

All Wheel Steering System

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ABSTRACT

Now a days most of the vehicles are use the two wheel steering system mechanism as their main handling system but, the efficiency of two wheel steering vehicle is proven to be low compared to all wheel steering vehicles. All wheel steering system can be employed in some vehicles to improve vehicle response, increase vehicle stability while moving at certain speed, or to decrease turning radius at low speed.

All wheel steering is a technologically, tremendous effort on heavy loaded vehicles. Hence, there is a requirement of a mechanism which result in less turning radius and it can be achieved by implementing all wheel steering mechanism instead of regular two wheel steering.

Keywords: Understeer, Oversteer, Neutralsteer, Turning radius, All wheel steering, Speed modes, Wheel configuration

1. INTRODUCTION

In this paper, both front wheel and rear wheels can be steered according to speed of vehicle and space available for turning. All wheel steering improve the stability and handling of vehicle while taking sharp turns. In that steering system, the all wheels are to be steered according to the steer perform to drive towards left or right. It should not be confused with four-wheel drive in which all wheels of a vehicle are powered.

2. COMPONENTS OF STEERING SYSTEM

The steering wheel rotates the steering column. The steering gear box is fitted to the end of this column. Therefore, when the wheel is rotated, the cross shaft in the gear box oscillates. The cross shaft is connected to drop arm. This arm is linked by

means of a drag link to the steering arm. The steering arms on both wheels are connected by tie rod to the drag link. When the steering wheel is operated, the knuckle moves to and fro, moving the wheels to the right or left.

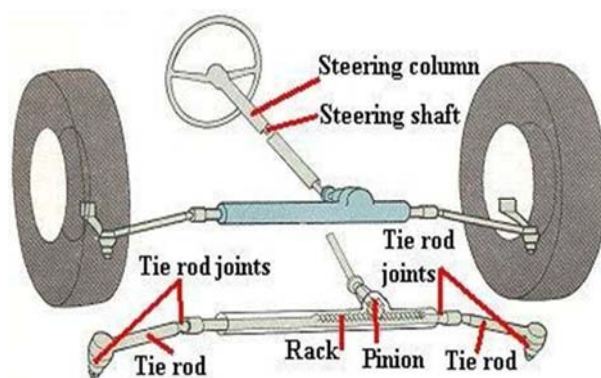


Fig.1: Basic components of steering system

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The ends of the tie rod and steering knuckle are connected to each other. One end of the drag link is connected to the tie rod. The other end is connected to the end of drop arm. A ball and socket joint gives the required movement to the joints between the tie rod, drag link and drop arm. When the vehicle is moving, the drop arm develops the vibration. Shock springs are used in ball and socket system to absorb this vibration.

3. STEERING

3.1 Slow and High Speed Modes

At Slow Speeds rear wheels turn in direction opposite to that of front wheels. This mode is used for navigating through hilly areas and in congested city where better cornering is required for U turn and tight streets with low turning circle which can be reduced as shown in Fig 2.



Fig.2 : Slow Speed

At High Speeds, turning the rear wheels through an angle opposite to front wheels might lead to vehicle instability and is thus unsuitable. Hence the rear wheels are turned in the same direction of front wheels in four-wheel steering systems. This is shown in Fig 3.



Fig.3: High Speed

3.2 In-Phase and Counter-Phase Steering

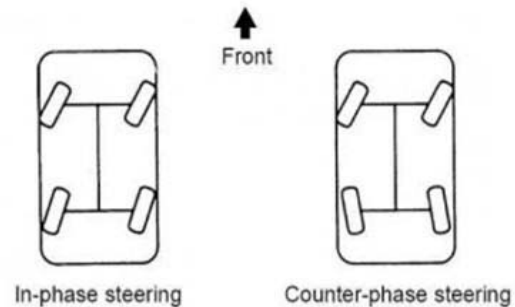


Fig.4: In- phase and counter- phase steering

4. BALANCING OF VEHICLE AND ITS STEERING

Balancing of vehicle is very important and it can be achieved in different ways i.e under-steer, over-steer and neutral-steer.

4.1 Under-Steer

Under steer is so called because when the slip angle of front wheels is greater than slip angle of rear wheels. The diagram for the under steer is given below, from the diagram the explanation is made out clear very well.

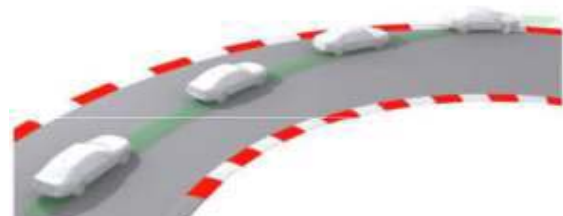


Fig.5: Under-Steer

4.2 Over-Steer

Over steer is defined when the slip angle of front wheels lesser than the slip angle of rear wheels.

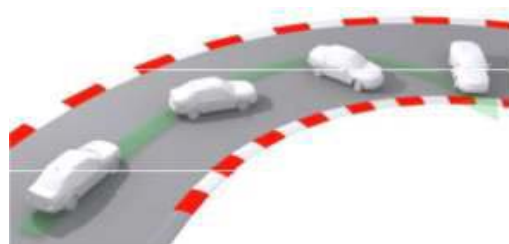


Fig.6: Over-Street

4.3 Neutral-steer or Counter-steering

Counter-steering can be defined as when the slip angle of front wheels is equal to slip angle of rear wheels.

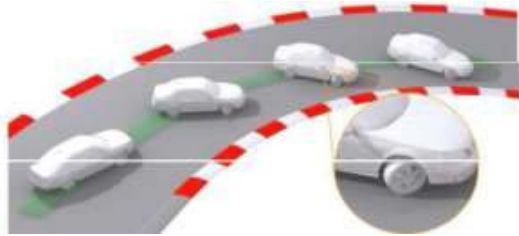


Fig.7: Neutral-Steer

5.APPLICATIONS

The ALL WHEEL STEERING system performs two distinct operations: in- phase steering, whereby the rear wheels are turned in the same direction as the front wheels, and counter phase steering, whereby the rear wheels are turned in the opposite direction. The 4WS system is effective in the following situations:

- Lane Changes
- Gentle Curves
- Junctions
- Narrow Roads
- U-Turns
- Parallel Parking

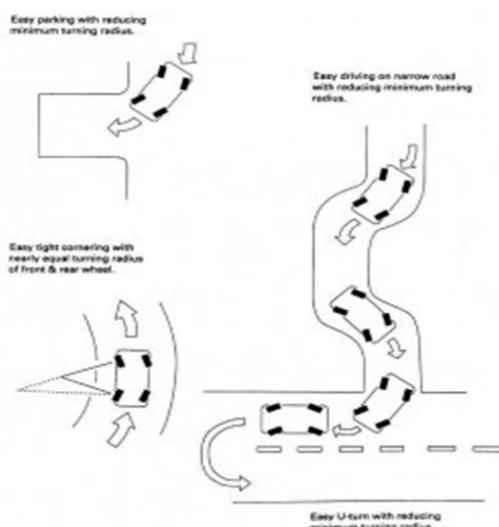


Fig.8 : Car in Various Modes

By minimizing the vehicle's turning radius, counter-phase steering of the rear wheels enables U-turns to be performed easily on narrow roads.

5.1 Parallel Parking

Zero steer can significantly ease the parking process, due to its extremely short turning footprint. This is exemplified by the parallel parking scenario, which is common in foreign countries and is pretty relevant to our cities. Here, a car has to park it between two other cars parked on the service lane. This maneuver requires a three-way movement of the vehicle and consequently heavy steering inputs. Moreover, to successfully park the vehicle without incurring any damage, at least 1.75 times the length of the car must be available for parking for a two-wheel steered car.

As can be seen clearly, the car requires just about the same length as itself to park in the spot. Also, since the 360 mode does not require steering inputs, the driver can virtually park the vehicle without even touching the steering wheel. All he has to do give throttle and brake inputs, and even they can be automated in modern cars. Hence, such a system can even lead to vehicles that can drive and park by themselves.

5.2 High Speed Lane Changing

Another driving maneuver that frequently becomes cumbersome and even dangerous is changing lanes at fairly high speeds. Although this is less steering intensive, this does not require a lot concentration from the driver since he has to judge the space and vehicles behind him. Here is how crab mode can simplify this action.

In most active four wheel steering system, the rear wheels are steered by a computer and actuators, the rear wheels generally cannot turn as far as the front wheels. Some systems including Delphi's Quadra steer and the system in Honda's

Prelude line allow the rear wheels to be steered in the opposite direction as the front wheels during low speeds. This allows the vehicle to turn in a significantly smaller radius sometimes critical for large tucks or tractors and Vehicles with trailers.

6. FUTURE ASPECTS

An innovative feature of this steering linkage design is its ability to drive all four Wheels using a single steering actuator. The system will utilize an onboard computer to control and direct the turning left and right of the rear wheels.

7. CONCLUSION

Thus, the four wheel steering system has got cornering capability, steering response, straight-line stability, lane changing and low speed maneuverability. Even though it is advantageous over the convectional two wheel steering system, four wheel steering is a complex and expensive. Currently the cost of a vehicle with four wheel steering is more than that of the convectional two wheel steering of vehicle. Four wheel steering is growing in popularity and it is likely to come in more and more new vehicles. As the system become more common place, the cost of four wheel steering system will drop down.

REFERENCES

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