ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

MODELLING AND OPTIMIZATION OF A THREE CYLINDER MARUTI S PRESSO ENGINE MOUNTING BRACKET USING FEM

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ABSTRACT
Engine brackets attached in automobiles today are mostly constructed using superior materials and innovative welding techniques. These brackets are metal-based castings that are used for supporting the engine and its various components. The different auto parts that comprise of engine brackets include alternator bracket, smog pump eliminator brackets, power steering brackets, ac-brackets, etc. Automobile aftermarket is flooded with revolutionary and improved engine brackets made from different materials like aluminum, polypropylene, fiberglass, mild steel, and stainless steel.

In order to get better designs, the industry was using tools like the FEM Optimization from couple of decades. These types of optimization techniques are useful in validation and optimizing the design to get new size and shape. These techniques surely reduced the design time, when compared to the experimental testing. In this project a three cylinder MARUTI S PRESSO engine mounting bracket is selected for analysis; there are four mounting brackets to mount the engine on monoque chassis. This is a very important parameter as the product market life is reducing and there is a need to get more new and better designs with less time to decrease the cost and at the same time increase performance.

INTRODUCTION
In this automotive era the necessity for light weight structural materials is increasing as there's a more specialise in fuel consumption reduction and improvement in decreasing the emission. The magnitude of production volumes has traditionally placed severe requirements on the robustness of process utilized within the manufacturing. The manufacturers have strong importance on the value has the demand for the component to enhance the fabric performance and to deliver these materials at low cost is that the requirement.

Cite this article as: Valluri Sai Krishna Saranya, Sri.M.Anil Kumar & Sri.P.Veerendra, "Modelling And Optimization Of A Three Cylinder Maruti S Presso Engine Mounting Bracket Using Fem", International Journal & Magazine of Engineering, Technology, Management and Research (IJMETMR), ISSN 2348-4845, Volume 8 Issue 9, September 2021, Page 29-38.

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In automobile sector the extremely competitive automotive business needs manufactures to pay tons of attention to travelling comfort. Resonant vibration is from unbalanced masses exist within the engine body; this is often causing the designers to direct their attention to the event of top-quality engine mounting brackets so as to confirm that there's improvement in riding comfort. The demand for higher playacting engine mount brackets shouldn't be offset by arise within the assembly prices and/or development cycle time.

In diesel , the engine mounting bracket is that the major problem as there's throttled condition and better compression ratio and even there are more speed irregularities at low speed and low load in comparison to gasoline engines. So thanks to this there are more vibration excitation. By this vibration engine mount bracket may fail, so by enhancing the form and width of engine mount bracket we'll recover the presentation at first project phases. By some studies it's observed that brackets saved 38% of mass. Structural optimization is a crucial tool for an optimum design; comparison in terms of weight and component performance structural optimization techniques is effective tool to supply higher quality products at lower cost.

Fig: engine mounted on engine mount

Three-cylinder Train deprived of balancer chute could also be a fresh trend near expansion of frivolous and fuel-efficient powertrain for trainer . In adding, customer's hope of larger NVH confidential car cabin is cumulative day by day. Engine mounts language mainstream of the NVH issues related with transmission of shaking from train to passenger hut. Idle vibration separation for a three-cylinder engine may be a challenging task thanks to option of overlapping of Powertrain's rigid body modes with engine's firing incidence. This Overlapping of rigid body are frequently evaded either by adapting mount typical or by altering the location of bases reinforced multi-body-dynamics (MBD) imitation.

This paper explains about two kinds of engine mounting system for a front-wheel drive transversely mounted three-cylinder engine. The disgraceful car was irresistible three-point rising arrangement i.e. all three engine mounts were pre-loaded. Then for study, positions of front mounts were changed so on have zero preload on rear mount. The study shows how rigid body modes change when right Side (RHS) and left Side (LHS) mount move closer to Torque-roll axis (TRA) and traditional rear mount is converted to a torque-rod. This layout is additionally called pendulum mounting system. Modal review complaints that in heaviness rising scheme, roll chic hygiene is better likened to three opinion cumulative preparation. In base Three point mounting configuration, Roll mode Eigen frequency is approaching the brink of 1.5th order engine excitation and after optimizing engine mount's position and

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characteristic, it's been moved away from 1.5th order. Car dimension statistics grievances there's over-all development in trembling parting through Pullman idling, crank-on/off conditions. The measurement penalties co-relate with mock estimate justly prudently. Here is too possibility of plunging weight of Pullman increasing ropes in heaviness rising strategy as there's less preload on hind most dishonorable (torque rod).

Fig: engine mounting brackets

S- PRESSO VEHICLE DETAILS

Maruti Suzuki has created waves with its latest offering the S-Presso. The Maruti Suzuki S-Presso formed the "Mini-SUV" unit in India. The S-Presso is out there during a single petrol variant throughout the 4 models on offer. The Spresso is that the 8th model within the Maruti's portfolio to be BS6 compliant.

PROBLEM STATEMENT

Engine mounting bracket is one of the main considerations while the vehicle is running when the vehicle dis-passes from the road barkers there may be a chance of displacement in the engine due to high vibrations. To brand it unbending or grip it this scheme assistances in numerous thoughts. The current project was industrialized for the examination dress of bh6 trains for the effort similar support was usage for bh6 train too. But unfortunately, the planning failed thanks to overloading and engine vibration so new design is required for the test rig with 1083.635 N approx. loading conditions.

OBJECTIVES

1. To study the objective of the working condition
2. Modelling current bracket.
3. Analysing for stresses and deformation.
4. To stay the mounting condition as reference and style a replacement bracket which may sustain the condition.
5. Analysing for stresses and deformation.
6. Comparing the results obtained between the original i.e. current model with the modified i.e. proposed model for future.

LITERATURE SURVEY

Umesh S Ghorpade[1] In this paper they have designed engine mount bracket of a car and focused on to determine natural frequencies of car engine mount bracket. They have considered the three materials for engine mount bracket that is aluminum alloy, magnesium alloy, gray cast iron when modal analysis is carried out, it is found natural frequencies of gray cast iron is low which will prove more hindrance in vibration of engine mount bracket so they have eliminated gray cast iron, in terms of analysis aluminum alloy and magnesium alloy are showing almost near value of natural frequency in practical terms as magnesium alloy is having better strength that

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is low stress value, so preferably magnesium alloy is selected as better material by study.

Mr. Pramod Walunje[2] In this work they have mainly focused on the use of light weight material for bracket and also to reduce the weight of the bracket. Here the weight of the material is reduced and preprocessing and post processing is carried out and even with this an experimental setup is also used to find the stress level of the materials they have observed that aluminum alloy have good natural frequency and stresses are also within the yield strength, so by considering the aluminum and reducing its thickness further by 2mm than original component, they found that now von misses stresses are also with in yield stress so they have achieved reduction in the mass of bracket up to 0.43kg when compared to previous one.

P.D. Jadhav[3] This work is a contribution to the development of new material for engine mounting bracket. The results obtained for the static structural and modal analysis have shown that the magnesium is better than aluminum. From the results it can be seen that the magnesium bracket is safe for the required application. It will help in decreasing the weight of the power train assembly, which can increase fuel efficiency.

Sagar V. Birari[4] Design and Analysis of Engine Mounting Bracket Engine mounting bracket plays very significant role in reducing noise, vibration and harshness caused due to engine and thus has very effective role in improving vehicle comfort. This current work accounts for the investigation of engine mounting bracket by using Hyper mesh and Opti struct approach. Static analysis of engine mounting bracket was done in order to check design of existing and modified bracket. The results were analyzed for stresses and deformations. The design was tested for different design of Mild Steel with different thickness. From Design and analysis, it is considered that stresses induced in the bracket were 262.00 Mpa and deformation 9.5 mm. It can be anticipated that modified brackets can be considered for desired application.

Mr. Sagar B. Awate[5] Experimental Validation & Testing of Brake Chamber Mounting bracket Experimental validation & testing is one of the important parts in design finalization. Now a days advances software's are developed to virtually test & validate the design of component but still physical validation & testing is necessary in order to check reliability, maintainability, performance of the designed component. This paper is about, physical validation & testing of newly designed brake chamber mounting bracket.

Jasvir Singh[6] Design of Engine Mount Bracket for a FSAE Car Using Finite Element Analysis Engine mounts have an important function of containing firmly the power-train components of a vehicle. Correct geometry and positioning of the mount brackets on the chassis ensures a good ride quality and performance. As an FSAE car intends to be a high-performance vehicle, the brackets on the frame that support the engine undergo high static and dynamic stresses as well as huge number of vibrations.

Rajath J K[7] Dynamic Response Analysis of Compressor Mounting Bracket of an

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Automobile Vehicle for Aluminum 6061T6 The compressor plays a vital role in the air conditioning system of an automobile. The compressor mounting bracket is a rigid structure which is used to mount the compressor to the engine. Design includes modeling of the bracket by considering all the constraints. Analysis comprises of normal modes analysis and frequency response analysis for aluminum 6061T6. The aim of this work is to find the natural frequency of the bracket for the self-weight by modal analysis and the stresses induced in the bracket due to external excitation by frequency response analysis using FEA method. The analysis is performed using ABAQUS tool and the results are interpreted.

Tushar P. Kamble [8] Optimization & Modal Analysis of Engine Mounting Bracket for Different Materials by Using Finite Element Analysis The Engine in the vehicle is one of the most important components of on road vehicle such as car. High performance sports car has their engine component supported by the mounting bracket to its chassis frame. It plays a very much important role in improving the comfort & work environment of a car as well as the engine component. The improvement of the engine bracket system has been the subject of intense interest for many years. It is required to design the proper engine mounting bracket for a road vehicle.

Sahil Naghate[9]Modal Analysis of Engine Mounting Bracket Using FEA The engine mounting plays an important role in reducing the noise, vibrations and harshness for improving vehicle ride comfort. The first and the foremost function of an engine mounting bracket is to properly balance the power pack (engine &transmission) on the vehicle chassis for good motion control as well as good isolation. Present work deals with FEA analysis of engine mounting bracket. It includes the modeling of the engine mounting brackets by changing the material of component.

Lv Lin[10] Strength Performance Analysis and Improvement of Engine Mounting Bracket for a Commercial Vehicle With the rapid development of the automotive industry and the increasing demand of consumers for the quality of automotive products, improving the reliability of automotive products has become the "top priority" of enterprises. While improving the reliability level of engine mounting bracket for commercial vehicles, it cannot reduce the mechanical strength performance of the structure.

A.S.Adkine[11] Static Behavior of Engine Mounting Bracket In an automotive vehicle, the engine rests on brackets which are connected to the main-frame or the skeleton of the car. Hence, during its operation, the undesired vibrations generated by the engine and road roughness can get directly transmitted to the frame through the brackets[1]. This may cause discomfort to the passenger(s) or might even damage the chassis. When the operating frequency or disturbance approaches the natural frequency of a body, the amplitude of Vibrations gets magnified. The first and the foremost function of an engine mounting bracket is to properly balance (mount) the power pack (engine & transmission) on the vehicle chassis for good motion control as well as good isolation[2].

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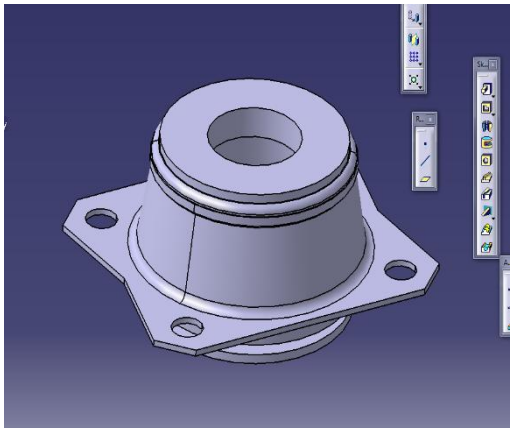
The need for light weight structural materials in automotive applications is increasing as the pressure for improvement in emissions and fuel economy increases.

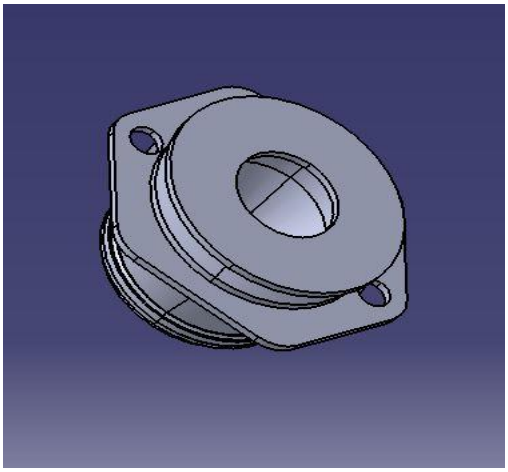
Dipali T. Bendarkar Design and Weight Optimization of Fuel Tank Mounting Bracket for HCV Automobile sector is one of the largest branch of Mechanical Engineering industry. It consumes a lot of fuel while transporting goods and people from one place to other by road. Reducing automobile weight for better economy is the challenge industry faces right now. This work is aimed at on design and weight optimization of HCV fuel tank mounting bracke.

DESIGN

MODEL 1



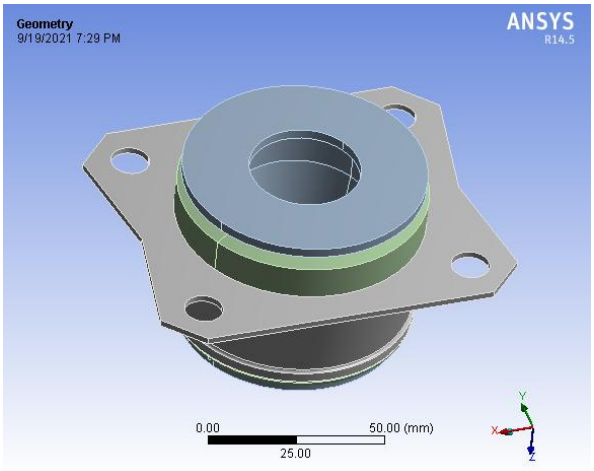
MODEL 2



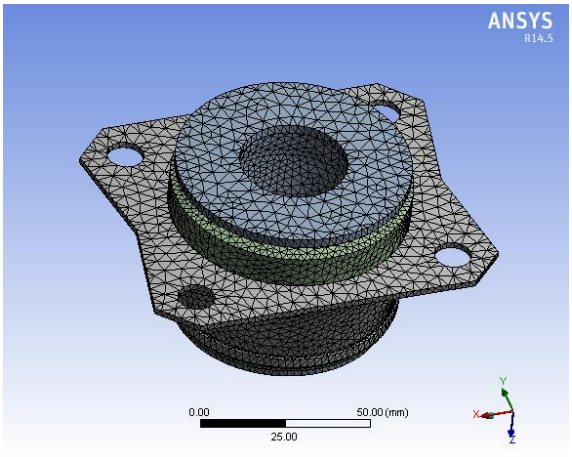
MODEL 1

STRUCTURAL ANALYSIS OF AN ENGINE MOUNTING BRACKET BY USING AL 6061

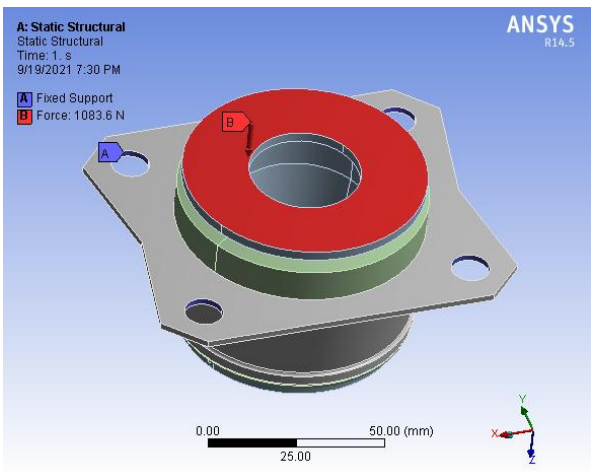
GEOMETRY



MESH



BOUNDARY INPUTS



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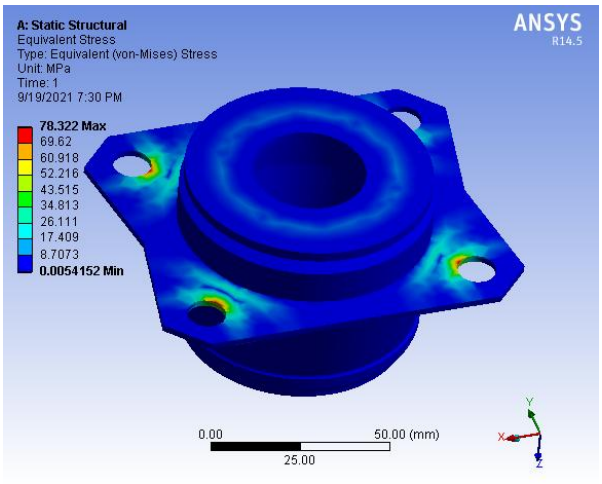
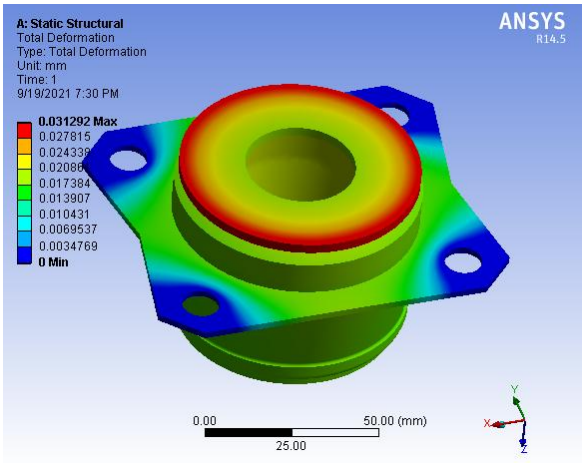
STRESS

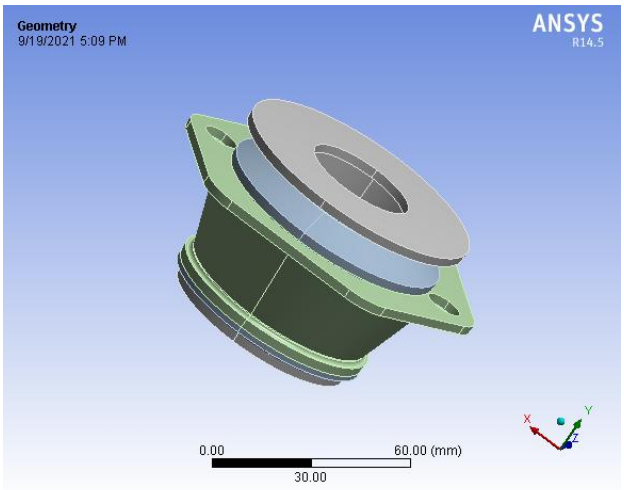


TOTAL DEFORMATION

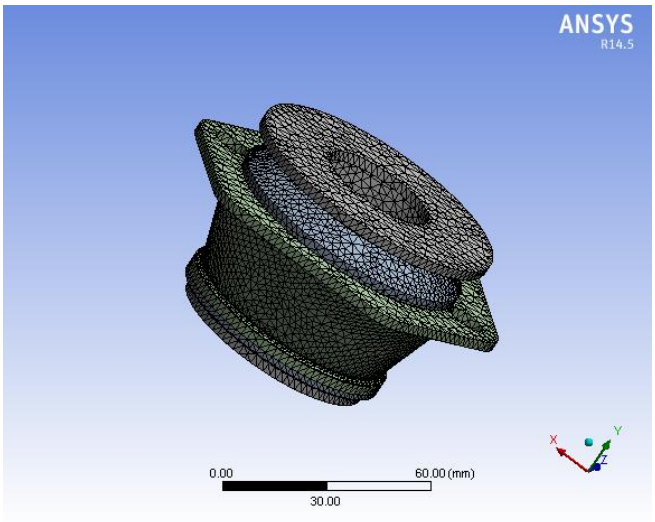


STRUCTURAL ANALYSIS OF AN ENGINE MOUNTING BRACKET BY USING MARAGING STEELS

GEOMETRY



MESH



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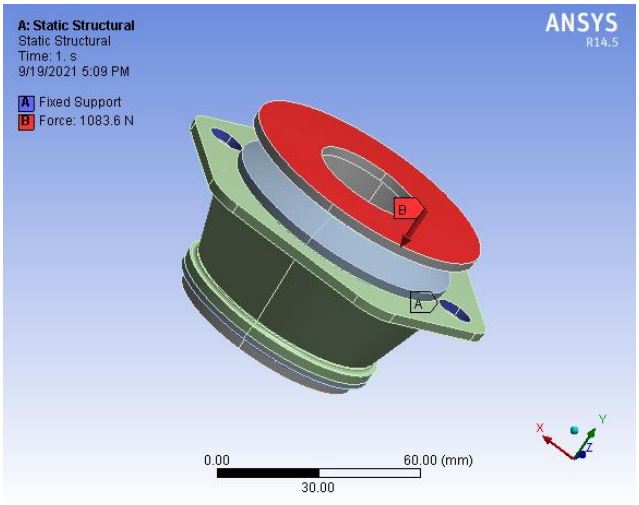

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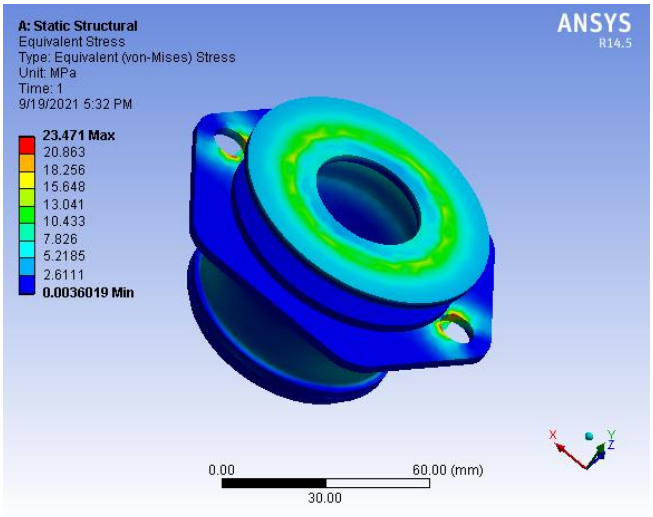

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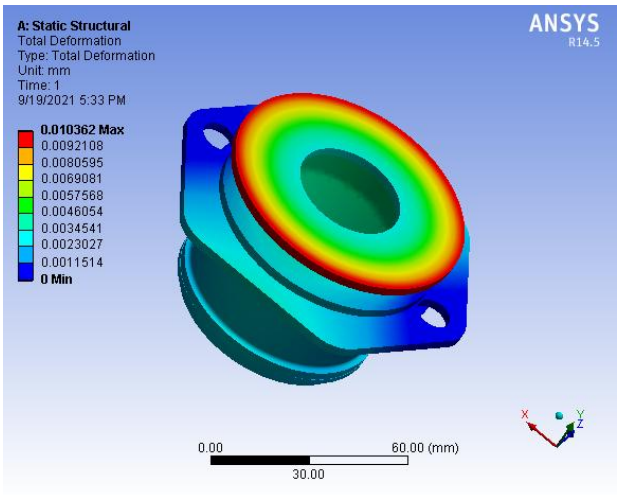
TOTAL DEFORMATION



TABULAR RESULTS

STRUCTURAL ANALYSIS

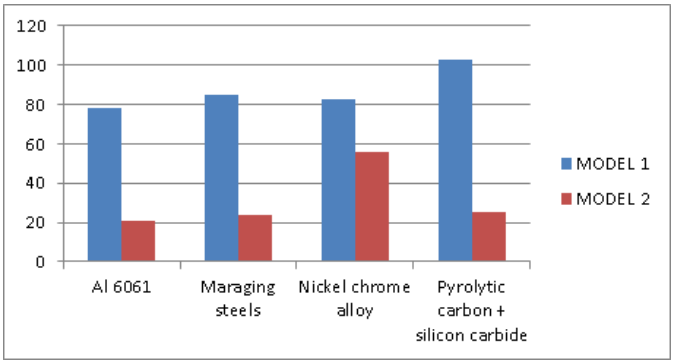
MODEL	MATERIAL	STRESS (Mpa)	STRAIN (mm/mm)	TOTAL DEFORMATION (mm)	DIRECTIONAL DEFORMATION (mm)
MODEL 1	Al 6061	78.322	0.0011774	0.031292	0.0022473
	Maraging steels	84.569	0.00051999	0.012182	0.00098505
	Nickel chrome alloy	82.613	0.3382	5.4687	0.59071
	Pyrolytic carbon + silicon carbide	102.45	0.00089439	0.022121	0.0016141
MODEL 2	Al 6061	20.515	0.00091186	0.026327	0.0029746
	Maraging steels	23.471	0.00060563	0.010362	0.0018239
	Nickel chrome alloy	55.477	0.17647	3.1365	0.42499
	Pyrolytic carbon + silicon carbide	25.194	0.00075286	0.018832	0.002396

MODAL ANALYSIS

MODEL	MATERIAL	TOTAL DEFORMATION (mm)	TOTAL DEFORMATION 2 (mm)	TOTAL DEFORMATION 3 (mm)	TOTAL DEFORMATION 4 (mm)	TOTAL DEFORMATION 5 (mm)	TOTAL DEFORMATION 6 (mm)
MODEL 1	Al 6061	50.298	83.449	81.905	71.44	70.137	70.306
	Maraging steels	43.397	63.207	62.08	61.986	61.563	74.052
	Nickel chrome alloy	61.651	37.034	61.009	57.652	59.969	46.952
	Pyrolytic carbon + silicon carbide	51.346	84.768	83.209	75.647	74.159	93.779
MODEL 2	Al 6061	81.959	67.872	57.107	90.118	75.06	171.52
	Maraging steels	60.199	54.111	54.822	117.96	76.611	75.657
	Nickel chrome alloy	58.492	195.95	302.21	293.44	331.86	307.29
	Pyrolytic carbon + silicon carbide	84.077	68.606	62.299	93.604	81.17	169.88

GRAPHS

STRESS



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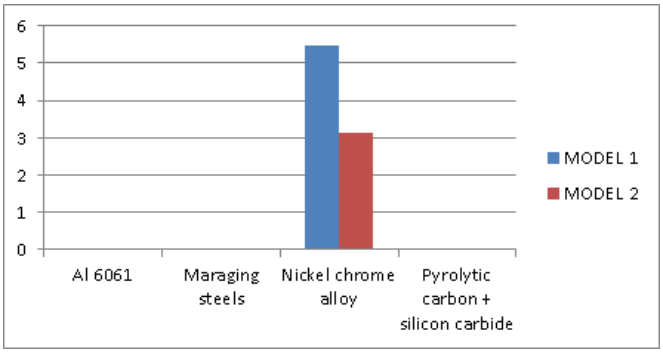

CONCLUSION

In order to get better designs, the industry was using tools like the FEM Optimization from couple of decades. These types of optimization techniques are useful in validation and optimizing the design to get new size and shape. These techniques surely reduced the design time, when compared to the experimental testing. In this project a three cylinder MARUTI S PRESSO engine mounting bracket is selected for analysis; there are four mounting brackets to mount the engine on chassis. This is a very important parameter as the product market life is reducing and there is a need to get more new and better designs with less time to decrease the cost and at the same time increase the stiffness to mass ratio and performance.

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Here we have considered two different models for the engine mounting bracket, as if we verify the results here in the structural analysis from all the aspects like deformations, strains and even stress values, the model 2 using maraging steels has the better output. And while comparing the results for the deformations at different level of frequencies, here the model 2 using maraging steels only obtained the better results. As we can conclude that for the better performance of the life we should have the lesser stress and the lesser deformations and even the best frequency outputs for the better parameters, so here we can conclude that the model using maraging steels and the rubber particle for the bush has obtained the better performance outputs.

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