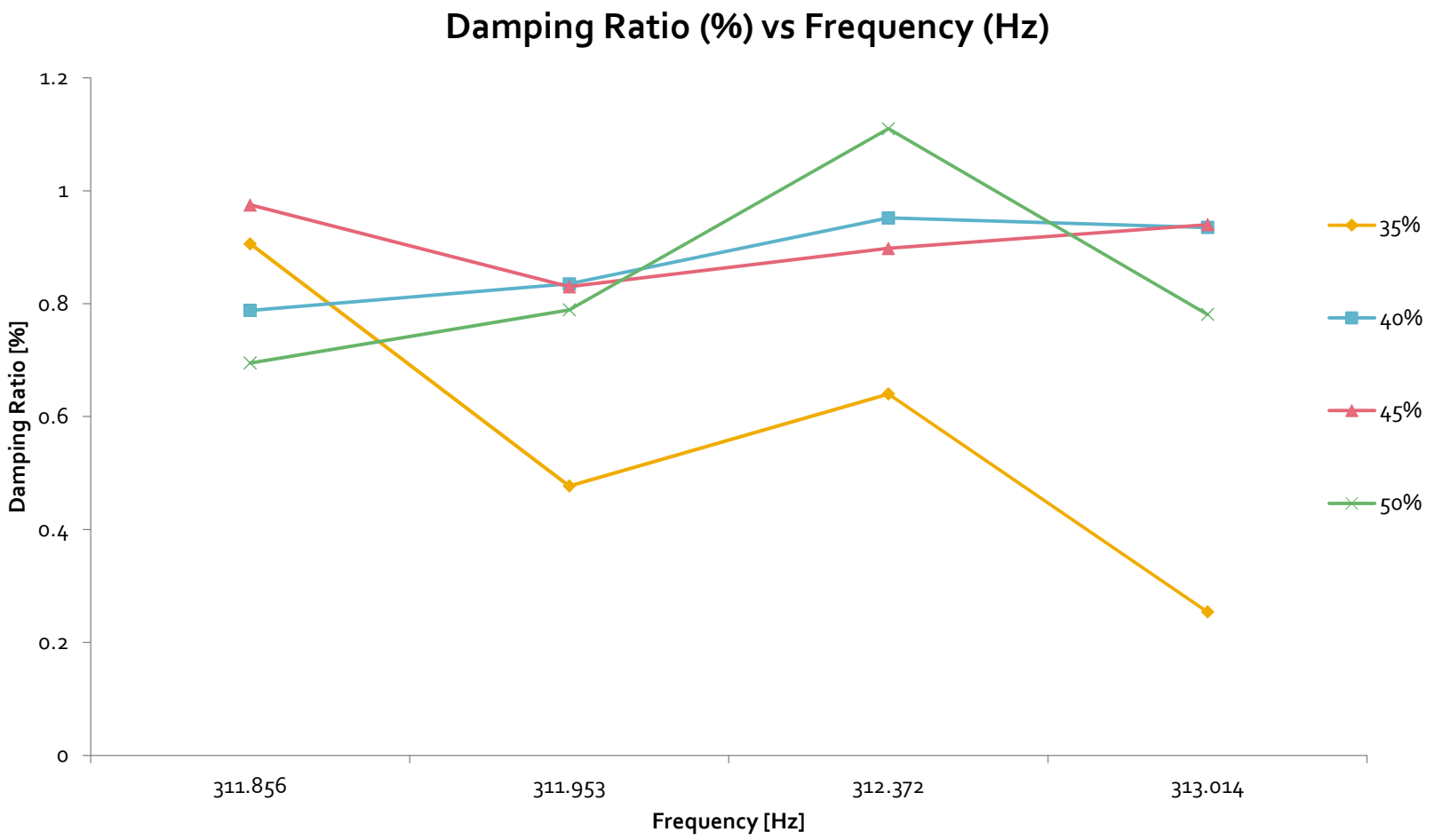
Typical Modal Analysis from the FRF signal to obtain the natural frequency and damping factor of the plates



RESULT

Volume Fraction of Composite Material	TEST 1		TEST 2		TEST 3		TEST 4	
	Frequency [Hz]	Damping [%]	Frequency [Hz]	Damping [%]	Frequency [Hz]	Damping [%]	Frequency [Hz]	Damping [%]
50%	311.856	0.695	311.953	0.789	312.372	1.11	313.014	0.781
45%	273.673	0.975	275.579	0.83	275.431	0.898	274.632	0.94
40%	311.126	0.788	310.452	0.835	310.202	0.952	310.023	0.935
35%	282.145	0.906	284.74	0.477	286.289	0.64	273.899	0.254

RESULT


Damping Ratio (%) vs Frequency (Hz)
Damping Ratio [%]
1.2
1
0.8
0.6
0.4
0.2
0
311.856
311.953
312.372
313.014
Frequency [Hz]
35%
40%
45%
50%

DISCUSSION

From the tabulated values in the table, it could be clearly seen that 50% volume fraction exhibit the highest fundamental frequency followed by 40%, 45%, and 35% under vibration of impulse. The results of all the plates with different volume fractions clearly showed in the graph. The most significant damping was observed for the plate with 50% volume fraction that is the plate of the highest internal damping. The plate with 35% volume fraction were observed to have the smallest damping ratio which is obviously showed the big different with the other plates.

CONCLUSION

As the conclusion, the frequencies of the plates with 50% and 40% volume fractions are approximately the same and also the damping values are remarkably higher compared to the others. The plates with 45% and 35% volume fraction have lower frequencies and the damping values are within the same range. Although all plates are glass fibre/epoxy laminated composite plates, they definitely show different damping characteristics: the damping value can be significantly larger or smaller, and linear or nonlinear damping is possible.