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Design & Analysis of Integrated Battery Mounting Tray for Commercial Vehicle

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***Abstract:** In vehicle battery mounting systems are very important due to different aspects and performance. At the start of improvement, the construction of the battery holder should be promptly checked and accurately analyzed, without sufficient authorization from the vehicle. The battery mounting bracket has been designed as a frame to support the battery. Battery carrier vibration and fatigue has always been a concern that can lead to tray failure if the design is wrong, due to vehicle vibration and stress, the mounting tray will be damaged. This is an important study that requires extensive investigation to understand the structural features and its dynamic behavior. This research presents a Finite Element (FE) analysis of a typical battery mounting tray of a car will be performed and the natural frequency will be determined.*
***Keywords:** Battery mounting tray, FEA, Model FEA, Battery,*

I. INTRODUCTION

The latest trend in the automotive industry is to pool the production line for different parts. Because now a single vehicle has different variants available in the market for each variant has different components depending on their functionality, therefore in the automotive industry it is difficult to maintain multimodal production lines for most of the different parts with same functionality but different design for different variations.

These processes are very time consuming and result in production losses which lead to a delay in the launch of the vehicle. For this, I selected a specific part of the vehicle to make it in an integrated design common to all the variants.

There is a part in the chassis system called the battery tray which is used for the purpose of mounting the battery in the automotive system, but there are several designs seen in different vehicle variations. This support plate is assembled to the frame using bolts with engine mounting bracket. To strengthen the battery tray assembly, different reinforcements are used. In design, lightness and stiffness are two important goals in the design and improvement of battery trays. In order to reduce the weight of the battery tray without altering the rigidity, a battery tray method. With the integrated design of the battery tray, we focus on the material of the battery tray. The various materials are used in the automobile industry in order to develop the new product design.

II. PROBLEM STATEMENT

There are several variations for each vehicle. In this case, I am observing a differently designed battery tray for each variant of the same vehicle. It is observed that efforts must be made to control the lack of assembly on the production line of motor vehicles. The research proposed the new design for the battery tray which will serve the purpose with less space and the additional mounting of other components for the compact design of the vehicle, which will be offered for the different variants available in the same segment. car manufacturers make different cars.

III. SCOPE OF PROJECT

Reducing costs is the key to the industry's success. If different individual functional parts are replaced by an integrated multi-functional module with the comparative weight reduction, it will not only benefit from the different aspects of cost reduction, but also an additional benefit for the mileage of the vehicle.

IV. OBJECTIVES

A. To study all interfaces with surrounded parts for design in all variants.
B. Design a battery tray with clearing all interfaces with surrounded systems.
C. CAE analysis on the design.
D. Development of battery tray.

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V. DESIGN METHODOLOGY

1) Step 1: - Definition of the problem.
2) Step 2: - Study the literature review and collect research articles related to this topic.
3) Step 3: - Evaluation of the design space by determining the space envelope available for the component.
4) Step 4: - Create a 3D model and the drawing will be done using CATIA software.
5) Step 5: - Analyze this support pattern with all systems circled for sufficient clearances.
6) Step 6: - Calculate the force and moments at the connection of the support.
7) Step 7: - The analysis of the battery tray will be done with the help of ANSYS using FEA
8) Step 8: - The experimental tests will be carried out using an FFT analyzer.
9) Step 9: - A comparative analysis between the experimental result and the result of the analysis will be carried out, then the result and the conclusion will be drawn.

VI. TYPE OF BRACKET

A. Car battery mounting bracket the car battery mounting bracket as shown in fig. 1 is the bracket which supports the battery and also the air intake system. It is made of steel and made by the stamping process. It is connected to the large-sided battery and connected to the vehicle structure with the 5 bolt attachment points to take the load and absorb vibrations. Its operational life is more due to the low vibration rate. But if the engine is old or there are other structural issues of the vehicle, there is a great chance that the battery mounting bracket will fail. The failure of the battery mounting bracket is primarily due to cracking which occurs at the point where the stress level is high and propagates through the structure of the bracket. Stresses in the support structure are generated primarily due to engine vibration and vehicle movement over an uneven road surface. [10]

VII. LOCATION OF BRACKET INSTALLATION

The battery mounting assembly includes a support member arranged to be attached to a vehicle frame component. a pair of elastomeric motor insulators positioned just below the battery tray relative to each other on the support member, and a pair of motor count brackets arranged to be positioned over the insulators and attached to an engine component, where in the engine isolators are arranged to keep the engine mounting brackets spaced from the support member, thereby damping engine vibration and controlling movement of the engine relative to the vehicle. An air intake system is also mounted on half of the tray. The structure of the vehicle at the mounting location is critical with regard to noise transmission, durability and impact resistance. The mounting bracket attaches to the vehicle structure using five horizontal fasteners. The air intake unit is also mounted on this bracket using a snap type mounting skim. With rubber snaps. Therefore, the support should be designed to be as rigid as possible. Through the use of computer aided engineering, a carrier design optimized for stiffness, strength and mass is achieved while supporting a shortened development cycle. The main functions of battery mounting systems are to support and position the battery.

VIII. THE FEM MODEL AND RESULTS

One of the most popular technical analysis methods for nonlinear problems is Finite Element Analysis (FEA). FEA requires a finite element mesh as geometric input. This mesh can be generated directly from a solid model for the detailed part model designed in a three-dimensional (3D) CAD system. Since the detailed solid model (see Fig. 1) is much critical to be analyzed effectively, some simplification with an appropriate idealization process including material change and reduction of the mesh size in the FE model is required. to reduce computing time. The battery mounting brackets consist of HSLA 340 with 1.2 thk. For thin bodies, a different type of mesh approach is required. For the battery mounting bracket part, we extracted and meshed the middle surface using dominant hexagonal quadrilateral and triangular elements. [3] The design has 5 mounting holes which are fixed and a force of 500 N. This force is produced by the thrust. There is also the dead weight (g). The material used for FE analysis is nonlinear. The FEM model having 6 freedoms: translations in the nodal directions x, y and z and rotations around the nodal axes x, y and z.

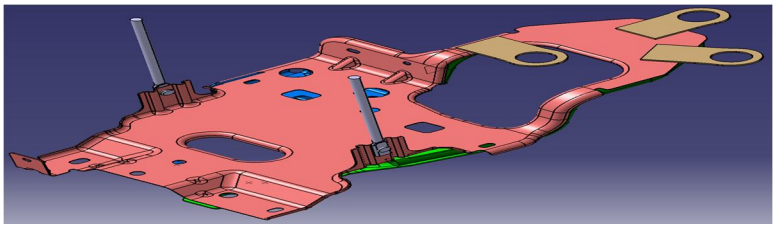
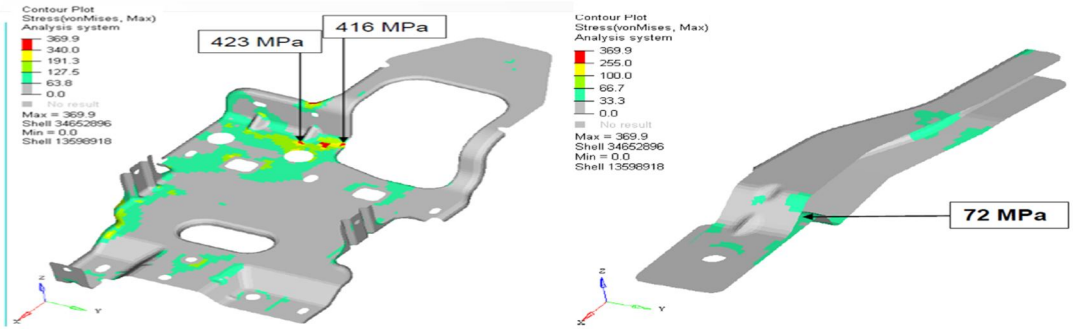


Fig.1. battery mounting tray

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Result Table

sr.no.	Load Cases	Key results	Units	Result value	Acceptance criteria
1	Battery tray	stress	Hz	423	<460
2	battery support bracket 2	stress	Hz	72	<255

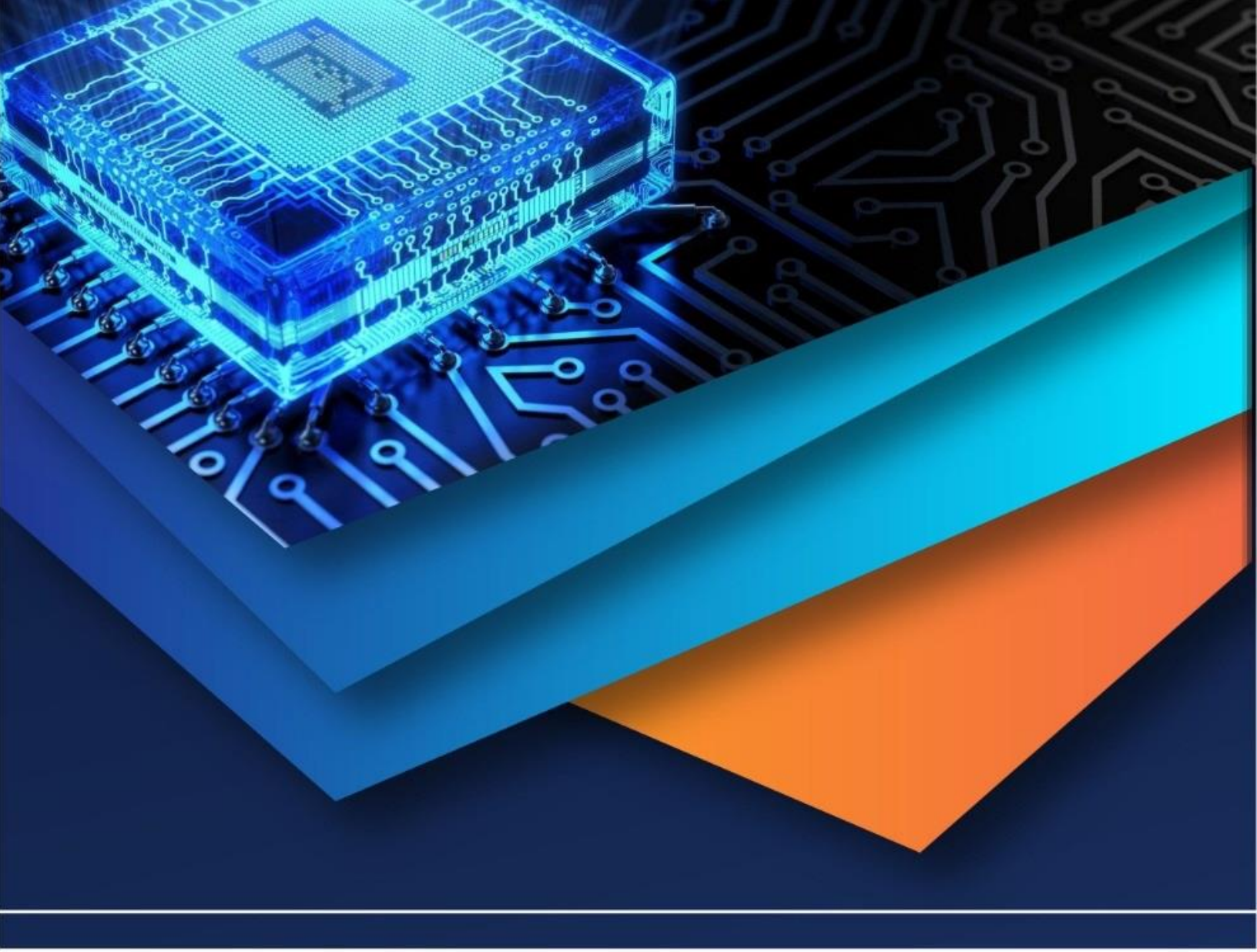
IX. CONCLUSION FROM LITERATURE REVIEW

After the actual operation and vehicle checking, no deformation, cracking and other abnormalities, the actual effect is better, meet the vehicle operation requirements. Verified by simulation analysis on the mechanical properties of the structure of the battery case, the design process has a reliable basis, avoids certain uncertainties, which greatly improves the accuracy of the design, not only improves the efficiency of product design, shortens the design cycle, speeds up the product development process, but also improve product performance, reduce product cost development.

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