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AN INVESTIGATION ON LINEAR ANALYSIS OF ON ROAD VEHICLE CHASSIS FOR THE VARIOUS SPECIAL EFFECTS OF STRESS DISTRIBUTION AND DEFORMATION BY FINITE ELEMENT METHOD

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ABSTRACT

Design and development considerations for a lorry chassis as a case study. Design methodology for the development of a series-hybrid vehicle chassis is explored. Next, several loading scenarios are investigated in order to understand the substantially increased forces that must be communicated through the chassis and suspension components due to the added mass of hybrid apparatus such as electric motors and battery arrays. Material selection will also be considered. Utilizing SolidWorks 3-D modelling software, several design iterations are run in order to determine the best compromise between vehicles mass, component packaging, and weight distribution while still ensuring driver safety. Finally, Finite Element Analysis is implemented using the ANSYS design software. A model with an examined in order to determine the efficiency of the structure in resisting torsional loads, as these are most critical in determining overall vehicle performance.

Key words: Chassis, Stress, Deformation, Analysis and ANSYS.

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1. INTRODUCTION

The chassis is considered to be one of the significant structures of an automobile. It is the frame which holds both the car body and the power train. Various mechanical parts like the engine and the drive train, the axle assemblies including the wheels, the suspension parts, the brakes, the steering components, etc., are bolted onto the chassis. The chassis provides the strength needed for supporting the different vehicular components as well as the payload and helps to keep the automobile rigid and stiff. Consequently, the chassis is also an important component of the overall safety system. Furthermore, it ensures low levels of noise, vibrations and harshness throughout the automobile. Chassis should be rigid enough to withstand the shock, twist, vibration and other stresses. Along the strength, an important consideration is chassis design is to have adequate bending and torsional stiffness for better handling characteristics. So, strength and stiffness are two important criteria for the design of chassis. The load carrying structure is the chassis, so the chassis has to be so designed that it has to withstand the loads that are coming over it.

2. CONVENTIONAL CONTROL CHASSIS

In which engine is mounted in front of the driver`s cabin. This type of arrangement avoids full utilization of the space. It is non-load carrying frame. The loads of the vehicle are transferred to the suspensions by the frame. The suspension in the main skeleton of the vehicle is supported on the axles through springs. The body is made of flexible material like wood and isolated frame by inserting rubber mountings in between. The frame is made of channel section or tubular section of box section. Ladder chassis is one of the oldest forms of automotive chassis these are still used in most of the SUVs today. It is clear from its name that ladder chassis resembles a shape of a ladder having two longitudinal rails inter linked by lateral and cross braces. C cross section type of ladder chassis frame. The engine is mounted that half of it is in the driver`s cabin whereas the other half is in front, outside the driver`s cabin. In this case the rubber mountings used in conventional frame between frame and suspension are replaced by more stiff mountings. Because of this some of the vehicle load is shared by the frame also. This type of frame is heavier in construction. It is non-load carrying frame. The loads of the vehicle are transferred to the suspensions by the frame. This suspension in the main skeleton of the vehicle is supported on the axles through springs. The body is made of flexible material like wood and isolated frame by inserting rubber mountings in between. The frame is made of channel section or tubular section of box section.

Properties	**Stainless Steel**
Young’s modulus(GPA)	193
Poisson’s Ratio	0.31
Density(kg/m^3)	7750
Tensile strength(GPA)	3.2

3. CREATING A SOLID MODEL & FEA ANALYSIS

A Three Dimensional solid model of Ladder chassis is created on the computer using SOLID WORKS 2016, Dassault Systems. This 3D Model is exported to Ansys for performing Finite Element Analysis

Figure 1 Original View of Chassis

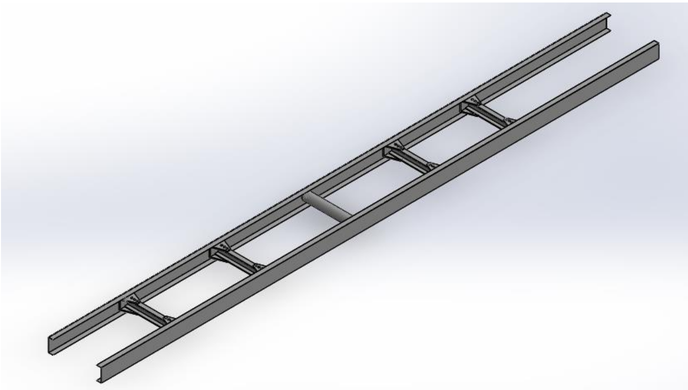

Figure 2 Chassis in solid works

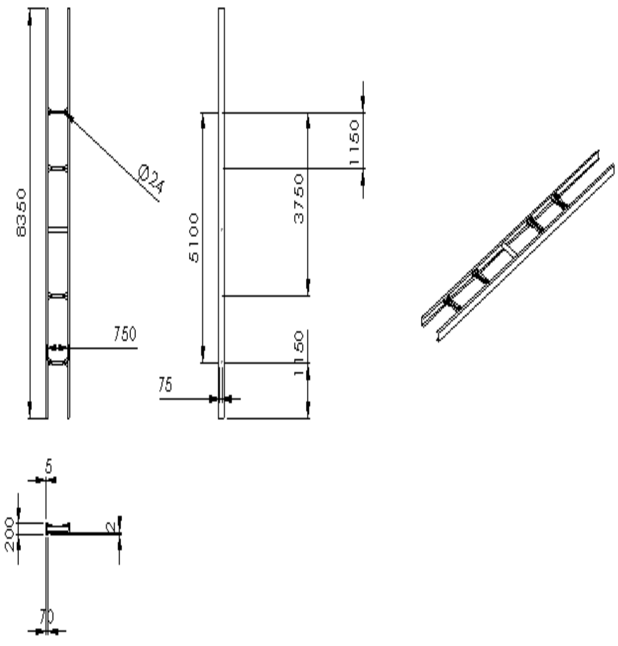

Figure 3 Two dimensional views of chassis

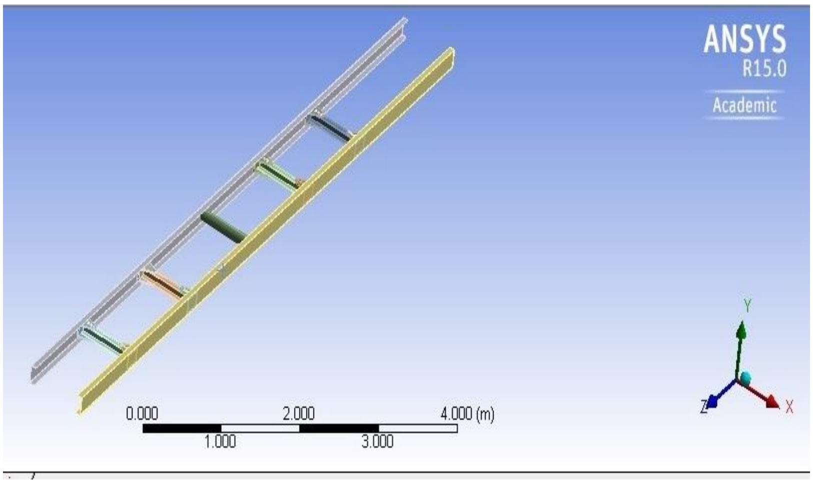

Figure 4 Importing Solid model into ANSYS

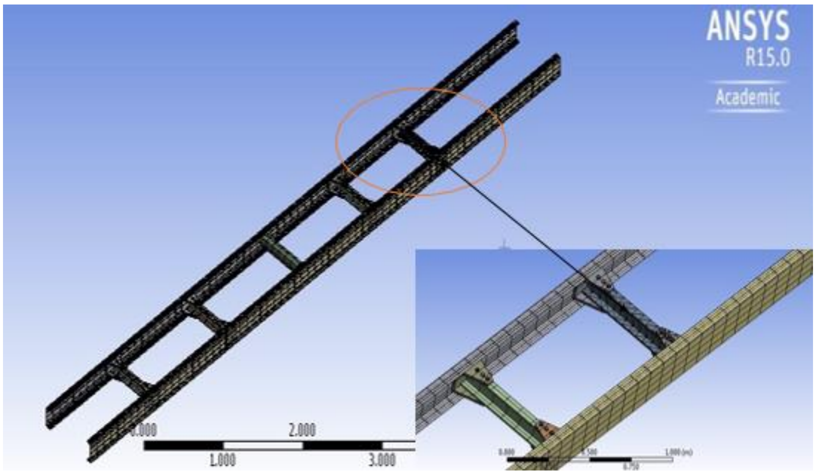

Figure 5 Mesh in Chassis

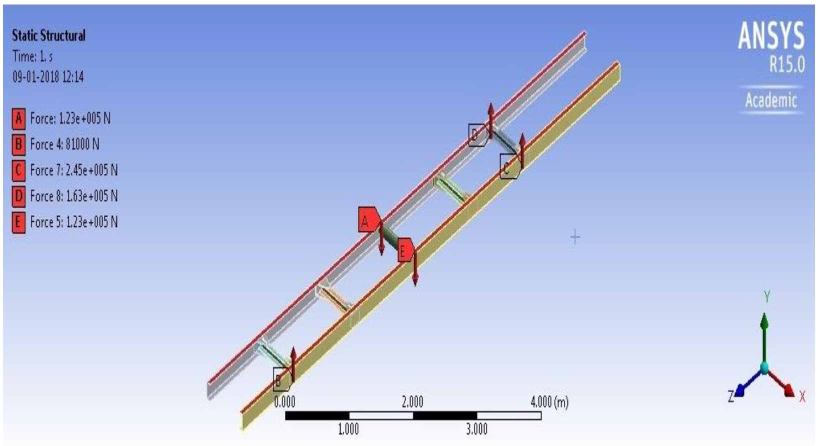

Figure 7 Static Structural Forces acting of chassis

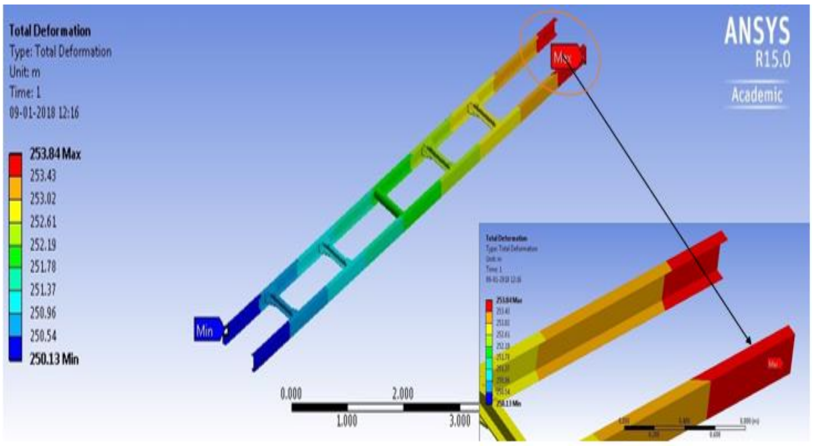

Figure 8 Total Deformation of C channel chassis

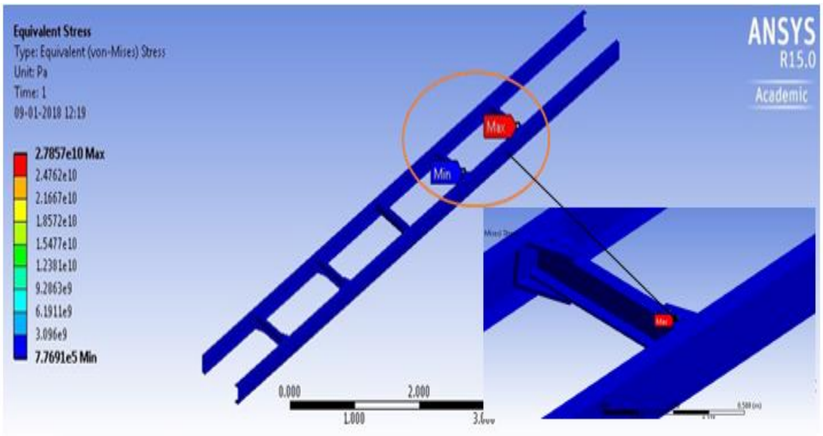

Figure 9 Equivalent Stress of C channel chassis

4. RESULTS

Material	Stainless Steel	
Shape	Total Deformation(mm)	Equivalent stress(Mpa)
C- section	2.8311	251.29

5. CONCLUSIONS

In the present work, ladder type chassis frame for ASHOK LEYLAND Truck was analysed using ANSYS software. From the results, it is observed that the Rectangular Box section is having more strength than *C* and *I* Cross-section type of Ladder Chassis. The Rectangular Box Cross-section Ladder Chassis is having least deflection and least Von Mises stress and Maximum Shear stress. Finite element analysis is effectively utilized for addressing the conceptualization and formulation for the design stages. Based on the analysis results of the present work, the following conclusions can be drawn. Part is safe under the given loading condition.

To improve performance, geometry has been modified which enables to reduce stress levels marginally well below yield limit. The generated Von Mises Stress & Maximum Shear Stress is less than the permissible value so the design is safe for all three materials.

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