



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512



9940 572 462



6381 907 438



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Design and Optimization of Mounting Bracket for Electronic Packages in Aircrafts

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ABSTRACT: At present in the competitive world a light weight component is playing a vital role. This leads to design a light weight component for desired safety standards. Due to the random vibrations, which occur at the mounting locations during the movement of the aircrafts, there is a chance for the electronic packages in the aircraft to get failed. Design the bracket supporting the electronic packages such that it with stand these random vibrations. A bracket is a component used to support load or any other attachments to structural element.

Bracket is fastened to the structural element by means of rivet joint or bolted joint. The bracket is subjected to different types of loading. The static load is one of the main loading that cause for the failure of bracket which is assumed to be constant throughout the operation. By comparing new design with the older design, the weight of the component will be decreased more than 20% then older design and the cost of the component also decreases. In this study the modelling of Bracket is carried out in CATIA V5r21 Cad software and Finite element Analysis on supercharger Using Ansys. Meshing was done in Hypermesh to get the fine mesh. In this study Strength of material, von mises stresses, and various engineering processes are the main consideration.

KEYWORDS: Bracket, FEA analysis, CATIA, ANSYS, HYPERMESH.

INTRODUCTION

Electronic devices used in military equipment such as RADAR systems, communication systems, and missile launch systems, and control devices in airplanes, helicopters, ships, and submarines operate in severe environmental conditions. It has been observed that most of the electronic failures are due to extreme temperature conditions (thermal cycling and thermal shocks), severe vibrations, humidity, and dust. According to US Air-Force statistics, of all the failures observed in electronic equipment used in defence applications, about 55 per cent are due to thermal problems, 20 per cent due to vibration problems, 19 per cent because of humidity and 6 percent due to dust and other reasons. High acceleration levels, displacements and stress will lead to failure of lead-wires; solder-joints, cracking of printed circuit board (PCB), and loosening of fastening screws because of severe vibration loads (in particular random vibrations).

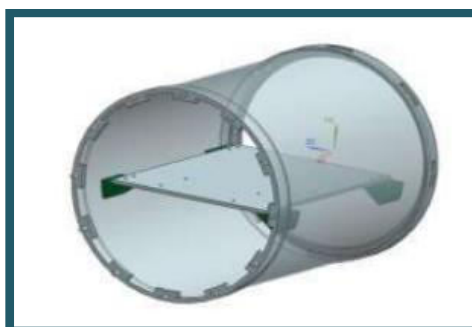


Fig1.Shows the mounting Structure

For reliable functioning of military equipment, the electronic based control systems must be designed to withstand all sorts of severe vibration loads. The reliability of electronic devices used in military applications is very important while operating in worst terrains of battlefield. Malfunctioning of critical systems in military equipment will lead to heavy loss of human lives and property. Random vibration is specified for acceptance tests, screening tests, and qualification tests by commercial, industrial, and military manufacturers of equipment, because it's been shown that random vibration more closely represents truth environments during which the equipment must operate. This includes airplanes, missiles, automobiles, trucks, trains, and tanks also as chemical processing plants, steel rolling mills, Electronic packaging designers and engineers must understand the elemental nature of random vibration and fatigue, so as to style, develop, and produce cost-effective and light-weight structures that are capable of operating in the desired environments with a high degree of reliability. Random vibration is exclusive therein all of the frequencies within the bandwidth are present simultaneously at any instant of time for every frequency. When the frequency bandwidth is in interval 20 to 1000 Hz, every natural 16 frequency of each support between 20 and 1000 Hz are going to be excited at an equivalent time. This includes every fundamental natural frequency, and each higher harmonic of each structural member within that bandwidth. Due to the random vibrations, which occur at the mounting locations during the movement of the missile, there is a risk for the electronic packages in the missile to get failed. The project explains in detail the methodology adopted for the analysis of mounting structures for flight vehicles.

II. LITERATURE REVIEW

S.V. Gopala Krishna et al (8) has demonstrated that -The most crucial aspect is compactness and weight in aerospace industries. Consistent with the Newton's second law, the energy required for the vehicle depends on the mass of flight. Since it's considerably needed to scale back the load and thus it's optimized and designed for minimum weight without sacrificing the function. As Minimum weight is that the critical think about Aerospace Industries we've optimized the load of the Bracket by reducing the volume of the Bracket by giving number of cut-outs and by changing materials of the Bracket like Al Alloy and Graphite Epoxy Composite.

In the paper, the author(s) initially calculated the weights of the bracket of without cut, single cut, double cut, four cuts then calculated the von misses stresses and deformed shapes of them and came with the conclusion that Mass of 6mm thick Graphite Epoxy Composite bracket with 6mm 2 cuts is 0.966kg which is about 42.5% but the 6mm 2 cuts Al alloy bracket.

Yalla Shirley et al (9) the launch of a flight vehicle are often one among the foremost rigorous loads environments that to style hardware. The highly random vibration loads imparted on vehicle by the electronic packages during launch create an adverse design requirement that each one hardware have a natural frequency greater than that of the vehicle, so as to avoid damage and failure thanks to dynamic coupling.

The project or the design comprises of design and analysis of the mounting structure. The mounting structure has got to be

Designed to face up to the hundreds generated by the electronic packages. It also includes the planning of mounting plate and brackets to face up to the given loads using CAD and CAE tools.

In the paper, the methodology performed was Create 3D model of the mounting structure using NXCAD software, Create Finite element model of the mounting structure using ANSYS software. Then perform structural static analysis of the mounting structure for Pitch, Roll and Yaw conditions then Modal analysis performed to calculate natural frequencies and mass participation's. Perform Power Density Spectrum analysis of the mounting structure in X, Y and Z directions and Perform Response spectroscopy of the mounting structure X, Y and Z directions.

Paper is organized as follows. Section I describes introduction about Bracket, section II lists out Literature review and Section III. Describes about the Material properties section IV presents the Modeling and Analysis and section V Presents the Experimental results and VI Presents the conclusion.

III. MATERIALS AND MANUFACTURING PROCESSES

The material selection must tend to necessary properties for the imposed implication. Few Requirements that require to be satisfied are weight, rigid, Ability to face up to from various environmental attacks, Service life and reliability. the fabric should withstand various mechanical properties like Bending, Torsional and buckling loads, Compressive shear, Elastic limit, fatigue and stress conditions. Secondly the very cost effective and easily available for this study we have considered Structural steel which is comparatively very strong can bare sudden loads. The modelling carried out using structural steel. Physical properties of the Structural steel are stated is as follows.

1	Material	Structural steel
2	Density	7850 kg/m ³
3	Poisson's Ratio	0.3
4	Young's Modulus	2E+11 pa
5	Bulk Modulus	1.6667E+11 pa
6	Shear modulus	7.6932E+10 pa

Table 1.shows the material properties of the structural steel

IV. MODELING AND ANALYSIS

This study is to identify the best design based on analysis stress and life factor of three models which are designed in cad software are used. The Early computer aided drawing system uses geometry construction and editing techniques to create on the base model. This create the models of wire frame and surfaces that could be edited by a geometric editing, Later on periodic experiments parametric modeling systems were introduced, which will used to build relationships between geometric entities. These techniques based on constraints and parametric expressions defined by the user used to build the base models, but sometimes user face an error from carrying out a modification due to constraints Parametric systems also relied heavily on bodies created from swept sketches, loft bodies generated in surface modeling and did not have a wide variety of construction and editing techniques.

Bracket is done using CATIA. CATIA is one of the powerful modeling software package which the most effective parametric modeling and surface feature based modeling software. Solid modeling is done in CATIA which has a rich set of features to create and modify the designs. And CATIA constitute a user friendly environment. In this paper 3-D solid Bracket is considered for the analysis

The procedure in CATIA in modeling the solid bar as follows; In order to generate the 2D Sketch which is the profile of the web; profile is projected using "project 3D element" option and need to convert the projected 3d element to the construction element and then tr "rotate" option is used to rotate the projected profile from the centre of axis and fillet according to the finish in CATIA Software and convert this cat part to IGES(Initial Graphic Exchange Specification) format which need to upload in Hyper mesh which can be easily uploaded in Hyper mesh software without any internal errors. The CATIA part file can also be saved as STEP file.

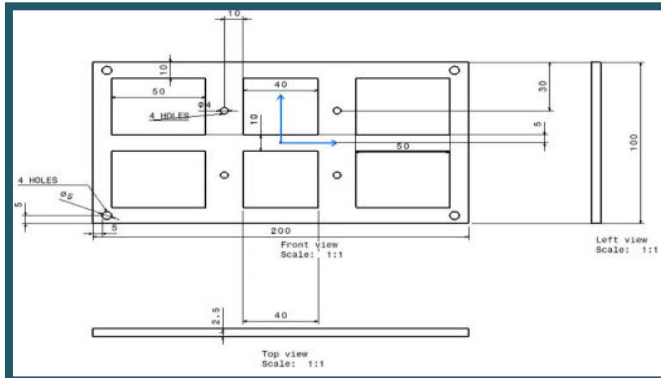


fig2.Shows the Line diagram of the bracket design

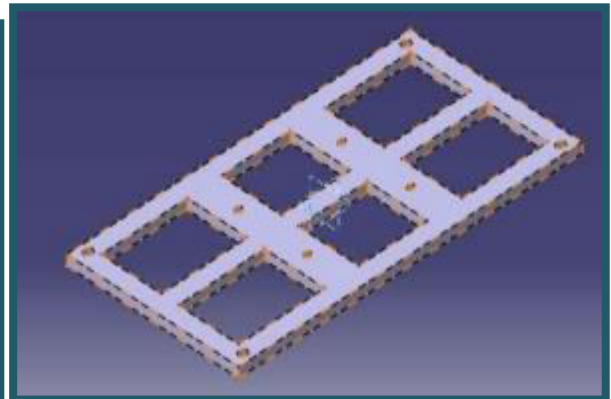


fig3.Shows the Cad Model of bracket

VI. RESULTS AND DISCUSSION

By comparing the natural frequencies of Brackets at Thicknesses @ 5mm, 3mm and 2mm

	Mode	✓ Frequency [Hz]
1	1.	82.689
2	2.	359.6
3	3.	502.66
4	4.	825.23
5	5.	1120.
6	6.	1392.8
7	7.	1824.9

For 5mm Thickness

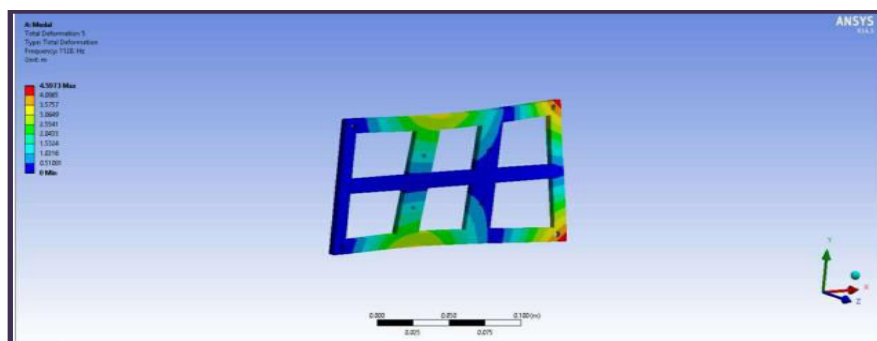
	Mode	✓ Frequency [Hz]
1	1.	49.728
2	2.	219.98
3	3.	303.26
4	4.	684.47
5	5.	804.88
6	6.	842.22
7	7.	1100.
8	8.	1263.2
9	9.	1573.7
10	10.	1955.1

For 3mm Thickness

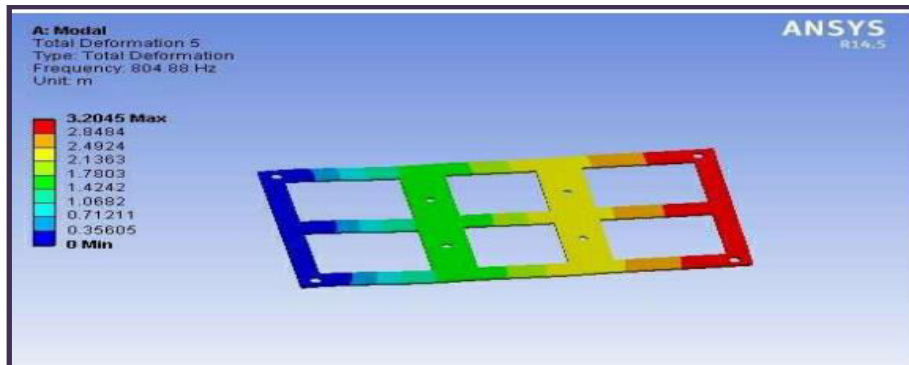
	Mode	✓ Frequency [Hz]
1	1.	33.903
2	2.	155.94
3	3.	207.8
4	4.	482.8
5	5.	578.73
6	6.	769.9
7	7.	828.5
8	8.	883.54
9	9.	1105.6
10	10.	1339.3
11	11.	1592.2
12	12.	1754.1

For 2mm Thickness

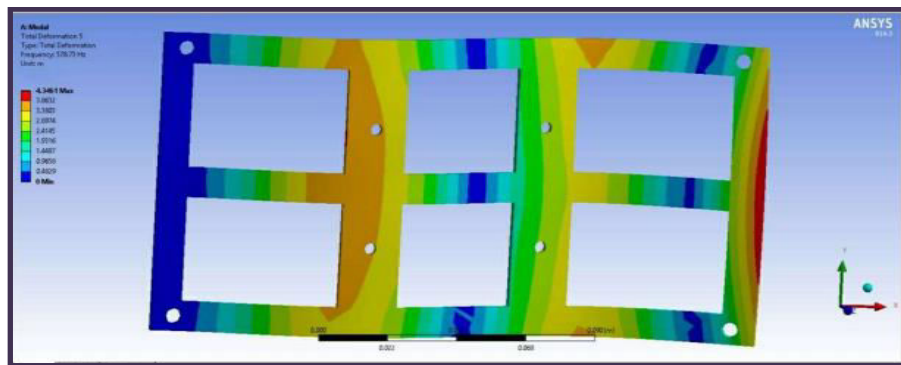
Total Deformation due to cyclic loads



Total deformation at 5mm bracket

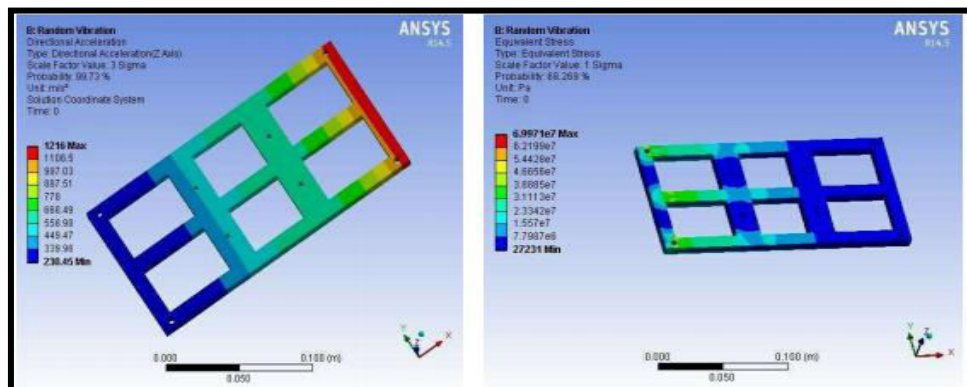


Total deformation at 3mm bracket



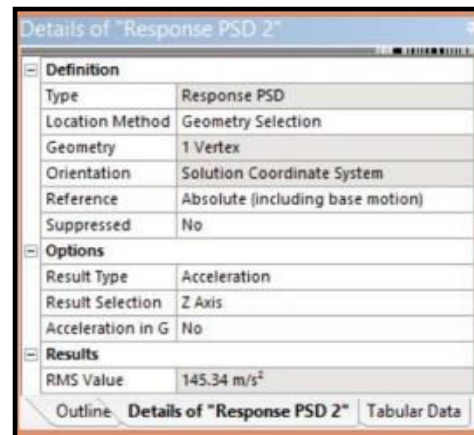
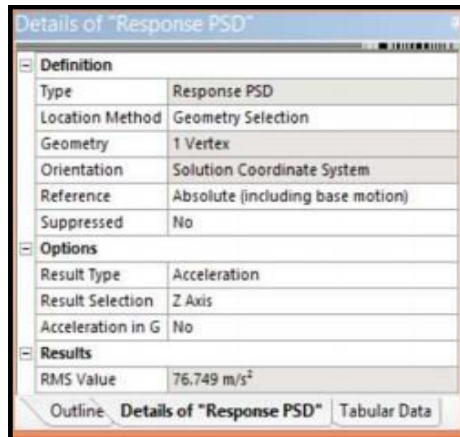
Total deformation at 2mm bracket

On performing PSD analysis, we have



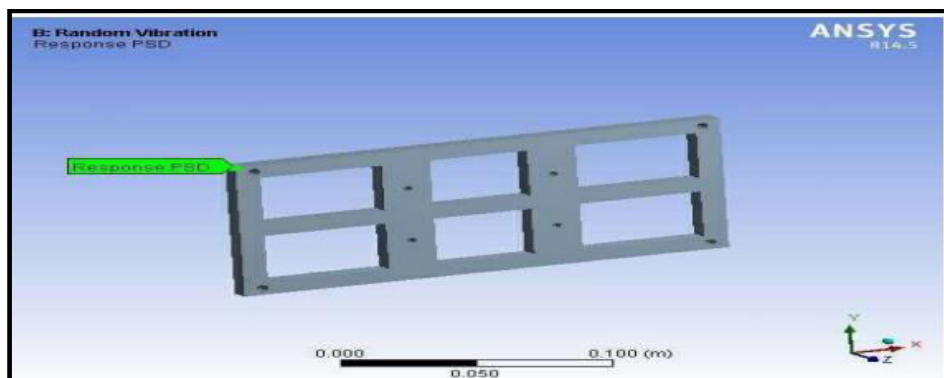
Directional acceleration in the bracket
for 9mm Thickness

Stress distribution in the bracket
for 9mm Thickness

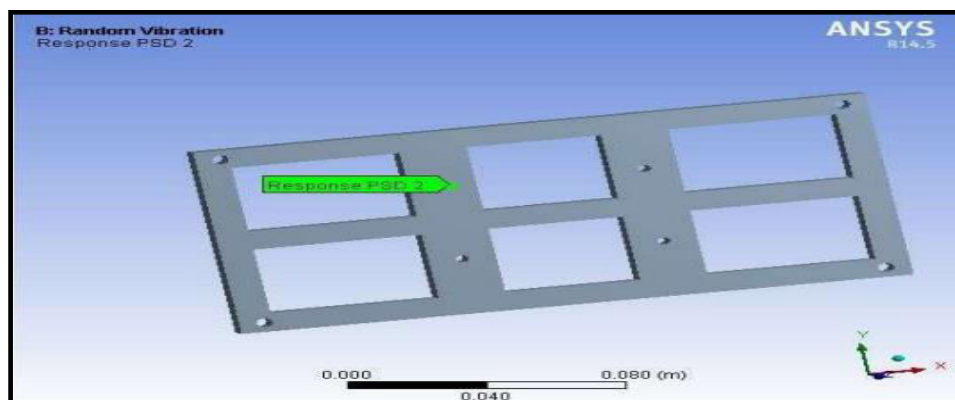


Response PSD details at position 1 for 9mm Thickness Response PSD details at position 2 for 9mm Thickness

We can observe that RMS value at the position2 is 145.34 m/s^2 .



Response PSD at position 1 for 9mm Thickness



Response PSD at the position 2 for 9mm Thickness

VII. CONCLUSIONS

As per the given problem definition it was concluded that the amplification can be achieved when the plate is supported as a simply supported structure, rather than a cantilever beam. The necessary stiffness cannot be achieved with a simple rectangular plate, hence plate geometry was modified. By increasing the thickness of plate the RMS values are decreasing. If we increase the thickness from 9mm to 10mm the weight of the plate will be increased. So that the 9mm values will be considered.



REFERENCES

- [1]. Einstein, E., (1905), "On the Movement of Small Particles Suspended in a Stationary Liquid Demanded by the Molecular-Kinetic Theory of Heat," Annalen der Physik 17 (1905) 549 (also, reprinted in Einstein, 1956).
- [2]. Einstein, A., (1956), Investigations on the Theory of Brownian Movement, R. Furth, Ed., Dover Publications, Inc., New York.
- [3]. Wiener, N., (1930), "Generalized Harmonic Analysis," Acta Mathematica, V. 55, No. 118.
- [4]. Schuster, A., (1899), "The Periodogram of Magnetic Declination," Camb.Phil. Trans., 18, 108.
- [5]. Schuster, A., (1900), "The Periodogram of Magnetic Declination," Trans.Camb. Phil. Soc., 107- 135.



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