IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

FABRICATION OF FOUR-WHEEL STEERING

[1]Dr.K.Mallikarjuna, [2]Paladugu Vijay Kumar, [3]Dasari Naresh, [4]Chinta Sumanth, [5]Shaik Afroz Basha.

[1]Professor and Head Of The Department of Mechanical Engineering, G. Pullaiah College of Engineering & Technology, Kurnool, India.

[2,3,4,5]Engineering Student Department of Mechanical Engineering, G. Pullaiah College of Engineering & Technology, Kurnool, India.

Abstract :

Nowadays, every vehicle uses the two-wheel steering system to control the movement of the vehicle whether it is a front-wheel drive, rear-wheel drive, or all-wheel drive. But due to the awareness of safety, four-wheel steering vehicles are being used increasingly due to the high performance and stability that they bring to the vehicles. In this report, the performance of four wheels steered vehicle model is considered which is optimally controlled during a lane change manoeuvre in three types of conditions: low-speed manoeuvre, medium-speed manoeuvre, and high-speed manoeuvre. For parking and low-speed manoeuvres, the rear wheel steers in the opposite direction of the front wheels, allowing much sharper turns. At higher speeds, the rest wheels steer in the same direction as the front wheels. The result is more stability and less body lean during fast lane changes and turns because the front wheels don't have to drag non-steering rear wheels onto the path.

Keywords: Two-wheel steering, four-wheel steering, rack and pinion, intermediate shaft, oversteer, understeer.

Introduction:

In an automobile, the steering of the vehicle plays a major role in the control of the path of motion of the vehicle. The steering systems are designed to give the best control designed for the vehicle. The vehicles are designed with steering control to the front wheels or in certain cases steering control is given to the rear wheels. Yet in any vehicle, the steering control is given to only the front axle or in certain cases the rear axle. This is normally referred to as a two-wheel steering system.

The two-wheel steering system employs only two out of the four wheels of a light motor vehicle. We can observe that the turning radius of the vehicle increases as the vehicle becomes bigger, longer and wider. With the increased traffic in cities, smaller roads and congestion, the bigger the vehicle more pressure and strain the driver undergoes. This makes turning the vehicle in small corners difficult. Even when the vehicle is driven on highways the vehicle is subjected to understeer and oversteer. This effort can be reduced by even employing the rear wheels of the vehicle to provide steering action. In a general steering mechanism, the vehicle's rear wheels do not play a significant role in the steering control of the vehicle. The rear wheels are fixed along a straight path of motion. So, employing the rear wheels to provide steering action will help to reduce the turning radius of the vehicle thereby, reducing the steering effort on the driver. The rear wheels of the vehicle can move in two phases concerning the front wheels, in-phase, and counter-phase. In the counter phase, the rear wheels rotate in the opposite direction of that of the front wheels giving a reduced turning radius to the vehicle whereas, in phase, the rear wheels rotate in the same direction as the front wheels providing a sliding action of the vehicle. The system is called a four-wheel steering system.

In the present study, the steering system is designed to have a 3-mode function, counter-phase steering, in-phase steering and no steering modes. These modes are selectable depending on the driver. It helps reduce the turning radius by about 20% to 30%. This system allows the vehicle to have reduced understeer and oversteer of vehicles. The vehicle has a turning motion with a reduced radius in counter-phase and a sliding motion in in-phase.

PURPOSE:

Four Wheel steering is a system employed by some vehicles to improve steering response, increasing vehicle stability while manoeuvring at high speed or decreasing turning radius at low speed. With all four wheels steering, instead of only the front two, this technology offers unprecedented control and manoeuvrability.

- Increasing stability of the vehicle while turning.
- Increasing agility of the vehicle.
- Decreasing turning radius.
- Decreases chances of skidding.

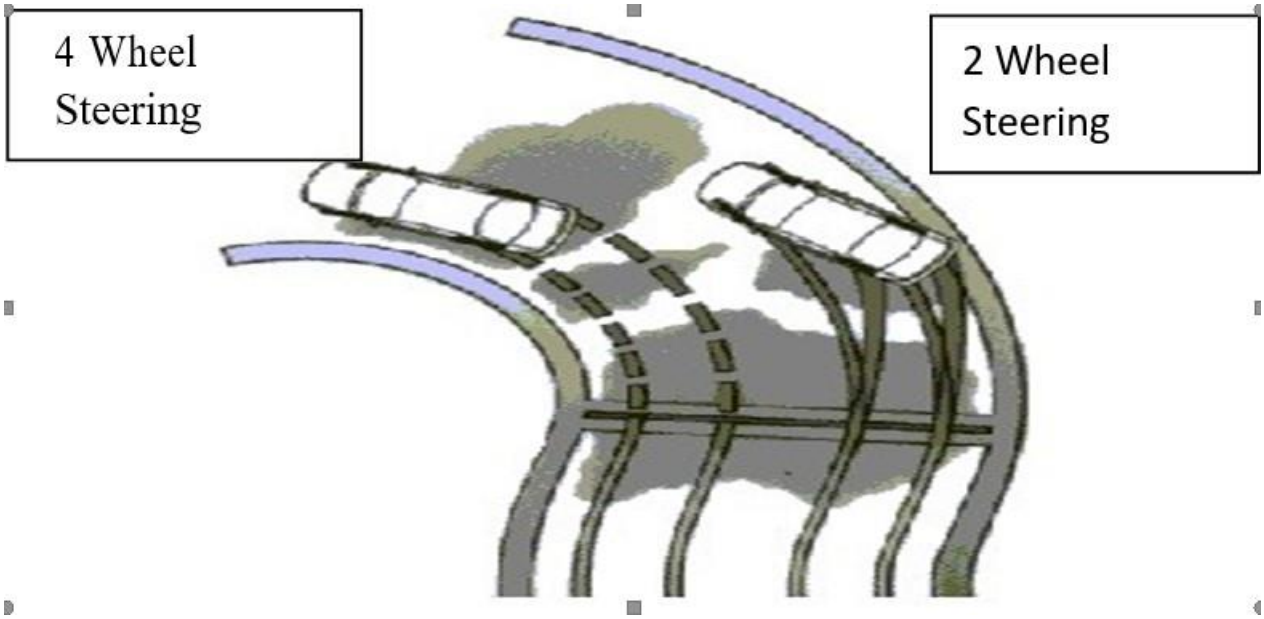

FIG 1. Comparison of Two-wheel drive and Four-wheel drive.

Four Wheel Steering

- Four-wheel steering, 4WS, also called rear-wheel steering or all-wheel steering, provides a means to actively steer the rear wheels during turning manoeuvres. It should not be confused with four-wheel drive in which all four wheels of a vehicle are powered. It improves handling and helps the vehicle make tighter turns. Production-built cars tend to understeer or, in a few instances, oversteer. If a car could automatically compensate for an under-steer/over-steer problem, the driver would enjoy nearly neutral steering under varying conditions.
- 4WS is a serious effort on the part of automotive design engineers to provide near-neutral steering. The front wheels do most of the steering. Rear wheel turning is generally limited to half during an opposite-direction turn. When both the front and rear wheels steer in the same direction, they are said to be in in-phase, and this produces a kind of sideways movement of the car at low speeds. When the front and rear wheels are steered in opposite directions, this is called anti-phase, counter-phase, or opposite-phase and it produces a sharper, tighter turn.
- This project aims to develop a 4 Wheel Steering System which would cater to the needs of people. This system is employed to improve steering response, increase vehicle stability while manoeuvring at high speed, or decrease turning radius at low speed.
- The concept is simple. Rather than controlling a car solely by the angle at which the front tires meet the road the method used by wheeled vehicles since the horse-drawn carriage, four-wheel steering turns the wheels simultaneously at both ends of the car. Theidea is intuitively appealing to any city driver who hasever pulled up to a too-short parking space and wished he could point all four tires toward the curb and crab right in.
- Not so easy. For starters, the rear wheels of a four-wheel-steer car do not always turn in tandem with the front wheels. Depending on the speed of the car, the rear wheels may turn in the same direction (same-side steering) as the front wheels, or in theopposite direction (counter steering). Most of the new four-wheel-steer autos are capable of both counter-steering and same-side steering. In sharp, slow-speed turns, counter steering can shave a full yard off a standard sedan's turning radius. At high speeds, however, counter steering can make a car dangerouslyunstable, while same-side steering improves the ride.
- The difference comes from the dynamics of high-speed motoring. When a driver travelling at highway speeds turns the wheel of a conventional, two-wheel steering car, the front tires immediately begin to pivot and the car's forward momentum generates a powerfulsideways or cornering force at the front axle. The rear tires, however, have to wait until the car has started its turn before they begin to generate a corresponding force at the rear axle. That is why a car with two-wheel steering fishtails during lane changes;the back end is trying to catch up to the front. In extreme cases, or under slippery conditions, the rear of the car may fishtail out of control.

In a four-wheel-steer car, this high-speed sway can be damped or even eliminated through the use of same-side steering. When the rear wheels are turned at the same time and in the same direction as the front wheels, the back end turns with the front, and the cornering forces occur at both axles simultaneously. The car slides smoothly to the side without sway or a fishtail.

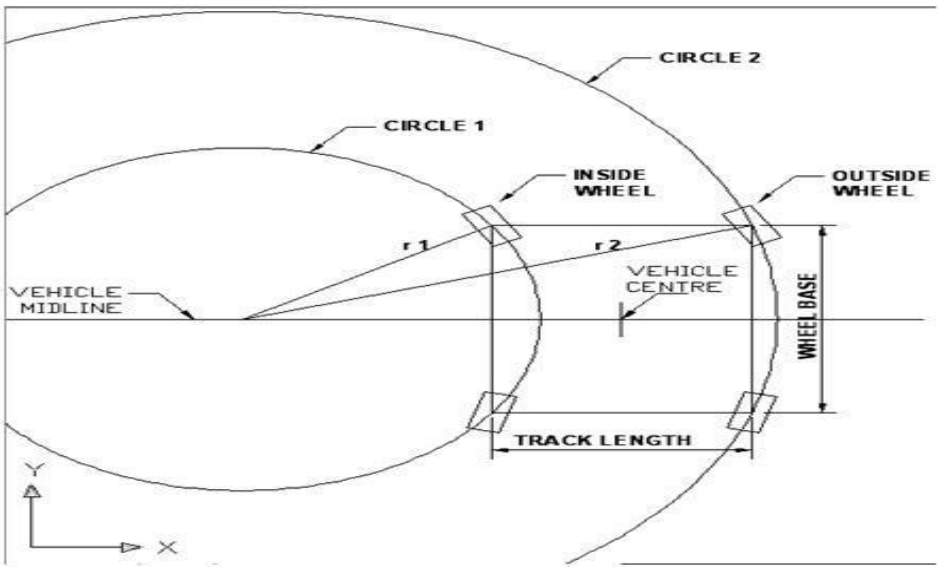

Fig: 2. Turning radius for inner and outer wheel.

Working:

- It consists of a rack-and-pinion front steeringsystem that is hydraulically assisted by a twin-tandem pump main power source.
- The rear wheel steering mechanism is also hydraulically assisted by the main pump and electronically controlled - according to the front steering angle and vehicle speed.
- The rear steering shaft extends from the rack bar of the front steering gear assembly to the rear steering-phase control unit.
- The rear steering system is comprised of the inputend of the rear steering shaft, vehicle speed sensors, a steering-phase control unit(determining direction and degree), a power cylinder, and an output rod
- A centring lock spring is incorporated, which locks the rear system in a neutral (straightforward) position in the event of hydraulic failure. Additionally, a solenoid valve that disengages hydraulic assist (thereby activating the centring lock spring) in case of an electrical failure is included.
- The 4WS system varies the phase and ratio of the rear-wheel steering to the front wheels, accordingto the vehicle speed.
- It steers the rear wheels toward the opposite phase (direction) of the front wheel during speedsless than 35km/h (22mph) for a tighter turn and "neutralizes" them (to a straightforward direction,as in a conventional two-wheel steering principle) at 35km/h (22mph).
- Above the speed of 35 km/h, the system steers toward the same phase direction as the front wheels, thereby generating an increased cornering force by stability.
- The maximum steering angle of the rear wheels extends 10 degrees.

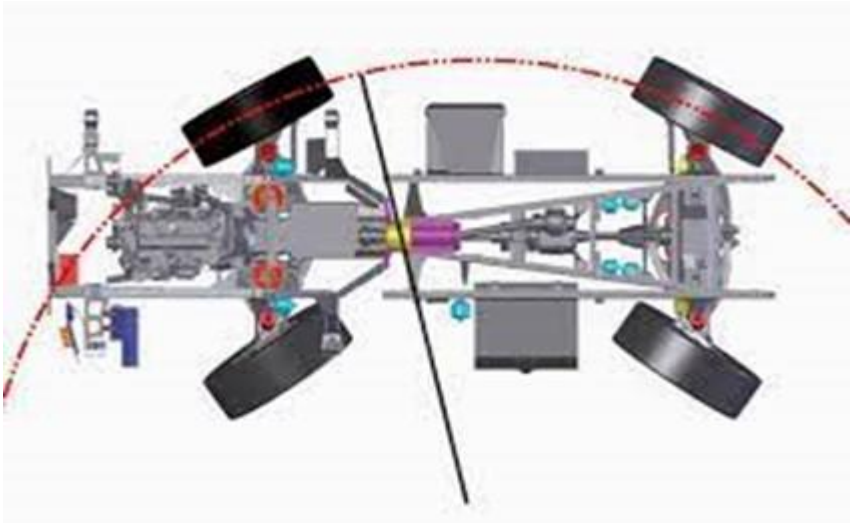

Fig: 3 Working Unit

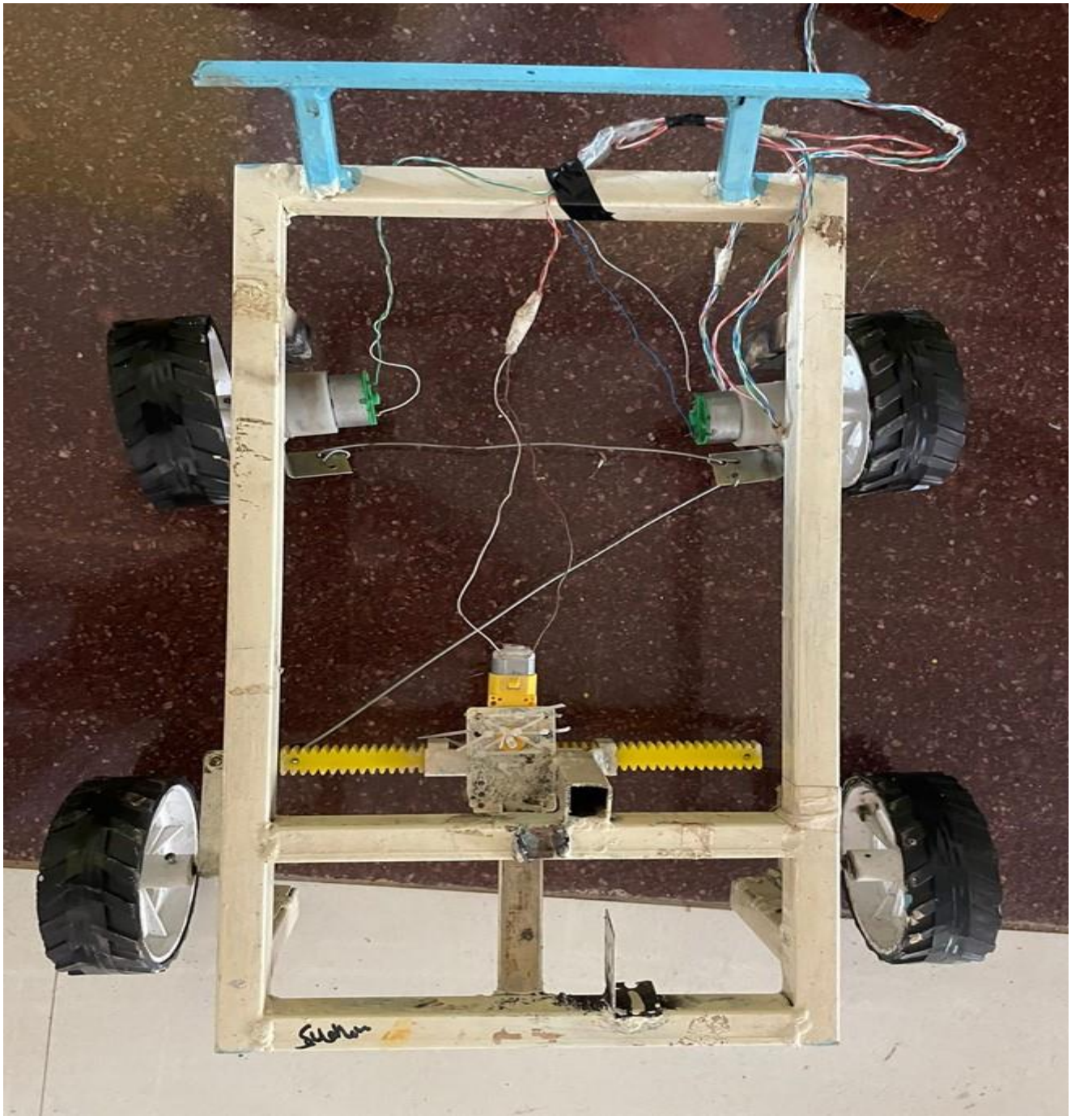

Fig 4: Working Model.

ADVANTAGES:

- **Superior cornering stability:** The vehicle cornering behaviour becomes more stable and controllable at high speed as well as on wet slippering road surfaces.
- **Improved steering response and precision:** Thevehicle response to steering input becomes quicker and more precise throughout the vehicle's entry speed range.
- **High-speeded straight-line stability:** The vehicle'sstraight-line stability at high speed is improved. The negative effects of road irregularities and crosswinds on the stability of the vehicle are minimized.
- **Improved rapid lane-changing manoeuvres:** This 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 wheelsat low speed, the vehicle's turning circle is greatly reduced. Therefore, vehicle manoeuvring on narrow roads and during parking becomes easier.
- **Controlling:** Computer-controlled Quadra steer can be switched on and off and has an effective trailer towing mode.

APPLICATIONS:

- **Parking:** During parking, the driver of a vehicle typically turns the steering wheels through a largeangle to achieve a small turning radius. By counter-phase steering of the rear wheels, the 4ws system realizes a smaller turning radius than is possible with the 2ws system. As a result, the vehicle is turned in a small radius at parking.
- **Junctions:** On a crossroad or other junction where roads intersect at 900 degrees or tighter angles, counter-phase steering of the rear wheels causes the front and rear wheels to follow a more-or-less path. As a result, the vehicle can be turned easily at a junction.
- **Slippery road surfaces:** During steering operation on low friction surfaces, steering of the rear wheels suppresses the sideways drift of the vehicle's rear end. As a result, the direction of the vehicle is easier to control.
- **High-speed straight-line operation:** When travelling in a straight line at high speed, a vehicle's driver frequently needs to make small steering corrections to maintain the desired direction, in phase steering of the rear wheels minimizes these corrective steering inputs.
- **Narrow roads:** On narrow roads with tight bends, counter-phase steering of the rear wheels minimizes the vehicle's turning radius, thereby reducing side–to–side rotation of the steering wheels and making the vehicle easier to turn.

  z
- **U-Turns:** By minimizing the vehicle's turning radius, counter–phase steering of the rear wheels enables U-turns to be performed easily on narrowroads.

CONCLUSION:

Four-wheel steering is a relatively new technology, that imposes manoeuvrability in cars, trucks, and trailers .in standard two wheels steering vehicles, the rear set of wheels is always directed forward therefore and does not play an active role in controlling the steering in four-wheel steering system the rear wheel can turn left and right. To keep the driving controls as simple as possible.

The aim of the 4WS system is better stability during overtaking manoeuvres, reduction of vehicle oscillation around its vertical axis, reduced sensibility to lateral wind, neutral behaviour during cornering, etc., i.e. improvement of active safety.

REFERENCES:

[1] Kirpal Singh M Automobile *engineering* (Delhi- Standard publishers).
[2] Chanpreet Singh, Rupesh Gupta, Himanshu Jindal and Rajeev Kumar Dang 2015 *Adv.Mater.Manuf.Technol.* **4** 10.
[3] Aman Doraya, Mohit Singh Panesar, Bhavya Bhardwaj and Aditya Bochare 2015 *Int.Jour.Mech.Engg. Technol.* **6** 2.
[4] http://what-when-how.com/automobile/four-wheel-steering-4ws-automobile/
[5] Amitesh Kumar Er and Kamble, D N 2014 *Int.Jour.Sci.Engg. Res.* 5 1635.
[6] http://www.scribd.com/doc/34677964/FourWheel-Steering-report.