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FOUR WHEEL STEERING SYSTEM

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ABSTRACT

Four wheel drive steering system which is also known as Quadra steering system is convenient way to control the vehicle in high speed. Here both front wheel and rear wheel can be steered according to space available. Four wheel steering systems is a great effort in the field of automotive design to provide near-neutral steering. As we know in conventional steering system uses either Ackerman or Davis steering systems. The main disadvantage associated with these systems is the minimum turning radius that is required for the steering action is more. To overcome the difficulty that is associated with the conventional methods of steering can be eliminated by employing a four wheel steering system.

KEYWORDS: Quadra steering system, Turning radius.

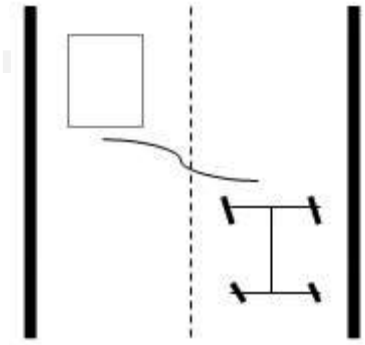
INTRODUCTION

Steering is the term applied to the collection of components, linkages, etc. which will allow vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. The most conventional steering arrangement is to turn the front wheels using a hand–operated steering wheel which is positioned in front of the driver, via the steering column.

SAILENT FEATURES OF STEERING SYSTEM

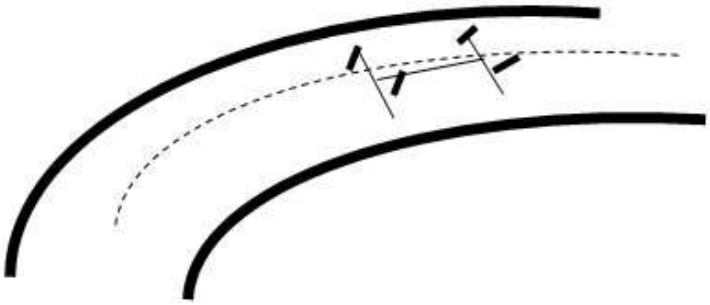
Working of the 4 wheel steering is different under varying speed condition. The operation of the system are given below

At high speed



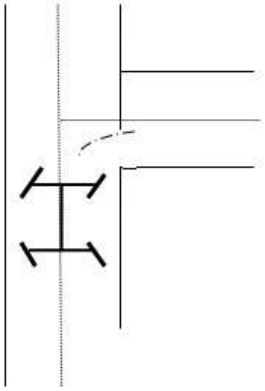
When the vehicle in high speed (above 80 km/h) as the speed of the vehicle goes increase it's difficult to control the vehicle while changing lane but in this system it will easier one to do so. At high speed the turning radius of the front wheel decrease and the rear wheel turn in same direction as front, this arrangement of the wheel enable the vehicle to change lane smoothly.

At medium speed



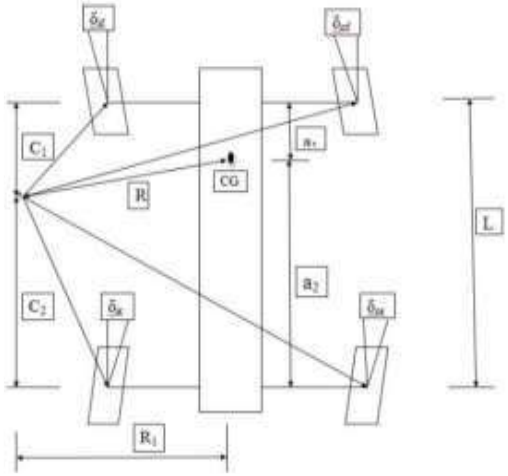
In case of medium speed i.e. in between 40 to 80 km/h driving in city or major road vehicle can moves stably in the desired direction as the front wheel moves with less steering wheel motion and rear one also turns in the same direction.

At low speed



Speed range between 10 to 40 km/h at this speed front wheel moves opposite to the rear which helps to turn the vehicle at residential and parking areas. Here the front wheel moves with less steering wheel motion so it's easier one to turn smoothly.

Calculation for turning radius

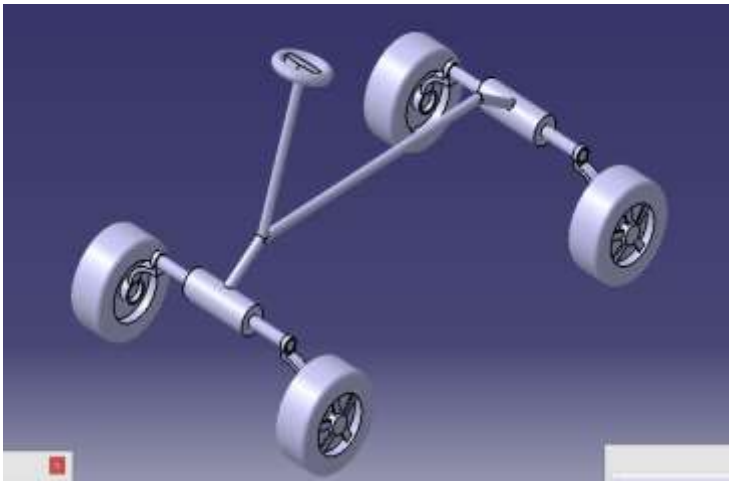


(Fig-Theoretical representation)

Where,

R=Turning radius,
L=Wheelbase,
a2=Distance between centre of gravity and rear axle,
θ=Total inner angle of vehicle,
ϕ =Total outer angle of vehicle,
δ=Total steering angle of vehicle,
Therefore, turning radius of vehicle (R) is,
R2= a2
2+ L2 (Cot2δ),
Where, cotδ = (cosθ + cosϕ) / 2

Four wheel steering system model



(Fig-4ws model using catia)

Above model is the four wheel steering system where it show that the front wheels are in right direction while the rear are in opposite direction.

Final model

(Top view)

(Where the wheel are in stable and straight)

(Top view)
(front wheels are opposite to rear)

Advantage and Disadvantage of 4 wheel steering

Advantages

- ✓ At low speed vehicle gets more stable.
- ✓ Easier in lane changing evens the vehicle in high speed.
- ✓ Accurate steering response.
- ✓ Easier to turn the vehicle in narrow road.
- ✓ High speed straight line stability.

Disadvantages

- ➢ High cost due to various components used.
- ➢ This system is very complex so it's difficult in maintenance.

CONCLUSION

On the analysis of 4 wheel steering system we came to know that this system is one of the best technology ever used in automobile which is far better than conventional steering system as it is complex in construction and for high cost it's not affordable but growing popularity of this system is likely to come more and more vehicles in upcoming days. When it's common for every one or every place it price will goes decrease.

REFERENCE

[1] Sanket bishikar, vatsal gudhka, neel dalal "Design and simulation of 4 wheel steering system"
[2] Dr. kripal singh "Automobile engineering" s standard public distributor, vol 1, 12th edition, 2012.
[3] D.S.CHOUDHARI ,Assistant Professor, Department of Mechanical Engineering, Atmiya Institute of Technology and Science, Rajkot, Gujrat 4WS ISSN 2774785.

[4] H. Sakai, T. Matsuo, S. Murayama, H. Hoshino, and R. Nagashima,Utsunomiya University, Utsunomiya, Japan.
[5] F. Vlk, "Dynamika motorových vozidel", Nakladatelství a zasilatelství VLK, Brno, 2001
[6] S. C. Chang, "Synchronization in a steer-by-wire vehicle dynamic system", International journal of engineering science, 45(2-8), 628-643, 2007
[7] C. D. Gadda, P. Yih, J. C. Gerdes, "Incorporating a model of vehicle dynamics in a diagnostic system for steer-by-wire vehicles", 2004
[8] T. Hiraoka, O. Nishihara, H. Kumamoto, Automatic path-tracking controller of a four wheel steering vehicle, Vehicle System Dynamics, 47(10), 1205-1227, 2009
[9] H. S. Kim, S. S. You, "Estimation of Vehicle Sideslip Angle for Four-Wheel Steering Passenger Cars", Transactions on Control, Automation and Systems Engineering, 3, 71-76, 2001
[10] R. S. Khurmi, J. K. Gupta, "A text book of Machine Design. Eurasia Publishing house (PVT.) Ltd", First multi color edition, pp 576-586 658-679, 1037-1040, 2005
[11] ISSN 2274-0149,no.1,jan 2014 "International journal of mechanical engineering & robotics research"
[12] Alter David Law (1989), "Alex. Transient Steady State Performance Comparison of Two-Wheel Steering and Four-Wheel Steering Vehicles", Quadra steer 2.0. Mazda Tetra COM.
[13] R. B. Gupta, "Automobile Engineering, Satya Prakashan", New Delhi, pp 3-8 and 571-579, 2007
[14] K. Singh, "Automobile Engineering Vol. 1, Standard Publishers Distributors, New Delhi, pp 448-453, 463-471, 2008.