

Four Wheel Steering Mechanism

Prof. N. B. Gajbhiye; Prashant Patle; Kishor Barange; Chainlal Uike & Vyankatesh Gawate

Shri Shankarprasad Agnihotri College Of Engineering Wardha

ABSTRACT

This paper aims for development of a system to reduce the turning radius of a car. The 3MI 4WS system assists driver by controlling the steering angle of a vehicle's four wheels as the requirement of driver, for making the parking and handling at congested areas easier. In this paper, both front as well as rear wheels can be steered according to speed of the vehicle and space available for turning. It makes the car more stable at speed (less body roll). It makes the car more efficient and stable on cornering, easier and safer lanes change when on motorways.

Keywords: 3MIWS; wheel; steering control

INTRODUCTION

Today, the condition of increasing road traffic makes the handling of vehicles more difficult. The present time demands an exploration of new vehicle handling mechanism, which in turn forces us to find out an alternative way instead of current system or a modified steering mechanism for better handling. While the vehicle enters a congested or narrow area there would be no one who doesn't wish for, if they would be able to reduce the turning radius of their vehicle or if they could move the whole vehicle sideways without turning the vehicle. So, here comes the application of 3 Mode Interchangeable 4 Wheel Steering (3MI4WS), which provides the same by steering the rear wheels too as our requirement.

The four wheels have fully independent Steering and need to turn in an unconventional direction to ensure that the vehicle turns around on its own axis. Such a

system requires precise calculation from a servo motor with

real-time feedback to make certain that all three steering modes function perfectly. The Only major problem posed by this layout is that A conventional rack-and-pinion steering with pitman arms would not be suitable for this Mode, since the two front wheels are steered In opposite directions. The Hurricane jeep is having the four wheels Steering System.



Fig. jeep hurricane

Ackerman steering mechanism

With perfect Ackermann, at any angle of steering, the centre point of all of the circles traced by all wheels will lie at a common point. But this may be difficult to arrange in practice with simple linkages. Hence, modern cars do not use pure Ackermann steering, partly because it ignores important dynamic and compliant effects, but the principle is sound for low speed manoeuvres.

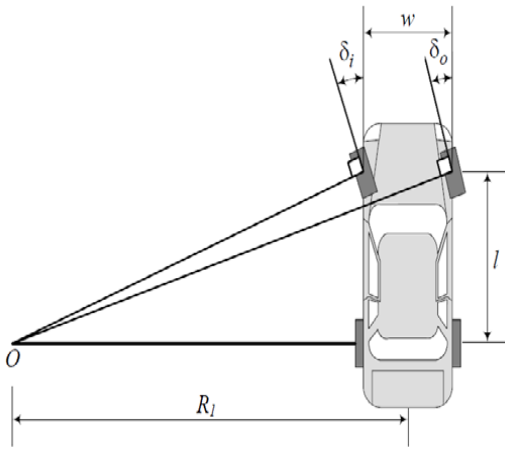


Fig. Ackerman steering mechanism

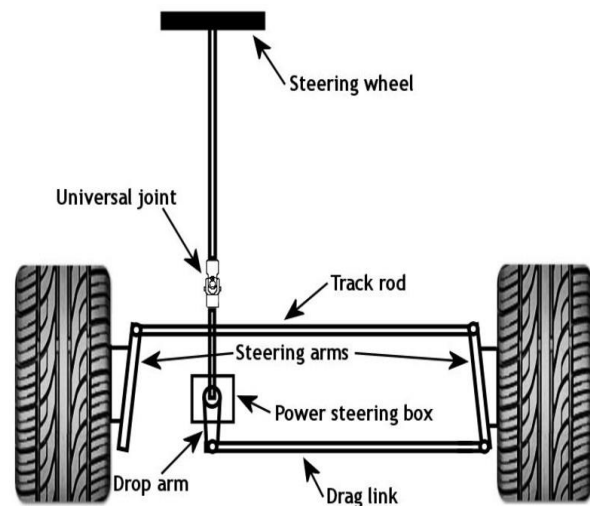
Principal Components

1. Steering wheel handles the steering operation.
2. Steering column joins the steering wheel and the steering gears.
3. Steering gears Convert the steering torque and rotational deflection from the steering wheel, transmit them to the wheel through the steering linkage, and make the vehicle turn.
4. Steering linkage is a combination of the rods and arms that transmit the movement of the steering gear to the left and right front wheels.

Working principle

The basic and widely used steering mechanism is the rack and pinion mechanism. It is suitable for all types of vehicles with different wheel track and wheel bases. The functioning of this mechanism is also quite simple to understand and use.

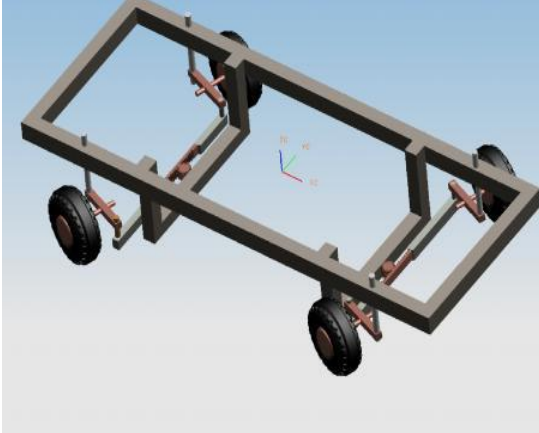
The pinion part of the steering system rotates with the steering wheel operated by the driver. The pinion is a circular gear which meshes with the gears on the rack, which is a longitudinal bar with gear teeth on it. As the pinion rotates, the rotary motion of it is transmitted as longitudinal motion on to the rack. The ends of the rack are usually connected to the kingpins of both wheels at either side by means of a drag link. This translational motion of the rack pushes or pulls the wheels about their kingpin axis, thus rotating the wheels in the desired direction.



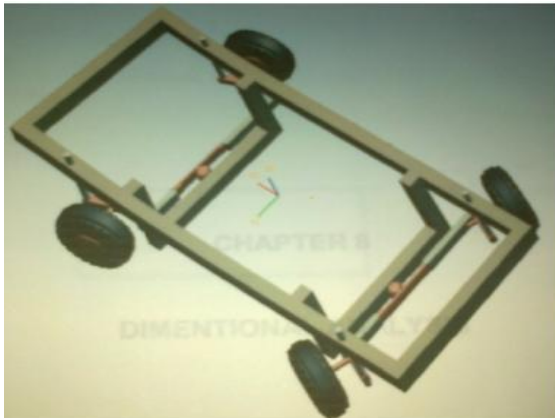
There are basically three modes of steering



- 1. Positive mode:** In this drive Both front and rear wheels steer in same direction relative to each other.

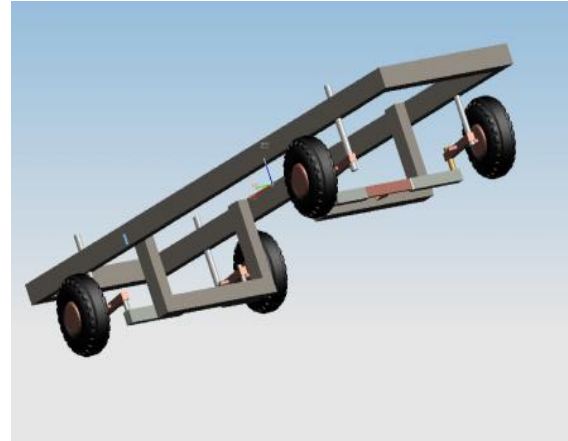


- 2. Negative mode:** In this drive Both front and rear wheels steer in opposite direction relative to each other. This drive is mainly used during parking of the vehicle. As both the axle move in different directions the radius of curvature while turning reduces. This means the vehicle will require less space for parking.



- 3. Neutral mode:** In this drive only the front wheel moves either in clockwise or anticlockwise direction and the rear wheel being unmoved.

This is the drive that we see in day to day life in all the four wheelers.



When the lock nut is removed, the steering operation is carried out in normal condition. That is only Front wheels steer.

But when the lock nut is inserted, the other two modes can be used. When the gear Arrangement is pushed to one position, the spur gears get engaged and the steering of rear wheel is ensured and Is in same direction as that of the front wheels.

When the gear arrangement is moved to other side, the spur gear Disengages and the bevel gear gets engaged. Due to bevel gear arrangement, the rear wheel steers in opposite Direction to the front wheel. This results in third mode steering.

Specification

- **Superior cornering stability:** The vehicle cornering behavior becomes more stable and controllable at high speed as well as on wet slipping road surfaces.
- **Improved steering response and precision:** The vehicle response to



steering input becomes quicker and more precise throughout the vehicle enter speed range.

- **High speed straight line stability:** The vehicle's straight line stability at high speed is improved. Negative effects of road irregularities and crosswinds on the vehicles stability are minimized.
- **Improved rapid lane-changing maneuvers:** This is stability in lane changing at high speed is improved. In high speed type operation become easier. The vehicle is less likely to go into a spin even in situations in which the driver must make a sudden and relatively large change of direction.
- **Smaller turning radius:** By steering the rear wheels in the duration opposite the front wheels at low speed, the vehicle's turning circle is greatly reduced. Therefore, vehicle maneuvering on narrow roads and during parking become easier.
- **Controlling:** Computer-controlled Quadrasteer can be switched on and off and has an effective trailer towing mode.

- Easy removal of vehicle from the traffic jam.
- Turning back at narrow roads.
- Increase stability of the vehicle

References

- [1] R. K. Rajput, "A Text book of Automobile Engineering".
- [2] "Theory Of Machine" Book by R.S. KRUMI
- [3] Jack Erjavec, Automotive Technology, A System Approach , 5th Edition, 2010.
- [4] Farrokhi, Four wheel steering, http://www.iust.ac.ir/files/ee/farrokhi_0a5f0/journal_papers/j13.pdf , Retrieved on 20th Oct 2012.

Conclusion

From the analysis it is noted that the turning radius of the vehicle can be reduced to a great extent by using four wheel steering mechanism without crossing the practical limitations with the following applications.

- Better parking in narrow space.