International Journal of Research
ISSN: 2348-6848 Vol-3, Special Issue-6
National Conference on Recent Engineering Trends
NCRET- 2016
Held on 16th March 2016 organized by Institute of Knowledge College of Engineering, Pune, India.

Design and Fabrication of an Auto-Tilting Car

Vyom Bhushan
Automobile Engineering IOK-COE, Pune, INDIA
bhushanvyom21@gmail.com
Parhad Atul Waman
Automobile Engineering IOK-COE, Pune, INDIA
atul33parhad@gmail.com
Nikam Sachin Arjun
Automobile Engineering IOK-COE, Pune, INDIA
nikamsachinauto96@gmail.com
Prof. Veerbhadrappa
Automobile Engineering IOK-COE, Pune, INDIA
veeru.ssk@gmail.com

Abstract—The narrow track cars have an increased rolling tendency. So, there is a need to develop such a mechanism which can increase the vehicle stability and passenger comfort. The main objective is to provide banking to the car on unbanked curves to run at high speed. The central front suspension has been used to provide vehicle stability. The design has been made and fabricated to minimize rolling tendency of the narrow track cars by introducing the auto-tilting mechanism. It improves the handling of the vehicle and hence provides more comfort to the passengers by minimizing rolling tendency and providing banking to the car.

Keywords-narrow track car; rolling tendency; vehicle stability; banking to the car;auto-tilting mechanism

I. INTRODUCTION

Now-a-days, some of the car companies are producing narrow track car prototypes to decrease the traffic congestion and parking problem. These narrow track cars have an increased rolling tendency. To minimize the rolling of narrow track cars on the curve, there is a need to develop a design of an auto-tilting car.

An auto-tilting car is one which has the ability to tilt at an angle to provide banking to the car on unbanked curves to run the car at a high speed. The principle of the tilting mechanism consists of a motor turning the back lyre and tilting the chassis which leads the front lyre.[1]

Figure 1 F 300 Life-Jet front cornering view[2]

In the present project work, an effort has been made to design and fabricate a tilting mechanism for a narrow track car. This feature enables the car to tilt into the curve while negotiating it. This tilting mechanism increases the maximum speed in curves. This also provides the advantage of increased passenger comfort and handling.

II. OBJECTIVES OF THE PROJECT

The main objective is to develop a design and to fabricate an auto-tilting mechanism for a narrow track car to minimize its rolling tendency especially on the curves and to provide banking to the car on unbanked curves to run the car at high speed than the existing narrow track cars. It is also supposed to increase passenger comfort as well as to improve handling.

III. LITERATURE SURVEY

Salim[1] Maakaroun, Wisama Khalil, Maxime Gautier and Philippe Chevrel presented a paper in an international conference for the geometric description of the tilting car.

Final Report[2] on 'Development of a novel tilt controlled narrow commuter vehicle' J. Gohl, R. Rajamani, P. Starr, L.

Alexander, focused on Modeling and Control of a narrow tilting car.

T. K. Garrett[3], K. Newton, W. Steeds described the suspension systems and its types.

George Murray[4], Charles V. White, Wolfgang Weise explained the properties of materials and the structure of crystalline solids.

Jörnsen Reimpell[5], Helmut Stoll, Jürgen W. Betzler explained types of suspension systems and drive and the steering system.

Heinz Heisler[6] described the suspension systems, steering systems and the braking system.

David A. Crolla[7] explained the suspension systems, types of suspension systems, the steering system and the braking system deeply.

S. Srinivasan[8] overviewed the suspension systems and explained the steering system in a better way.

Jack Erjavec[9] described the suspension systems and braking systems and their types.

R. B. Gupta[10] explained the basics of suspension system, steering system and braking system.

IV. DELIMITATION OF THE PROJECT

The present project is delimited to the narrow track cars as the auto-tilting mechanism is most needed in those cars.

V. METHODOLOGY

Suspension is the main component that distinguishes this car from all other designs. The central front suspension has been used to provide vehicle stability and to increase the comfort of the passenger while the vehicle is taking a turn. It allows and simultaneously causes the vehicle to sway while cornering. It gives the vehicle a high center of gravity, to allow the swaying motion to occur passively.

The suspension linkage geometry controls the relative angle between the body of the vehicle and the wheels. The relative angle can be adjusted by changing the length of the vertical linkages. The angle of tilt of the vehicle varies from 11° to 13°.

VI. DESIGN OF THE MODEL

Design consists of the application of scientific, technical information and imagination for the development of new machine or mechanism to perform a specific task with maximum economy and efficiency. In the present design, the modelling of the proposed model of an auto-tilting car has been done by using CATIA V5R20 software.

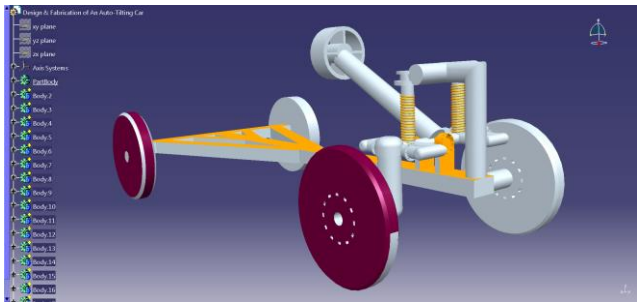

Figure 2 Model in CATIA Software

This design consists of a triangular frame to maintain the stability of the vehicle while taking a curve at high speed with the tilting mechanism. The system is equipped with the central steering as well as the central suspension system in accordance to maintain the speed of the vehicle constant without losing its stability during a turn.

VII. FABRICATION OF THE MODEL

The fabricated model consists of triangular frame, suspension coil springs, steering wheel, ball bearings, bicycle wheel hubs, bolts and nuts and upper and lower suspension supporting frames. The triangular frame maintains the weight distribution of the vehicle. The central suspension has been introduced to minimize the loss of stability of the vehicle and to increase the vehicle handling which also increases the passenger comfort. The central steering system has been used as it tilts the vehicle by applying a very less effort and also the steering ratio can be maintained for controlling the speed of the vehicle on turn.

Figure 3 Actual Fabricated Model

VIII. WORKING

Consider the vehicle is taking a right turn.

First, the steering wheel is rotated to the right. The wheels also rotate to the right.. The front suspension linkages moves to the right side. The steering column tilts to the right side as a result. Finally, the right half section of lower wishbone goes downside and the left half section of lower wishbone uplifts.

IX. ADVANTAGES

The main advantages are:

- It minimizes the rolling of the narrow track cars on the curves.
- Provides banking to the car on unbanked curves to run the car at high speed.
- Increases passenger comfort and improves handling.

X. CONCLUSION

An auto-tilting mechanism has been designed and fabricated for a narrow track car. It minimizes the rolling tendency of the car especially on the curves and provides banking to the car on unbanked curves to run at high speed than the existing narrow track cars. It also increases the passenger comfort by increasing the stability of the vehicle. It also improves handling as the central steering system has been introduced and the central suspension system increases the auto-tilting ability of the car.

XI. FUTURE ENHANCEMENT

Here, the project has been delimited to narrow track cars only. Furthermore, electric narrow track auto-tilting cars can be manufactured and also, this auto-tilting mechanism can be used for normal cars, if needed. In the present project, the front wheel suspension has been taken but moreover, four wheel suspension system can be implemented.

REFERENCES

[1] Salim Maakaroun, Wisama Khalil, Maxime Gautier, Philippe Chevrel, "Geometric model of a narrow tilting car using robotic formalism", 15th International Conference on Methods and Models in Automation and Robotics, August 2010, Miedzyzdroje, Poland, paper 9011, 2010.

[2] J. Gohl, R. Rajamani, P. Starr, L. Alexander, "Development of a novel tilt-controlled narrow commuter vehicle", Final Report, Intelligent Transportation Systems Institute, Department of Mechanical Engineering, University of Minnesota, May 2006.

[3] T. K. Garrett, K. Newton, W. Steeds, "The Motor Vehicle", Butterworth Heinemann, Thirteenth Edition, New Delhi, 2001.

[4] George Murray, Charles V. White, Wolfgang Weise, "Introduction to Engineering Materials", CRC Press, Second Edition, Boca Raton, 2012.

[5] Jörnsen Reimpell, Helmut Stoll, Jürgen W. Betzler, "The Automotive Chassis: Engineering Principles", Butterworth Heinemann, Second Edition, Great Britain, 2001.

[6] Heinz Heisler, "Advanced Vehicle Technology", Butterworth Heinemann, Second Edition, Great Britain, 2002.

[7] David A. Crolla, "Automotive Engineering – Powertrain, Chassis System and Vehicle Body", Elsevier-Butterworth Heinemann, First Edition, United States of America, 2009.

[8] S Srinivasan, "Automotive Mechanics", Tata McGraw Hill Education Pvt. Ltd., Second Edition, New Delhi, 2012.

[9] Jack Erjavec, "Automotive Technology", Delmar Cengage Learning, Fifth Edition, United States of America, 2010.

[10] R. B. Gupta, "Automobile Engineering", Satya Prakashan, Fifth Edition, New Delhi.