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A Review Paper on Automobile Chassis

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ABSTRCT

Chassis is the most significant structural component. The vehicle's chassis is the only part that receives any loads produced by other parts of the vehicle. Therefore, the chassis structure needs to be sturdy enough to support the loads under both static and dynamic circumstances. Despite varied loads, the cross section of the chassis construction is uniform in the majority of on-road vehicles. The variable section chassis structure must be developed based on the varied loads along the length of the vehicle in order to overcome more failure in the chassis structure and maintain safety. The next parts contain a presentation of the findings from the current study's review of the chassis design literature

Introduction

ON-ROAD vehicles have evolved dramatically in terms of design and other functional aspects in the modern world. The market demands faster and higher transportation in a short period of time. Vehicle manufacturers are designing heavy load carrying vehicles to meet market demand. These heavy load carrying vehicles have the advantage of providing faster, heavy transportation in a short period of time. On the other hand, the heavy load carrying vehicle's safety must be ensured. According to historical data, the chassis/body is only responsible for 7% of the failure types. Chassis failures, on the other hand, are catastrophic and have serious consequences. In some cases, these in-service failures result in the recall of all affected vehicles, resulting in high costs and negative publicity

bodywork or superstructure. The conventional chassis frame, which is made of pressed steel members, can be thought of structurally as grillages. The chassis frame includes cross-members at critical stress points along the side members. The cross-members keep the two main rails parallel to provide a rigid, box-like structure. Connection plates are typically used to connect the cross members to the side members. In trucks, the joint is riveted or bolted, whereas in trailers, it is welded. A vehicle's chassis is its foundation. If the chassis fails, the entire vehicle system will fail Chassis design should be economical, lighter in weight, and capable of withstanding the harshest loading conditions. A primary criterion in chassis design is to first encounter safety requirements, then reduce weight to meet fuel economy requirements. It is critical to comprehend the primary loads that the vehicle structure must be able to withstand. These loads must always be efficiently transferred through the structure in order for the chassis to be mechanically sound. As a result, the current study examined and discussed the literature on chassis design.

Literature Survey

Vijaykumar V. Patel, R. I. Patel have used structural analysis analysis to study the Eicher E2's ladder chassis frame. In this study, the chassis was envisioned as a straightforwardly supported beam with an overhang. Software from Ansys and Pro-E were used in this project. The analytical evaluation of chassis was also a part of the investigation. When the results of the software analysis and the analytical calculations were compared, it was discovered that the displacement was 5.92 percent higher and the stress value produced from the software analysis was 10% higher.

Kutay Yilmazcoban, Yasar Kahraman used the Finite Element method to analyse and improve the thickness of a medium tonnage truck chassis. The main goal of this project was to decrease material utilisation in order to lower material costs. They evaluated the findings of stress and displacement after analysing three different types of thickness material for the chassis. According to a study, 4 mm of thickness is secure enough to support a 15 tonne load.

V. Veloso, H.S. Magalhaes, G.I. Bicalho, E.S. Palma examined the vehicle's longitudinal stringer failure. During the durability test, failure was seen at the car suspension's fixation points close to the bumpers. The component was fractured as a result of an initial crack that grew over time. They looked into six different sorts of reinforcement to address this issue. Using hyper mesh software to assess all six forms of reinforcement techniques, it was determined that the sixth type of reinforcement produced the best outcomes. Based on software results, laboratory tests were performed, and no failures were found. They reduced the number of laboratory tests used and got better findings faster by using the software analysis. Consequently, the majority of testing expenses are cut.

Yongjie Lu, Shaopu Yang, Shaohua Li, Liqun Chen examined the vehicle's longitudinal stringer failure. During the durability test, failure was seen at the car suspension's fixation points close to the bumpers. The component was fractured as a result of an initial crack that grew over time. They looked into

six different sorts of reinforcement to address this issue. Using hyper mesh software to assess all six forms of reinforcement techniques, it was determined that the sixth type of reinforcement produced the best outcomes. Based on software results, laboratory tests were performed, and no failures were found. They reduced the number of laboratory tests used and got better findings faster by using the software analysis. Consequently, the majority of testing expenses are cut.S.S Sane, Ghanashyam Jadhav, H. Ananadaraj (2008) analyzed the light Commercial Vehicle chassis using FEM and simulated the failure during testing. Hyper mesh and Opti-struct software were used for analysis and simulation. During the study they introduced local stiffeners to reduce the magnitude of the stress. The modified chassis stress values were reduced by 44%.

K. Chinnaraj, M. Sathya Prasad, Lakshmana Rao (2008) examined the vehicle's longitudinal stringer failure. During the durability test, failure was seen at the car suspension's fixation points close to the bumpers. The component was fractured as a result of an initial crack that grew over time. They looked into six different sorts of reinforcement to address this issue. Using hyper mesh software to assess all six forms of reinforcement techniques, it was determined that the sixth type of reinforcement produced the best outcomes. Based on software results, laboratory tests were performed, and no failures were found. They reduced the number of laboratory tests used and got better findings faster by using the software analysis. Consequently, the majority of testing expenses are cut.. The study helped in understanding prevailing stresses in truck frame rails especially during cornering and for heavy vehicle applications starts based on the loads primarily acting on it. In heavy transportation vehicles the vertical load due to pay load is a primary. In order to overcome this vertical load the chassis has to resist the bending moment acting on it. As per the basic equations of pure bending,

Bending moment = bending stress* section modulus Section modulus = I/y

Cicek Karao, glu, N. Sefa Kuralay The issue was resolved using ANSYS version 11.0, a commercial finite element programme. Side member thickness, connection plate thickness, and connection plate length were changed to reduce the amount of stress close to the chassis frame's riveted union. The side member's stresses can be minimised, according to numerical results, by thickening the side member.

Alireza Arab Solghar, Zeinab Arsalanloo The issue was resolved using ANSYS version 11.0, a commercial finite element programme. Side member thickness, connection plate thickness, and connection plate length were changed to reduce the amount of stress close to the chassis frame's riveted union. The side member's stresses can be minimised, according to numerical results, by thickening the side member

N.K.Ingole, D.V. Bhope To save the cost of production, Awachat Industries, Wardha, examined its tractor trailer. Pro-E software was used to create four different modified trailer designs, which were then examined using Ansys software. When four distinct trailer chassis designs were compared, the fourth design was the most effective one in terms of weight. The fourth design trailer chassis was allegedly appropriate for mass production and reasonably priced.

Roslan Abd Rahman, Mohd Nasir Tamin, Ojo Kurdi employed FEM stress analysis as a first set of data to determine fatigue life. They studied ASTM Low Alloy steel A710 (C) and used the simulation and analysis software ABAQUS. Finding the high stress spot where the fatigue failure will begin was the main goal. The portion of the chassis opening that comes into touch with the bolt is shown to be under significant stress.N.V.Dhandapani,

G Mohan kumar, K.K.Debnath have used Ansys software and finite element methods to analyse the impact of different stress distributions. They installed gussets in the failure location to better understand the field failure of the 100-ton dumper. After alteration, the chassis structure underwent linear static analysis to confirm its safety, which was successful.

Alireza Arab Solghar, Zeinab Arsalanloo examined and evaluated the Hyundai Cruz Minibus's chassis. Modeling and simulation were performed using ABAQUS software. Static analysis of the chassis takes into account its own weight, whereas dynamic analysis took acceleration, braking, and road roughness into account. It was found that braking put greater stress on the chassis than accelerating did.

M. Ravichandra, S. Srinivasalu, Syed altaf Hussain examined and evaluated the Hyundai Cruz Minibus's chassis. Modeling and simulation were performed using ABAQUS software. Static analysis of the chassis takes into account its own weight, whereas dynamic analysis took acceleration, braking, and road roughness into account. It was found that braking put greater stress on the chassis than accelerating did

Kenji KARITA, Yoichiro KOHIYAMA, Toshihiko KOBIKI, Kiyoshi OOSHIMA, Mamoru HASHIMOTO had created an aluminum-made chassis. The 6061-T6 material has been used for the frame. The chassis was constructed using the variable section extrusion technique. It was created using computer-aided engineering. Weight reduction is a benefit of aluminium material. Researchers discovered that the aluminium chassis achieves the desired weight reduction, strength, and rigidity. Additionally, they came to the conclusion that the remaining technical concerns will be resolved to allow the commercial use of the aluminium frame.

Teo Han Fui, Roslan Abd. Rahman have examined the 4.5 Ton truck chassis' resistance to road abrasion and excitation. Road roughness-induced vibration and excitation by vibrating components installed on the chassis were investigated. By examining stress distribution and displacements, chassis reactions were investigated. The positions where components, such as engine and suspension systems, should be mounted are determined by mode shape results.

Conclusion

The current study examined the various literatures. Following a careful examination of various research studies, it was discovered that totally inadequate studies on the variable segment chassis concept had been conducted. As a result, future research studies on the variable section chassis concept in automotive may be conducted to fill the gap.

We conclude from the literature review and methodology that chassis rigidity has a considerable impact on the behaviour and handling of the vehicle. As the vehicle's chassis becomes less rigid, it responds to driver inputs in an undesirable way and gets harder to drive. We can draw the conclusion that additional design improvements should be made in the coming to boost the overall chassis' stiffness through the examination of these patterns, taking manufacturing error into consideration. When stiffness will be less than the specified value, the car runs the risk of entering a regime in which the stiffness has a substantial impact on vehicle behaviour. Stiffness more than the designed value results in extra weight with declining returns.

Due to the results' close resemblance to the optimum chassis stiffness previously produced, the analysis approach has proven to be highly effective, and a great deal of confidence was placed in them. According to the literature review and the original design, it was determined that the force that was exerted on the chassis following the impact was significantly more than usual, which has an impact on the rigidity. In addition to stiffness and torsional rigidity, stacking of Clearance and Compliance was another occurrence that had an impact on the chassis. Another crucial aspect that needed to be taken into account was the suspension point design.

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