e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:11/November-2022 Impact Factor- 6.752 www.irjmets.com

REVIEW PAPER ON SUSPENSION SYSTEM FOR FSAE VEHICLE

Mr. Sahil Patil[*1], Mr. Prathamesh Pitale[*2], Mr. Adwait Kshirsagar[*3],
Mr. Sagar Shinde[*4], Prof. Prashant Ingle[*5]

[*1,2,3,4]Bachelor Of Engineering, Department Of Automobile Engineering, Saraswati College Of Engineering, Kharghar, Navi-Mumbai, Maharashtra, India.

[*5]Professor, Department Of Automobile Engineering, Saraswati College Of Engineering, Kharghar, Navi-Mumbai, Maharashtra, India.

DOI : https://www.doi.org/10.56726/IRJMETS31019

ABSTRACT

This paper presents a review of recent research that has been carried out on the Suspension system of a Formula Student car. In any formula student race car, racing cars, Baja cars, or any given car suspension plays an important role. Suspension is primarily used to prevent the driver from sudden road shocks. It's also used to control the longitudinal load transfer, lateral load transfer and giving the exact amount of feedback needed by the driver. While designing a suspension system few factors need to be considered such as C.G, Roll-center, camber, toe-in, toe-out. Handling characteristics are also improved by optimizing the suspension system. The objective of the paper is to redesign the suspension system of the FSAE vehicle according to the new chassis and engine of the vehicle.

Keywords: Suspension, Lateral Load Transfer, C.G, Roll- Center, Handling.

I. INTRODUCTION

Formula SAE is a student design competition organized by SAE International (also known as Society of Automotive Engineer, SAE). This competition challenges students to conceive, design, fabricate the cars and compete with other student formula teams. This paper will analyses numerous design criteria and construction sections for designing a suspension system that have been presented in various articles.

Generally, a suspension system arrangement of a vehicle connecting the unsprung mass includes wheels, brakes, knuckle and a large portion of the heaviness of control arm and dampers, with the sprung mass including the total body. The final suspension system will have new suspension geometry, lighter elements and the upright structure will be based on the dimension of the rims as well. In between the distance of the rims the upright will be placed there and the upright will be designed not to collide with the rim.

II. LITERATURE REVIEW

Alejandro Diaz Et. Al [1] conducted a research on suspension and chassis of 2015 FSAE vehicle and the overall project goals were considered, and after extensive research throughout our project, the best performance of each aim was attained. It was noted that improving prototype 2's stiffness above prototype 1 would be unnecessary and add to the weight. So, for prototype 2, the weight was drastically reduced while reducing rigidity to a point where the vehicle could still operate as intended. Utilizing evaluations from prototype 1, the vehicle integration for prototype 2 was likewise carried out and accomplished.

Samant Saurabh Y Et. Al [2] found the kinematic parameters, such as caster, camber, toe angles, etc., by kinematic analysis. They were able to determine the spring stiffness for a specific ground clearance by dynamic analysis of the kinematic linkages (static condition). The components' robustness and sustainability were guaranteed by the related FE analysis. The design's vibration or ride analysis demonstrated the impact of the damping ratio on comfort and wheel deflection, allowing to determine the ideal coefficient of damping. Knowing the spring damper characteristics allowed us to test design and determine if it would exhibit body roll at a given speed and radius of curve.

Ojas Babannavar Et. Al [3] observed that This upright was designed using the iterative design approach. After conducting a structural and fatigue examination of the upright, it was found that the component withstood static and cyclic loads without failing early. In order to reduce the component's weight without sacrificing the upright's functionality or safety, design optimizations were made based on the analysis findings of earlier designs. The components' static and fatigue analyses can be used to improve vehicle dependability, reduce weight, and other design factors.

Jock Allen Farrington Et. Al [4] creates Understanding about the underlying ideas behind a car's steering and suspension, as well as the typical racing steering and suspension systems. The results of the analysis revealed a wide range of problems with the car, all of which may have contributed to the 2008 University of Southern Queensland (USQ) Faculty of Engineering FSEV team vehicle's crash.

Ayush Arvind Singh Et. Al [5] Found that the results of the simulation demonstrate that the wheel assembly and suspension parts can operate safely under real-world track circumstances and still exceed performance standards. By giving the wheel during a turn more traction and contact patch, negative camber angle enhances vehicle stability. The oversteer arrangement enables the driver to have superior vehicle control by reducing the required steering effort. To achieve aerodynamic stability, the vehicle's front has a low roll center height. When the C.G height is kept near to the ground, the vehicle's rolling effect is reduced. The anti-dive feature lessens the jerking effect when braking. With the anti-squat feature engaged, jerking when accelerating quickly is reduced.

III. CONCLUSION

In conclusion, they see how the suspension system is a crucial element in the design process of a new FSAE vehicle, they discuss different material comparison and how for improved machining, simulation, and cost cutting, material selection is a key step when designing any mechanical component. They observe the design process of the suspension system, where according to different aspects comparison is done. and how Negative camber angle improves vehicle stability by providing extra traction and contact patch to the wheel during cornering. By lowering the needed steering effort, the oversteer arrangement allows the driver to have better vehicle handling. Low roll center height in the front of the vehicle is used to achieve aerodynamic stability. The rolling effect of the vehicle is lessened when the C.G height is kept close to the ground. When braking, the anti-dive feature decreases the jerking effect. The anti-squat feature decreases the jerking effect when accelerating quickly.

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