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Review Paper on Suspension Arm

Prof. S V. Pandit, Prof. J.G. Shinde, Sagar D. Patil, Sourabh A. Patange, Omkar A. Ingawale, Prithviraj M. Misal.

Assistant Professor, Department of Mechanical Engineering, BharatiVidyapeeths College Of Engineering, Kolhapur, Maharashtra, India.
Assistant Professor, Department of Mechanical Engineering, BharatiVidyapeeths College Of Engineering, Kolhapur, Maharashtra, India.
U.G. Student, Department of Mechanical Engineering, Bharati Vidyapeeths College Of Engineering, Kolhapur, India
U.G. Student, Department of Mechanical Engineering, Bharati Vidyapeeths College Of Engineering, Kolhapur, India
U.G. Student, Department of Mechanical Engineering, Bharati Vidyapeeths College Of Engineering, Kolhapur, India
U.G. Student, Department of Mechanical Engineering, Bharati Vidyapeeths College Of Engineering, Kolhapur, India

ABSTRACT: Chassis is the backbone structural member in the On-Road vehicles. All the loads generated by other components of the vehicle are transferred to chassis only. So the frame structure has to be strong enough to with stand the loads in static and dynamic conditions. In most of the on- Road vehicles the cross section of the frame structure is uniform in spite of the variable loads. In order to overcome more failure in the chassis structure and ensure the safety, the variable section chassis structure has to be designed based on the variable loads along the length of the vehicle. This papers presents previous work carried on suspension by different researchers.

KEY WORDS: Suspension Arm, Suspension, CATIA, ANSYS,

I.INTRODUCTION

Automobile frame is mounted on the axle through a suspension system. Due to uneven road profile and variable velocity, vehicle is subjected to random excitation. It affects comfort and road handling characteristics. The main objective of suspension system is to safeguard the passenger against road shock which may be in the form of bounce, roll, pitch etc. Also suspension has to limit the body displacement to a minimum. Suspension system of a vehicle is subjected to a force due to vertical loading, rolling, braking, acceleration and cornering.
Function of suspension system are-

1. To support vehicle and passenger weight.
2. To safeguard the passenger against road shock and provide riding comfort.
3. To maintain steering and vehicle handling characteristics, which is achieved by means of mechanical linkages and controlling relative motion between sprung and unsparing mass.
4. To provide stability to vehicle during pitching or rolling, while in motion.

Spring and damper are most widely used element in vehicle. Spring reduces the force transmitted to the chassis while travelling over bump reduces the acceleration of the chassis while wheel falls on a depression or pothole. Damper reduces the tendency of the chassis to bounce up and down after the disturbance and also prevents the excessive built up of amplitude of bounce when the excitation frequency is nearer to the natural frequency the system. Suspension system is classified into passive, active, semi active system. Passive suspension system satisfies the requirements only at certain operating condition. Hard springing will increase acceleration force during light loading and soft springing will reduce the body height when heavily loaded. Active suspension controls the vertical movement of wheel through an on-board system. Active suspension systems use
Separate actuators that exert an independent force on the suspension to improve the riding characteristics. Semi-active systems can only change the viscous damping coefficients and do not impart any additional force to the suspension system. In most passenger passive suspension system is widely used. In passive suspension system, there is always compromise between passenger comfort and handling. In passive suspension system high stiffness spring gives good

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handling but poor comfort. Low stiffness spring gives good comfort and less handling. The main advantage of passive suspension system is that the design is simple and also economical. Also maintenance cost is low.
Three wheeler suspension arm is mostly used for the rear suspension of the passenger cars. It is also called as crank axle suspension system. Control arm placed longitudinally along the driving direction and mounted on suspension sub frame or body on both the sides. Control arm is subjected to high torsional and bending stresses. It allows the wheel to move up and down only. No change in camber and toe due to lateral and vertical forces. Increased un-sprung mass of trailing arms reduces the ride quality.

II. OVERVIEW

The three wheeled vehicle is a very common public transport vehicle in India, with a maximum speed of about 14 m/s. This vehicle is commonly known as athree wheeler Auto-rickshaw. Similar vehicles are used throughout the world, especially in Asian countries, for public transport as well as to carry freight. The total weight of the vehicle is around 650 kg including the driver and three passengers. It has one front wheel with linkage (trailing or leading) suspension attached to the steering column and two rear wheels attached to corresponding swinging arms that are pivoted to the frame.

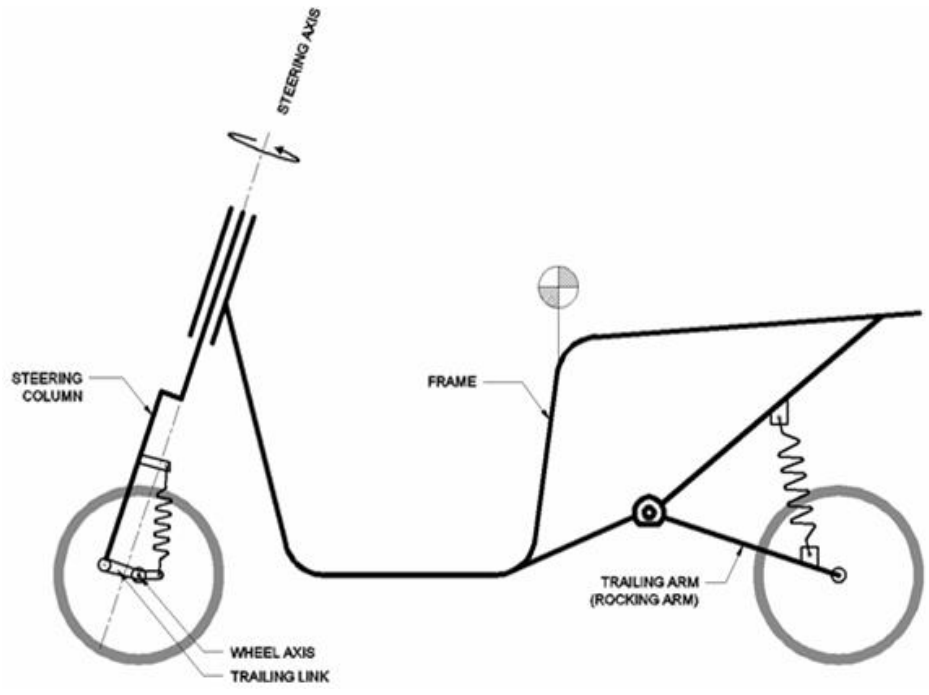

Fig: Schematic Diagram of Three wheeler

Trailing arms are often used as a rear suspension, and consists of a control arm connected between the wheel spindle/hub and chassis. Trailing arm placed longitudinally along the driving direction and mounted on suspension sub frame or body on both the sides. The trailing arm has to withstand forces in all directions, and is therefore highly subjected to bending and torsional stress. If the arm withstands the forces no camber and toe change will be caused by vertical and lateral forces. Trailing arm suspension is mostly used for the rear suspension of the three wheelers. It is also called as crank axle suspension system. Trailing arm is subjected to high torsional and bending stresses. It allows the wheel to move up and down only. No change in camber and toe due to lateral and vertical forces. Increased un-sprung mass of trailing arms reduces the ride quality.
As these all references says that of the front Suspension Trailing Arm fails due to many of the parameters so it is necessary to study the exact reasons for the failure of Suspension Trailing Arm in this it intended to observe these failures with the different tests. This projected study is an overall revive of existing Suspension Trailing Arm failure and to minimize this failures by improving some failure parameters. So that it will helps to maximize life of Suspension Trailing Arm and resulting minimizing road accidents and reduce weight of the three wheeler.

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III. LITERATURE SURVEY

Many of the researchers were work on the failure of Suspension Trailing Arm in three wheeler with different methods it is not possible to mention all the work carried out by the researchers. Only most of the work which seems motivational is mentioned below:

Santosh Ukamnal et al. [1]In this study design of the quarter car trailing arm suspension system suspension geometry is carried out in CAD software. The optimized values of spring stiffness, damping coefficient of sprung and un-sprung masses are coupled with the geometry design and is analyzed in Lotus Suspension Analyser to get various values of the suspension geometry. All the obtained suspension parameters are checked by the Lotus suspension analyzer for kinematic analysis. For the calculated values and it is observed that there is no change in the camber and toe angle values, and even change in wheel base is also within the desired limit.

R.Lather et al. [2]In this research work authors concluded that modal of semi trailing arm using AISI 4130 is highly suitable where light weight and high strength is first priority because for the same thickness of both pipes F.O.S for chromoly is nearly triple of mild steel pipe .Hence weight can be reduced to half in case of chromoly material, LOTUS suspension analyzer v5.01 validate geometry and ANSYS WORKBENCH 12.1validate the strength of semi trailing arm from AISI 4130.

YadneshNipaneet al. [3]focused research work manages scientific displaying of a quarter auto trailing arm suspension framework. The quarter auto model of two-degree opportunity framework is tackled in MATLAB and time reaction is plotted. The parameters, for example, spring firmness, damping proportion of sprung and un-sprung masses of the quarter auto demonstrate are streamlined to get great solace and vehicle dealing with. Outline of the suspension geometry is completed in CAD programming. The advanced benefits of spring solidness, damping coefficient of sprung and un-sprung masses are combined with the geometry plan and is dissected in Lotus Suspension Analyser to get different estimations of the suspension geometry.

Akshay G Bharadwaj et al. [4]during this study, components were fabricated according to the design and assembled. The vehicle performance was then validated by performing various tests. Measurement of the static parameters such as track width, height, length was carried out and was found to be within the limits specified by the SAE for the E-Baja vehicles. The dynamic testing of the vehicle was carried out multiple times and was found to be satisfactory in the aspects of driver safety, driver comfort, ease of steering and manoeuvrability. In conclusion, the implementation of the design in the vehicle achieved the goals of optimum performance by flexibility of camber adjustment, minimum toeing, driver comfort and maximum travel; these were achieved at a reasonable cost.

Thomas Gyllendah et al. [5]developed a vehicle suspension intended for an auto rickshaw. A variety of different suspension types were investigated and evaluated until two suspension types were chosen; one type for the front and one type for the rear. These suspension types were then simulated and tested in Siemens NX 8.0 in different critical scenarios to gain useful information. The information was then evaluated to draw a conclusion if the developed suspension obtained good performance. The final solution was simulated and partly verified and still work remains to get a full overview of the performance.

VenkataMangarajuKaranam et al. [6] examined models using rigid bodies do not capture this instability and a multi-body dynamic model, including flexibility, is developed and validated using the experimental results. Using this model it was found that structural flexibility modelling is essential to capture the wobble mode instability that is observed experimentally. Also, it was found that steering column flexibility may be one of the main reasons for these instabilities. The dynamic model, results and findings of this study can be used not only in future industrial design oriented studies, but also will lead to improved understanding of three wheeler dynamics as well, especially the wobble instability.

Milind M. Gore et al. [7] studied instability using a multi-body dynamic model and with experiments conducted on a prototype three wheeled vehicle on a test track. The MBD model of a three wheeled vehicle is developed using the commercial software ADAMS-CAR. In an initial model, all components including main structures like frame, steering column and rear forks are assumed to be rigid bodies. A linear eigenvalue analysis, carried out at different speeds, reveals a mode that has a predominantly steering oscillation, also called a Wobblemode, with frequency around 5 to 6 Hz. Also in the SVM method maximum displacement is observed in rear right chassis. The displacement is 0.153m, when compared with finite element model the error is 3.6%.

IV.STUDY AND OBSERVATION

A. PROBLEM DEFINITION:

Currently as per new design and suspension requirement there are some additional functionality which are being which are included in the role of suspension trailing arm in three wheeler with its ability to withstand loading and seviour

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working condition. Most of the time whenever the design of trailing arm done and tested under working condition and found that it is under gone very complex combination of failing to meet the strength and functionality requirement. So in this study we defining the specific methodology to full proof the trailing arm design. Initially analyzing the designed trailing arm under complex loading condition then finding out major factor which responsible for particular failure and to modified the design. Finally counteracting the failure and after that validating the design through virtual simulation and verifying it through experimental cross checking.

B. RESEARCH OBJECTIVES:

The proposed work is based on the following objectives,

1. To study existing scenario of selected Suspension Arm in three-wheeler.
2. CAD modeling of the existing Suspension Trailing Arm in three-wheeler.
3. Analysis of the existing Suspension Trailing Arm in three-wheeler using ANSYS software.
4. Analyze the failure of Suspension Trailing Arm by considering geometrical parameters.
5. Modify the Geometric design at the failure cross section Suspension Trailing Arm.

C. METHODOLOGY:

The proposed work involves the following steps:

1. Detailed theoretical study Suspension Trailing Arm presently used in car.
2. Modelling of Suspension Trailing Arm in CATIA by taking actual dimension from actual Suspension Trailing Arm which was in application and import into ANSYS for further analysis.
3. To improve the design of Suspension Trailing Arm by selecting suitable design parameter.
4. Carry out Finite element analysis for newly design Suspension Trailing Arm using ANSYS.
5. Experimental Validation of result through Finite element analysis.
6. Experimental Testing Of Trailing Arm Using UTM

V.CONCLUSION

This experiment and analysis will conducted modelling on Trailing Arm with the help of design optimization will be done.

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