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Research Article

Multi Functional Steering Vehicle

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Abstract

Production cars are designed to under steer and rarely do them over steer. If a car could automatically compensate for an under steer/over steer problem, the driver would enjoy nearly neutral steering under varying operating conditions. Four-wheel steering is a serious effort on the part of automotive design engineers to provide near-neutral steering. Also in situations like low speed cornering, vehicle parking and driving in city conditions with heavy traffic in tight spaces, driving would be very difficult due to vehicle's larger wheelbase and track width. Hence there is a requirement of a mechanism which result in less turning radius and it can be achieved by implementing four wheel steering mechanism instead of regular two wheel steering. In standard 2 Wheel Steering System, the rear set of wheels are always directed forward and do not play an active role in controlling the steering. While in 4 Wheel Steering System, the rear wheels do play an active role for steering, which can be guided at high as well as low speeds We have developed an innovative 4 wheel steering design to implement a mechanism that can serve the purpose of changing in-phase and counter-phase steering of rear wheels depending upon the conditions of turning and lane changing with respect to front wheels, thus enhancing the maneuverability of a sedan in accordance with its speed. We can use this car with two wheel steering system also. And another major advantage we provided is Ring Motion to the car, it will helps to when our car is in motion, a sudden obstacle obtain we don't take the turning we just change the gear to ring motion and the total body of the car is reversed. Finally the four functions are arranged in a single car so we called it as a Multifunctional Four Wheel Steering System

Keywords: *2W Steering, 4W Steering, In-Phase, Ring Motion.*

1. Introduction

Steering is the term applied to the collection of components, linkages, etc. which will allow a vessel (ship, boat) or vehicle (car, motorcycle, and bicycle) to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches provide the steering function. 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, which may contain universal joints, to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, a tiller or rear–wheel steering. Tracked vehicles such as bulldozers and tanks usually employ differential steering that is, the tracks are made to move at different speeds or even in opposite directions, using clutches and brakes, to bring about a change of course or direction. The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is typically achieved by a series of linkages, rods, pivots and gears. One of the concepts is that of caster angle - each wheel is steered with a pivot point ahead of the wheel; this makes the steering tend to be self-centering towards the direction of travel. The steering linkages connecting the steering box and the wheels usually conforms to a variation of Ackermann steering geometry, to account for the fact that in a turn, the inner wheel is actually travelling a path of smaller radius than the outer wheel, so that the degree of toe suitable for driving in a straight path is not suitable for turns. The angle the wheels make with the vertical plane also influences steering dynamics (see camber angle) as do the tires. Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear; the pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion). This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm.

Four-wheel steering, 4WS, also called rear-wheel steering or all-wheel steering, provides a means to actively steer the rear wheels during turning man oeuvres. It should not be confused with four-wheel

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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 under steer or, in few instances, over steer. 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 toward the same direction, they are said to be 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 direction, this is called anti-phase, counter-phase or opposite-phase and it produces a sharper, tighter turn. This project aims at developing 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 to decrease turning radius at low speed. Four-wheel steering (or all wheel steering) is a system employed by some vehicles to improve steering response, increase vehicle stability while manoeuvring at high speed, or to decrease turning radius at low speed.

2. Performance

The main theme of this project is to make a car with both two wheels and four wheel steering system. we 100% succeeded in that but already some of the projects existed with this type so we plan to add some more additional functioning to this vehicle so for this reason we study so many automobile books, websites & journals finally we got an idea to implement in-phase i.e. parallel motion and ring motion up to now as per our knowledge we don't have this type of system in any car. The systems in this car are explained below

2.1 Two Wheel Steering

For perfect steering we must always have an instantaneous centre about which all the wheels must rotate.

Fig 2.1 Two wheel driving mode

For this purpose inner wheel has to turn more than the outer wheel. To achieve this condition, two types of mechanism, have been devised viz., the Davis and Ackermann steering mechanism. Out of these Ackermann mechanism is almost universally used because of its simplicity. Most of the cars present we have two wheel steering system. But the turning radius of two wheel steering system is more. Parking and reverse gearing and turning by using this system is some difficult but it is very easy to operate. In our project the two wheel steering system is shown in above. We change the front gear levers like this. Once we arrange the levers like this the vehicle changed to two wheel steering system mode.

2.2 Four Wheel Steering System

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 under steer or, in few instances, over steer. 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 toward the same direction, they are said to be in phase and this produces a kind of sideways movement of the car at low 4 speeds. When the front and rear wheels are steered in opposite direction, this is called anti-phase, counter-phase or opposite-phase and it produces a sharper, tighter turn.

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This project aims at developing 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 to 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. The idea is intuitively appealing to any city driver who has ever pulled up to a too-short parking space and wished he could point all four tires toward the curb and crab right in. The lever arrangement for this four wheel steering system mode is shown below

2.3. In-Phase Steering

This is a special and advanced type of steering system in this type the vehicle travel in parallel direction it is mainly helpful in 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. In this figure the four wheels not exactly in parallel direction but we can apply this mechanism to large vehicles we use Hydraulic Systems so we can get exact parallel Motion.

For the parallel steering system mode we will change the levers into following direction.

2.4. Ring Motion

It is one of the top mechanisms implemented in this project main agenda for this mechanism is when there is a sudden obstruction in travelling there is no necessity to take the reverse gear we just change the lever to ring motion mode the vehicle totally reversed at that place with limited radius.

The ring motion is very useful for off road vehicle like Mahindra bolero and jeeps etc….in off road and rock, hill areas the vehicle face lot of problem to take the turnings due to uneven surfaces so at that time we change the lever ring motion mode the entire body of the vehicle is reversed in very limited radius with less time.

The conversion of ring motion mode is change the levers to front it is shown in given below.

3. Applications

- During a parking a vehicles driver typically turns the steering wheels through a large angle to achieve a small tuning radius. By counter phase steering of the rear wheels, 4ws system realizes a smaller turning radius then is possible with 2ws system. As a result vehicle is turned in small radius at parking.
- When traveling in a straight line at high speed, a vehicle's driver frequently needs to make small steering correction to maintain the desired direction; in phase steering of the rear wheels minimizes these corrective steering inputs.
- 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.
- By minimizing the vehicle's turning radius, counter –phase steering of the rear wheels enables U-turns to be performed easily on narrow roads.
- On a cross roads 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 more or-less path. As a result the vehicle can be turned easily at a junction

Conclusion

The project carried out by us made an impressing task in the field of automobile industries. It is very usefully for driver while driving the vehicle. In this we arrange 4 modes in a single car. The aim of my project modes, We have developed an innovative 4 wheel steering design to implement a mechanism that can serve the purpose of changing in-phase and counter-phase steering of rear wheels depending upon the conditions of turning and lane changing with respect to front wheels, thus enhancing the maneuverability of a sedan in accordance with its speed. 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 are always directed forward therefore and do 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.

We can use this car with two wheel steering system also. And another major advantage we provided is Ring Motion to the car, it will helps to when our car is in motion, a sudden obstacle obtain we don't take the turning we just change the gear to ring motion and the total body of the car is reversed. Moreover components used in this system are easy to Fabricate & material used is feasible, reliable and easily available in market. The system assembly is easy to install and light in weight and can be implemented in all sections of cars efficiently. Finally the four functions are arranged in a single car so we called it as a Multifunctional Four Wheel Steering System. but here we prepared just a demo model with purely mechanical System once we applied this mechanism to large vehicles we use hydraulic Mechanism then we get better results and very easy to operate the vehicle.

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