CAD Design and Modelling of Suspension Unit for Increasing Stability of a Four Wheeler

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Abstract— This article discusses the significance of adaptive control of the modified suspension arm over the existing standard suspension strut used in the four wheeler suspension assembly. The objective is to increase control over vehicle during a sharp turn. In this paper we have compared the major aspects of safety and vehicle control during cornering at increased speeds. While making the modifications, the existing conventional suspension system is retained, adding a new component which can certainly adapt according to changing conditions of load on vehicle. This gives more flexibility to the un-sprung mass which lies over the suspension assembly to counteract with incoming unbalanced forces at corners. The conditions could be simulated by use of software before using it in actual prototype. The main advantage of this modification is reduced chances of body roll even at high speed corners.

Key words: Adaptive Control, Suspension Strut, Cornering, Un-Sprung Mass, Car Body Roll

I. INTRODUCTION

There has been a significant improvement in suspension systems over the decades; the goal is to achieve more and more safety and control over the ride with better comfort for passengers. Though most of the cars today are equipped with the major safety systems to save the life of its passengers, accidents are unavoidable at increased speed especially at corners of the road. The chances of car body roll from its roll centre are increased while making a turn. During normal travelling speeds a vehicle is under control on road as well as in corners but at elevated speeds, things work quite different. The chances of losing control over the vehicle increase as the vehicle becomes unstable at corner and various forces try to set it off the track. These types of failures mainly occur due to change in position of centre of gravity of the car. By analysing all those factors which are responsible for changing the position of centre, we are trying to maintain its correct position to minimise chances of losing control over the car. This result will be included in design of a system which will counteract the forces responsible.

II. PROBLEM IDENTIFICATION

After identifying the main problem behind the accidents happening around turns and corners, we know the exact reason behind the instability of a car. Thus we can start the design phase according to the requirements for stability improvement. This could be achieved through the adaptive controlled suspension system working accordingly with the steering system to maintain the correct position of centre of gravity while taking a turn around corner.

III. DESIGN OBJECTIVES

1) To maintain the centre of gravity at its original position as far as possible.
2) To shift the weight of the vehicle away from its roll centre.
3) To allow the suspension arm/strut to alter its length according to speed of turning vehicle.

IV. DESIGN PROCEDURE

1) Selection of suitable design software Creo parametric 2.0
2) Using the standard available suspension model Double wishbone suspension strut
3) Assembling all the individual units into a half car suspension model
4) Using the same assembly for simulating in the virtual environment.

V. PARTS OF SUSPENSION MODEL

Following list shows the various components of our adaptive suspension system:

A. Frame component

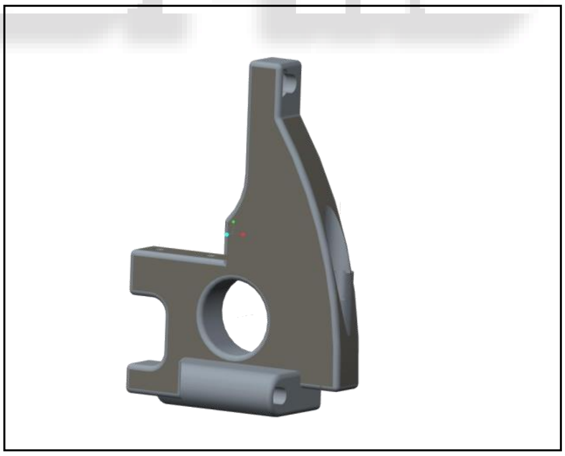

Fig. 1:

The following model requires two frame components and a joining member to form a stable middle structure of chassis of a vehicle.

B. Suspension arm/strut

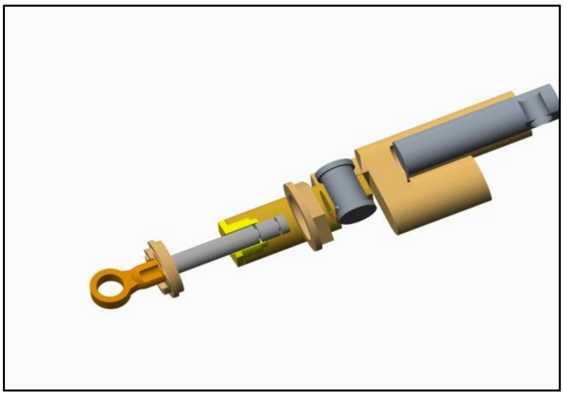

Fig. 2:

The suspension arm is composed of a linear actuator joined with conventional spring shock absorber. The actuator can increase/ decrease the length of whole strut.

C. Suspension link

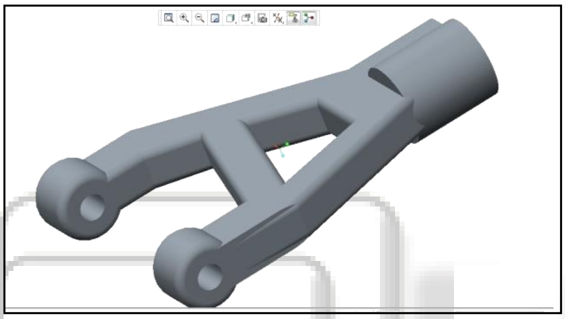

Fig. 3:

There are four suspension links connecting the main chassis frame with wheel hub and suspension strut. These links transfer the shocks to the spring-damper arrangement.

D. Hub coupling and Wheels

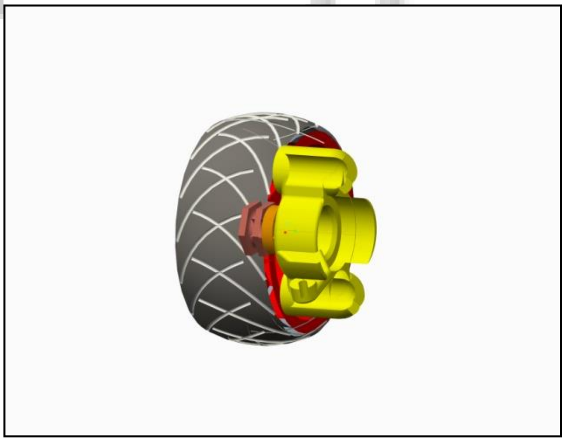

Fig. 4:

This is the last member of the assembly which is in direct contact with the road surface. The hub coupling is connected with the suspension links by means of ball-socket joint. The wheel is mounted on the hub by means of long bolts.

VI. Assembled View

The last figure shows the assembly of all the above components in their correct order completing the two wheeled suspension model.

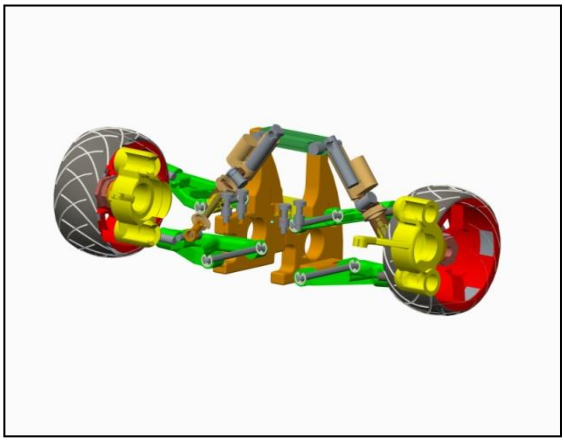

Fig. 5: Two Wheeled Suspension Model

VII. Part List

Sr.No	Name of Part	Quantity
1	Frame component	2
2	Suspension Strut	2
3	Suspension link	4
4	Linear Actuator	2
5	Wheel Hub	2
6	Rims	2
7	Tyres	2

VIII. Conclusion

The individual parts for adaptive four wheeler suspension systems have been designed and then assembled into a half car suspension model. This model can be used to simulate actual working conditions of the adaptive control of vehicle during encountering a turn. Thus we conclude the parametric design of suspension unit for improvement of stability of four wheelers.

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