DESIGN AND FABRICATION OF SUSPENSION SYSTEM FOR FORMULA STUDENT VEHICLE

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Abstract -The main criterion of this project is to design the suspension system for the formula student vehicle, this is typically achieved by Push-rod, Up-right, Rocker arms, Anti-roll bar. To provide the smooth suspension of the vehicle, this system creates. There was design of components and calculations of them for required smooth operation of suspension system, the complete knowledge about the working and mechanism and modelling of the suspension system is covered. We deal about the design process consists of first determining the suspension system given data and geometry and analysing it on lotus shark suspension software after analysis and optimization of the geometry the entire system is designed in solid works .Different analysis were performed while iterating and getting the best possible design which is suitable for our vehicle and also for the rider .The overall components design and modelling of suspension system for our vehicle was done and tested and proved to be reliable in all possible working conditions .

Key Words*:*suspension, damper, kingpin, anti-roll bar

1.INTRODUCTION

The suspension system includes the of tires, damper, spring, A-arm, linkage which are connected to the vehicle and the wheels and allowed relative motion in between the Suspension systems which supported the roads holding/handling and ride quality. Hence this provides a mechanism to isolate the body from the bumps roads. The springs manipulation the continual of un even road and check out to bring them into a more manage the band. They also provide the damping action through friction and own hysteresis from dampers spite the energy for the dynamic load coming through the bump's roads. To safeguard the reside from road shocks and to obtain the stability of the vehicle in pitching or rolling, while in motions Working of the suspension system control arms or links allow wheel are movement independent of the vehicle.

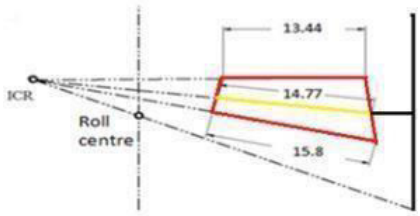
There are mainly three types of suspension systems in the automobile Engineering. *It* based on the type of weight and the performance of the vehicle.

1. Dependent suspension system
2 Semi-independent suspension system
3. Independent suspension system

2. METHODOLOGY

Design of Suspension Geometry

The suspension system geometry was acquired by using the instantaneous center method so as to have minimum shocking of shafts. The lengths of the camber links are to be kept max so as to reduce the Tire scrub. The Geometry obtained by using the Instantaneous Centre Method.

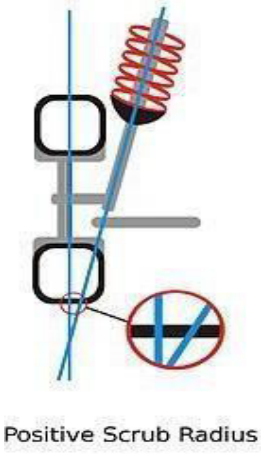


Suspension Geometry

The assemble of the suspension system was made beside the engine area which considered reduced the load of the engine compartment members. The complete weight from the suspension was moved to the firewall due to the shock-absorber was mounted on the overhanging. Camber links were provided to achieve camber load in a roll. The camber gains were help in reducing the weight of the drive shafts thus preventing the shafts from putting out of the gearbox.

Scrub radius

The scrub diameter is that the space ahead view between the kingpin axis and thus the middle of the contact of the wheel. The kingpin axis is that the points between the higher and lower ball joints of the uprights. On a McPherson strut, the highest pivot point is that the strut bearing, and therefore the lowest point is that the lower ball joint. The inclination of the steering is rack dimension due to the angle between the steering rack and therefore the center line of the wheel. That means that the camber angle are adjust with in the pivot points to the scrub radius are often changed, this alters the offset and width of the tires on a vehicles.



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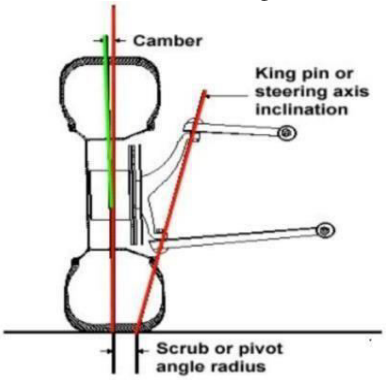
Scrub radius

Kingpin inclination

The kingpin is about at an angle to the vertical plane from the front or rear of the vehicle. This angle is called as the kingpin inclination. The put forward of the Kingpin is to produce a vertical direction of the vehicle in during steering mechanism in an upward direction. The KPI also generates scrub radius



Kingpin inclination

Movement of the vehicle

Yaw movement

A yaw movement could also be a movement around the yaw axis of a rigid body changes the direction it's pointing, to the left or right direction of motion. It is usely commonly measured in degrees/second or radian/second. Another important concept is that the yaw moment which is the components of a torque about its yaw axis.

Anti-roll bar

An anti-roll bar which is used is a part of many suspensions system that helps reduce the body roll of a vehicle during fast turning or over bump road. Anti-roll bars were unusual on cars thanks to the wide much rigid suspension and acceptance of body roll. A roll bar increases the suspension system roll stiffness' its resistance to appear turns, independent of its spring rate within the vertical directions.

Track width

On most vehicles, the track width will differ between the front and rear axis since they perform different functions. A vehicle's track, or track width, is that the distance differs between the center line of every of the wheel on an equivalent axle on any given to vehicle.

Wheelbase

In road and rail vehicles, the wheelbase is that the space between the centers of the front and rear wheels. For road vehicles with quite two axles the wheelbase is that the distance between the steering axle and therefore the center point of the live axle group

3.LITERATURE REVIEW

Alejandro Diaz studied et.al.,In terms of the vehicle itself, there is a multitude of construction types allowed in the competition rules, each providing their own pros and cons. A fiber monocoque is employed by teams with research and resources into the event of carbon fiber structures. Carbon fiber may be a composite that is possesses double the strength of steel and it is five times lighter, manfauter it the right choice for a chassis Many of the highest tier teams, such as those from Oregon A monologue is essentially a structural skin, where the chassis of the vehicle supports the external loading that is being applied from the suspension, brake, power-train, etc. Since the monologue is also the outside support of the vehicle, it is also made for aerodynamic. The monologue chassis is tested and hence proven to satisfy minimum FOS design standards. inspite the benefits of the chassis design, there's one glaring drawback; it's very expensive in cost to style and manufacture.

Soliman 2011: Presented method LQR control design is for the control of a vehicle suspension full vehicle model was used studying the effect of the control system begin using the active suspension system on riding performance. The dynamic and acceleration tire load were estimate. For the time static analysis, different bumped conditions are considered so as to show the performance of the controllers. The simulation results show that system gives a far better ride performance compared with system.

Yoshimura eta.: Built an active EMS using the concept of relative motion control. According to that, the reviter motion control was much better than LQ control concept and passive suspension. Analytical solution was wont to design the suspension. As a result, the suspension system using sliding mode control was much better than active suspension that using LQ control concept and passive suspension system in terms of vibration.

Lin etal.: Proposed a retiver motion mode controller to control the suspension system and evaluate its control performance. The employed the error of the spring mass position and therefore the error change to determine a sliding surface, then introduced the sliding surface and therefore the change of the sliding surface as input data of a standard fuzzy controller (TFC) in controlling the suspension.However, no substantial improvement within the ride comfort might be obtained with the FSMC relative to the TFC because the dynamic effect of the spring mass acceleration from the bouncing tire during tire rotation was not eliminated.

V.D.Thorat, Prof. S.P.Deshmukh: Developed rigid multi body dynamic analysis approach in design. The applications of this system simplify design process and provides correct result. In this first consistent with Ackerman conditions are basic geometry is meant for static load, model analysis then for dynamic foresees generated on steering linkages while turning using Rigid Dynamics tool in Ansys. Results are shown rigid dynamics mode for design reduces time for development, simulation and supply to the prospect to require most reward action. Author concluded that rigid dynamics approach is employed in modern design techniques for various domains.

Prof Raghvendra B. Ravi K: Developed of the planning like differ materials, shape and size and studied theoretical and to the buckling ratio, experimental and modal analysis of by ANSYS. Author with this Results decreases displacement, buckling Eigen value then buckling loads.

4. CONCLUSIONS

The objectives this were to realize a far better understanding of the way to suspension systems to figure and mix theorical and practical knowledge by designing and fabrication of the suspension system.

In this suspension system properties like camber, caster and toe-in and toe-out was explained and what effects on the general handling of the car. The design is simple as possible without reducing performance is explained. Lowering the COG by using pull rod suspension instead of pushrod suspension. Design the suspension system and the possibility of having no anti load. After the planning of every component of the suspension, an assembly was created to verify the planning in which they no interference in between components. As the main objectives of this were to gain a better understanding of how to pull and push rod suspension systems to work the theory and practical knowledge by designing and fabrication the pull pushrod suspension system car they have. Lowering the COG by using suspension instead of pushrod suspension. After the planning of every component of the suspension, an assembly was created to verify the planning which no inter-ference was between components.

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