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Design and Systemic Anatomization of Steering System

Dr B Vijaya Kumar[1], A Ashish R Rao[2], MD Rahmath Pasha[3], V Sri Harsha[4], V Nagendra babu[5]

[1]Head of the Dept, Dept of Mechanical Engineering, Guru Nanak Institute of Technology, Hyderabad, India
[2]B.E U. G Scholar (IV year), Dept of Mechanical Engineering, Guru Nanak Institute of Technology, Hyderabad, India
[3]B.E U. G Scholar (IV year), Dept of Mechanical Engineering, Guru Nanak Institute of Technology, Hyderabad, India
[4]B.E U. G Scholar (IV year), Dept of Mechanical Engineering, Guru Nanak Institute of Technology, Hyderabad, India
[5]B.E U. G Scholar (IV year), Dept of Mechanical Engineering, Guru Nanak Institute of Technology, Hyderabad, India

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Abstract - This project ensures the efficient steering system assembly selection for a GO-KART by geometric optimization and analysis of every component of steering system. The main purpose of the project is to ensure the steering input between the driver effort and the wheels should be more effective and sensitive. Reducing the driver effort and increasing interaction between the driver and the wheels of Go-Kart. In this process to get that sensitivity various parameters are considered for effective selection of steering system like Ackermann steering geometry, steering arm length, steering ratio, turning radius, castor angles, toe angles, kingpin inclination and camber angle. Here Triangular Bracket is the intermediate between the steering and front wheels by connecting through tie-rods with steering arm, completes the functional kinematic links. The steering wheel is so designed to meet the weight reduction requirement along with keeping in mind of driver comfort. Soft-wares used for designing and analysis of components are SOLIDWORKS, ANSYS. Every component of steering system is Manufactured after being designed and analysed for their load bearing capacities

***Key Words*:** Steering System, Ackermann steering geometry, Turning radius, Tie rods, Camber angle, Castor angle, Rack travel, Steering ratio.

1.INTRODUCTION

The steering system for the go-kart was designed by following the driver ergonomics and by complying to the Percy model mentioned in the rulebook. Selecting the right steering geometry is very important as it makes the go-kart more stable during curves and allows the driver to steer the kart with ease. At the same time the steering system is able to withstand the external requirements and the design of it has to deal with the rules and the designs of other parts of the car. The objective is to improve the actual steering system, which is a direct transmission with a steel tube. There are several things to improve of that design, such as ergonomics, security, weight. It is really important for the driver to be comfortable with the steering system because in some dynamic events he may have to drive the go-kart during half an hour. Once the different alternatives have been contemplated and choose the best one, the whole system will be designed in CAD. This will let us choose the materials we will use in order to optimize the weight. Steering system is a mechanical device of components, linkages, etc. which allows all the vehicle like car, motorcycle, bicycle to follow the desired path. An exception is the case of rail transport by which rail tracks combined together with railroad switches to provide the steering function. The primary purpose of the steering system is to allow the driver to guide or control the vehicle in desired path to reach destination.

2. LITERATURE REVIEW

Muhammad Ikhwan Bin Razak [1]. The objective of this project is to design and fabricate the steering system for electric go kart. Usually, majority of the go kart available at the market are based on petrol engine. The functional for this steering system are based on available product which is evaluated by research on the available source such as Internet. The basic part for the steering system such as steering column, track rods and stub axle are being research thoroughly to understand the function of each part. The final phase of this project is to assemble all the components and parts of the electric go kart fabricate from the team members. The purpose of this project is to allow the driver of go kart to change the direction during handling.

Aashish Porwal, Karunesh Chouhan, Nirmal Chohuan, Jhanvi Chatur [2]. This report is aimed at designing and developing a working model of an electric go-kart. The design and fabrication of the go-kart are made simple so that it could be operated even by non-professional drivers. The design is made keeping in mind the high strength of vehicle which can sustain more weight and provide the best facilities at a low cost. The primary objective of the any steering mechanism is to reduce the steering effort as possible and for that, decreasing the steering wheel travel which results in a quick responsiveness of the steering wheel. The steering geometry is Ackermann-type steering mechanisms which uses four-bar linkages. The report is a submission proof that these ideas have been efficiently and viably converted into a high-performance vehicle.

Mohd Yousuf Ahmed, Asfan Mohiuddin, Mohd Sayeed, Kalamullah Akhtar, Md Nawaz, Mohammad Abrar Mohiuddin- Assistant Professor Of Mechanical Department [3]. The authors working on the design of steering system for an electric go-kart vehicle would like to thank all those who have sincerely and whole heartedly lend their support and contributed to the project. We express our gratitude and thankfulness to the professors for their valuable guidance and their co-operation in the project. The main purpose of this paper is to design and manufacture manual rack and pinion steering system according to the requirement of the vehicle for better manoeuvrability. Quantities like turning circle radius, steering ratio, steering effort, etc. Are inter-dependent on each other and therefore there are different design consideration according to the type of vehicle. A virtual rack and pinion assembly can be created using software like Solid works and Ansys.

Pushkar Wadagbalkar, Chirag Somani [4]. The documentation includes a description of the design processes adopted for the various parts of the steering system. This begins with the actual design of Ackermann Geometry, steering components and their integration together in SOLIDWORKS, followed by the technical specifications of the final design. The designed steering system was used in a Go-Kart for a student level racing event. Various concepts related to steering system were studied. Four Bar Linkage Ackermann Geometry was designed in SOLIDWORKS by varying the different parameters until a precise geometry was obtained. After obtaining the final dimensions of all the components, CAD models of these components were designed and assembled in SOLIDWORKS, and then manufactured respectively. An optimal procedure was followed and hence can be considered as a standard procedure for designing steering system of small vehicles like Go-Karts.

Abhishek Pawar1, Gavrav Mane, Siddhesh Pawaskar, Pranav Deshpande, Heeranand Vhangade [5]. The theory is included in this work and the article focus on the conventional and general steering arrangement on the synthesis of design and analysis of go kart steering system. There is a significant role of the steering system in each and every vehicle too make the handling convenient and to enhance the stability 28 of the vehicle, as to guide the motor vehicle through direction of the road is totally the responsibility of the driver for steering the car, it requires the driver to look straight ahead at the intended path relative to the car and somehow analyzing and give the car a controlled desired input with the path way. A steering wheel which is hand operated which is used on basis to turn the wheels on the front axle and is positioned by the driver controlling the steering wheel. Other aspects like wheels, tyres, steering assembly plays an important role to improve vehicle handling. Considering different steering modes changes the need of steering system of go kart. Under consideration of short turning radius, steady road conditions.

Anjul Chauhan, Lalit Naagar, Sparsh Chawla [6]. This report documents the process and methodology to produce a low-cost go-kart which is comfortable, vulnerable, durable and complete in all aspects by modelling it with CAD software The feasibility of the go-kart design was examined through FMEA, Cost report. The team focuses on a technically sound vehicle which is backed by a profound design and good manufacturing practices. The report explains approach, reasons, selecting criteria and expected working of the vehicle parameters. The procedural way of explanation is used for different parts of the vehicle, which starts from approach with the help of known facts, then the design and calculation procedure has been explained. The best way known had been use to go on to the final result of all parameters.

Vaibhav, Nitin Kukreja [7]. The objective of the design is to optimize the working and performance of go-kart considering various factors. The modelling of our Go-kart was done using CATIA V5 software. The Finite Element Analysis was analyzed by ANSYS R18.2 software. Our central idea was to focus on designing a safe and functional vehicle that could be manufactured and be capable to compete in the market. This article summarizes the advances of vehicle dynamics which includes braking system, transmission system and steering system. Some of the attributes of the vehicle dynamics related to geometric attributes, attributes based on the mass and its distribution and attributes which are tire specific are also discussed in this paper.

Shaik Himam Saheb, Govardhana Reddy, Md. Hameed [8 This paper concentrates on explaining the design and engineering aspects of making a Go Kart for student karting championship 2015. This report explains objectives, assumptions and calculations made in designing a Go Kart. The team's primary objective is to design a safe and functional vehicle based on rigid and torsion free frame. The design is chosen such that the Kart is easy to fabricate in every possible aspect.

R. Chandra Sekhar Reddy, T. Vijay Kumar, A. Raja Goud, V. Mukesh Reddy [9]. This report explains the objective, assumptions and calculations made in design of steering and braking system for a Gokart. The design is made such that Go-Kart is easy to fabricate in every possible aspect. We made our design in all possible

alternatives for a system and modelled them in CAD software namely CATIA V5 R21, analysis is done by using ANSYS R15.0based on analysis results. In addition, it brings an awareness of the various parameters of the kart that can be altered to try to improve the competitiveness and also exist in other forms of motor racing. The steering is attached to the front axle so that the wheel is turned, the wheels will change the angle that they are facing. It is a simple mechanism which works well on a Go-kart. Go-kart wheels are usually made out of aluminium (rims) and measure at 12.7cm wide. Their tires are smaller when compared to a car tire.

Thomas D. Gillespie.[10]. This document determines how wheel loads on a vehicle relate to center of gravity location loading, aerodynamic forces, road grade, trailer towing forces, and acceleration, braking and cornering. Describe how the powertrain and brake systems work to produce longitudinal acceleration and deceleration, and how these are influenced by powertrain type and traction limits.

Tune To Win By Carroll Smith [11]. To complete the whole laps, facing all the technical consequences without causing any 30 issues and being prepared for all type of causes. The things that are to be considered while moving into a race are, Vehicle Dynamics and the type of racing tyres and the distribution of the weight and mass load and load transfer on the vehicle. Suspension Geometry, Steering Geometry and Self Steering Effect, The Shock Absorber, External Aerodynamics and cooling and internal dynamics. The Brakes, Understeer, Oversteer, Stability and Response, Tuning the Engine, The Drive Line, The Peculiar Case of the Large Sedan, racing in the Rain, putting it all together and everything else are to be tuned and need to be considered.

Dr.V.K. Saini*, Prof. Sunil Kumar'' Amit Kumar Shakya#1, Harshit Mishra#2 [12]. This Study named "Design Methodology of Steering System for All-Terrain Vehicles" is to ensure the most efficient steering assembly selection for an All-Terrain Vehicle. In this process various parameters are kept in mind for an effective selection of Steering system. The Steering system uses a Rack and pinion gearbox for Steering along with this Ackerman geometry is being used for the steering assembly. In this assembly modified Column of Tata Nano car is used which is connected to Rack and Pinion Gearbox by a Universal Joint. The Steering wheel is so designed to meet the weight reduction requirement along with keeping in mind the driver comfort. The Rack and pinion gearbox is connected with Steering arm by the Tie Rods. Tie Rods and Steering arm are being designed and analyzed for their load bearing Capacities.

J. Naveen Assistant Professor [13]. This article presents the "Design of steering geometry for formula student cars", optimization and analysis of steering components. The main purpose of the project is to ensure the steering input or response between the driver and the wheels should be more effective and sensitive. Reducing the driver effort and increasing interaction 31 between the driver and the wheels. To get that sensitivity we have to consider the factors like Ackerman set-up, steering effort, steering arm length, rack travel, turning radius, steering ratio, slip angle, castor, toe angles, kin-pin angle and camber angle. Here, Rack and Pinion is the intermediate between the driver and wheels.

Akshay Pawar , Suraj Zambare [14]. The steering system is a vital component of the vehicle as well as the driver interface. The basic function of steering system must provide maximum direction control and stability to the vehicle. In this project we are designed steering system for ATV which compete in SAE BAJA competition. An ATV is a vehicle which travels on all terrains because of this the steering system of an ATV is designed for the worst possible terrain and should provide maximum directional stability, pure rolling motion to the wheel, minimum turning radius. The objective of these paper is designed efficient, durable and relatively inexpensive steering system for ATV by using rack and pinion mechanism.

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REFERENCES

1. DESIGN AND FABRICATION OF STEERING SYSTEM FORELECTRIC GO KART -MUHAMMAD IKHWAN BIN RAZAK.

2. DESIGN AND FABRICATION OF ELECTRIC GO-KART – Aashish Porwal, Karunesh Chouhan, Nirmal Chohuan, Jhanvi Chatur, Department of Electronics & Communication, Shivajirao Kadam Institute of Technology & Management, Indore.

3. STEERING SYSTEM OF ELECTRIC GO-KART - Mohd Yousuf Ahmed, Asfan Mohiuddin, Mohd Sayeed, Kalamullah Akhtar, Md Nawaz, Mohammad Abrar Mohiuddin-Assistant Professor of Mechanical Department, Lords Institute of Engineering and Technology, Hyderabad.

4. FORMULATION OF A STANDARDIZED PROCEDURE FOR DESIGNING THE STEERING SYSTEM OF SMALL VEHICLES LIKE GO-KARTS - Pushkar Wadagbalkar, Chirag Somani.

5. A REVIEW ON DESIGN AND ASSEMBLY OF GO-KART STEERING SYSTEM - Abhishek Pawar1, Gavrav Mane, Siddhesh Pawaskar, Pranav Deshpande, Heeranand Vhangade.

6. DESIGN AND ANALYSIS OF A GO-KART - ANJUL CHAUHAN, LALIT NAAGAR, SPARSH CHAWLA, B. Tech Mechanical Engineering Dehradun Institute of Technology University.

7. OPTIMIZATION OF DESIGN PARAMETERS OF GO-KART – Vaibhav, Nitin kukreja. Department of Mechanical Engineering Department of Mechanical Engineering GLA University, Mathura, U.P., India.

8. DESIGN REPORT OF A GO KART VEHICLE - Shaik Himam Saheb, Govardhana Reddy, Md. Hameed, Assistant professors, Department of Mechanical Engineering Guru Nanak Institute of Technology, Hyderabad.

9. DESIGN AND ANALYSIS OF GO-KART STEERING AND BRAKING SYSTEM FOR FKDC SEASON 3 - R. Chandra Sekhar Reddy, T. Vijay Kumar, A. Raja Goud, V. Mukesh Reddy, Assistant Professors, Department of Mechanical Engineering, CMR Engineering College, Medchal-501401-India.

10. Thomas D. Gillespie, Fundamentals of Vehicle Dynamics. Society of Automotive Engineers, Inc.1992.Print. “About Formula SAE Series”. http://students.sae.org/cds/formulaseries/about.htm. SAE International. Web. Mar. 2014.

11. TUNE TO WIN by Carroll Smith, AERO PUBLISHERS, INC. 1978-- LIBRARY OF CONGRESS CATALOG CARD NO.: 78-73549ISBN 0-87938-071-3

12. DESIGN METHODOLOGY OF STEERING SYSTEM FOR ALL-TERRAIN VEHICLES - Dr.V.K. Saini*, Prof. Sunil Kumar’’ Amit Kumar Shakya#1, Harshit Mishra#2, Department of Mechanical Engineering, IMS Engineering College, Ghaziabad (U.P.), India.

13. DESIGN OF STEERING GEOMETRY FOR FORMULA STUDENT CAR’S - J. Naveen Assistant Professor, Department of Mechanical Engineering, KL Educational Foundation (KLEF), Vijayawada, India.

14. DESIGN OF STEERING SYSTEM FOR ALL TERRAIN VEHICLE - Akshay Pawar1, Suraj Zambare2 - 1,2. Department of Mechanical Engineering, Sinhgad Academy of Engineering, Kondhawa.