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Design and Optimization of HTV Fuel Tank Assembly to Improve the Performance: A Review

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Abstract: **In the present study based on the previous literature review a paper is prepared on the optimization of HTV fuel tank assembly. The design of automotive components is a challenging process due to the complex set of requirements that influence the automobile life cycle. The structural three dimensional solid modeling of an automobile fuel tank assembly was developed using the computer aided drawing software. The finite element analysis was then performed during NASTRAN. The primary aspect of this project is to change the design of fuel tank assembly and optimize it. Which are deals with the mounting location of fuel tank, mounting brackets stiffener and stress analysis of empty and full filled tank.**

Keywords: **Bracket stiffener, Fuel tank, Optimization, Modal Analysis, FEA.**

1. INTRODUCTION

The first heavy duty trucks were developed in United States in the late 1890s. During World War 1heavy duty truck played an important role in moving supplies at home and overseas. Fuel tanks in the heavy duty trucks were made with steel because of high strength and durability. Fuel tank is a safe container for flammable fluids.

The fuel system of automobile vehicles should perform within major safety parameters related to the importance of flammable substances such as diesel fuels which is extensively consumed worldwide.

Important consideration in designing a fuel tank are determining placement choosing the shape and determining the required volume. The fuel system of automobile chassis body system may undergo undesirable vibration due to disturbance from road and fuel tank system. In order to control the road induced vibration the fuel tank bracket should be stiff and damped. Fuel tank mounting is accomplished with use of brackets, straps or a combination of both for the purpose of attaching the fuel tank to the truck frame.

Let us consider an example of high speed vehicle boat, at high speeds the sloshing that occur in the tank can drastically affect center of gravity of the vehicle, depending on the size of the fuel tank severity of the sloshing can negatively affect a control system. The forces that act on the wall of the tank can also reduce the integrity of the tank. By considering these guidelines we are going to examine the overall geometry of a fuel tank and designing the most effective fuel tank for a given vehicle. This paper mainly focusses on finite element analysis of fuel tank bracket for optimizing natural frequency by use of different bracket stiffeners.

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2. LITERATURE SURVEY

2.1 Umesh s. ghorpade, D. S. Chavan, Vinaay patil, Mahendra gaikwad: [1]:

This paper deals on finite element analysis of engine bracket of car and natural frequency will be determined. Engine bracket has been designed as a framework to support engine. The main concern is for vibration and fatigue of engine bracket which may lead to structural failure if resulting vibration and stress are excessive**.**

2.2 Mr. Mohd. Tanveer akhtar: [2]:

The fuel tank is safe container for automobile since it contains flammable fluids which may leads to explosion. A good fuel system is decided on correct selection or construction of the tank, tank location, correct venting, spillage and leakage dispersal, and care. So this project is undertaking an investigation on commercial vehicles fuel tank design.

2.3 T. Kandasamy, S. Rakheja and A.K.W. Ahmed: [3]:

This project deals on effectiveness of different design of baffles for partly filled fuel tank. In road tankers the free surface of liquid cargo may experience a large excursion for very small motion of the container. This problem is common in automobile, aircrafts and tankers. To study the anti-slosh properties of different baffles design under different cargo loads a 3D model of partly filled fuel tank is developed**.**

2.4 Murat kucumen, serdar ozkan, cuneyt dagdeviren: [4]:

The fuel system of automobile vehicle should be perform with major safety parameters.in order to maintain an overall safety standard ECE R34 directive are represented by the united automotive authority. This study propounds the importance of material selection and packaging of fuel system components designed for liquid fuel verities according to ECE R34 directive definition**.**

2.5 Tatsuo kasuga, Eisei higuchi: [5]:

The method and structure for mounting fuel tank improves the efficiency of assembling work, certainty of piping and workability can be attempted.

The fuel tank is placed on a tank supporting frame and tightened to said frame by a belt. For pipe and seal installation pipe and leak preventing seals are assembled with the tank. For frame fixing frame are fixed on a car body and tank is fixed on the frame. This arrangement reduces the unnecessary time hour and labor to install each fuel one by one on the car body.

2.6 Pavan B. chaudhari, Dr. D. R. Panchagade: [6]:

This paper explains the process of optimization of natural frequency of engine bracket by finite element analysis by use of different lightweight materials. The strategy of increasing lightweight material in vehicle has proven to be successful method of achieving fuel economy and environmental concepts. Evaluation of engine mount bracket assembly was performed using FEA and modal analysis technique from the result it was found that bracket manufactured with Mg alloy gives optimized frequency.

2.7 Jasvir Singh Dhillon, Priyanka Rao, V. P. Sawant: [7]:

In an automotive vehicle the engine rest on bracket which are connected to the main frame or chassis of the body. The engine mount plays an important role in vehicle. Correct geometry and positioning of the mount bracket gives a good ride quality and performance. This paper discusses the modeling, finite element analysis, modal analysis and mass optimization of engine bracket foe FSAE car. Since the FSAE car are high performance vehicle brackets tends to undergo continuous vibration so fatigue strength and durability calculations also have been done to ensure engine safety.

2.8 Michael Davis, Zhingxing fu, Qunhui Han, Ivonne Rivas, Anna Zemlyanova: [8]:

The design of fuel tank for high speed vehicle is not a simple task. There are numerous physical factors that need to be considered while designing an effective fuel tank. This paper discuss about some different models that have been proposed for sloshing in a fuel tank and it also examine the overall geometry of the fuel tank to gauge the volume of fuel remaining in the fuel tank.

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3. CONCLUSION

The case study mainly focuses on three dimensional modeling of a fuel tank assembly and finite element analysis of fuel tank mount bracket for optimizing natural frequency by use of different bracket stiffeners.

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