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Project on Electronic Steering Sysytem

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Abstract: As the four-wheel steering (4WS) system has great potentials, many researchers' attention was attracted to this technique and active research was made. As a result, passenger cars equipped with 4WS systems were put on the market a few years ago. This report tries to identify the essential elements of the 4WS technology in terms of vehicle dynamics and control techniques. Based on the findings of this investigation, the report gives a mechanism of electronically controlling the steering system depending on the variable pressure applied on it. This enhances the controlling and smoothens the operation of steering mechanism.

I. INTRODUCTION

1.1 steering mechanism

Steering is the collection of different components which helps us to control our vehicles. So, it is one of the most important part of our vehicles and also it help us to provide relevant motions to our vehicle. But in traditional design there are some parts which we have used just for supporting purpose on the recent technology if we try to change that we can more effective operations from steering wheel. In our project we have replaced the tie rod which is present at the lower portion of the vehicle and it provide support to the steering rod and also it help us to provide wheels movement. We have replaced these part with linear actuator.

A linear actuator is a device which helps to convert low form of energy into high form of energy in linear form and these device help us to control our vehicle movements.

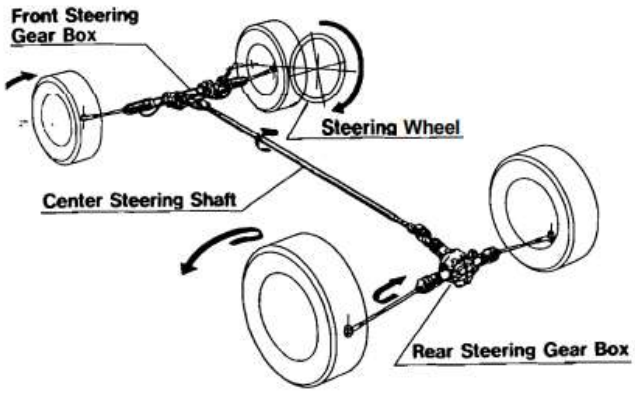

Fig 1: Steering System

System construction

During driving our bodies 1.6% energy is used by our hands and 0.5% energy is used by our legs and according to the study of human tendency we get to know that our brain system sends quick alert message to our hand as compared to our legs. That's why during accidental cases we get to see that many times driver during accidental cases they use to control vehicle with the help of steering wheel and due to that brake is not applied by them. So we have try to use the energy which is getting generated between steering wheel and human hand. With the help of these energy we are trying to operate our vehicles operation like acceleration and brake. As according to the condition human energy generation on the steering wheel gets changes so it will be best method to operate the vehicles.

1.2 Piezoelectric sensor:

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix piezo- is Greek for 'press' or 'squeeze'.

1.2.1 Applications

Piezoelectric sensors are versatile tools for the measurement of various processes. They are used for quality assurance, process control, and for research and development in many industries. Pierre Curie discovered the piezoelectric effect in 1880, but only in the 1950s did manufacturers begin to use the piezoelectric effect in industrial sensing applications. Since then, this measuring principle has been increasingly used, and has become a mature technology with excellent inherent reliability.

They have been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a tilt sensor in consumer electronics[1] or a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built-in miniature piezoelectric sensor.

The rise of piezoelectric technology is directly related to a set of inherent advantages. The high modulus of elasticity of many piezoelectric materials is comparable to that of many metals and goes up to 106 N/m².[citation needed] Even though piezoelectric sensors are electromechanical systems that react to compression, the sensing elements show almost zero deflection. This gives piezoelectric sensors ruggedness, an extremely high natural frequency and an excellent linearity over a wide amplitude range. Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some materials used (especially gallium phosphate or tourmaline) are extremely stable at high temperatures, enabling sensors to have a working range of up to 1000 °C. Tourmaline shows pyroelectricity in addition to the piezoelectric effect; this is the ability to generate an electrical signal when the temperature of the crystal changes. This effect is also common to piezo ceramic materials.

1.2.3 Sensing materials

Two main groups of materials are used for piezoelectric sensors: piezoelectric ceramics and single crystal materials. The ceramic materials (such as PZT ceramic) have a piezoelectric constant/sensitivity that is roughly two orders of magnitude higher than those of the natural single crystal materials and can be produced by inexpensive sintering processes. The piezoeffect in piezoceramics is "trained", so their high sensitivity degrades over time. This degradation is highly correlated with increased temperature.

The less-sensitive, natural, single-crystal materials (gallium phosphate, quartz, tourmaline) have a higher – when carefully handled, almost unlimited – long term stability. There are also new single-crystal materials commercially available such as Lead Magnesium Niobate-Lead Titanate (PMN-PT). These materials offer improved sensitivity over PZT but have a lower maximum operating temperature and are currently more expensive to manufacture.

II. LITERATURE SURVEY

[1] Advanced Steering System with artificial steering wheel torque-active kinesthetic information feedback for improving handling qualities is discussed. Fundamentally the structure of the system may be considered to another form of model following control. In this system, a driver always remains in the control loop and receives steering control information which give him/her a direct hint to steer a steering wheel. This system works as a stability and control augmentation system of the vehicle to improve the vehicle handling qualities both in compensatory and pursuit control task, and is expected to reduce driver's workload. Effects of this system are analyzed in terms of man-machine system characteristics. Identification of driver dynamics was carried out to find why such improvement could be achieved. Availability of the proposed system is verified by analysis, simulator and proving ground tests.

[2] A discussion of low speed maneuvering shows why significant improvements in parallel parking cannot be expected. Using the classical two degree-of-freedom “bicycle model” of the automobile, comparisons of highway maneuverability are made between 4WS and FWS (front-wheel steering) cars. The 4WS lateral response has less phase lag, which permits rapid lane changes with less high frequency motion of the steering wheel. In addition, 4WS vehicles can make more efficient use of tires during transient maneuvers. An extended mathematical model which treats steer angle as a degree of freedom shows that a free control FWS mode is stabilized by either of two 4WS mechanisms considered. This weave oscillation can be excited by a rapid application of steering torque, so moderating the resonance with 4WS probably helps drivers maintain control during emergency maneuvers.

[3] We have already proposed a feedforward type control system for the four wheel steering (4WS) vehicle using the model following control theory. The control system is designed on the assumption that the input is the steering wheel angle. In this paper we deal with the stability of the 4WS vehicle. Generally, it is considered that the driver steers a vehicle by both steering wheel angle and steering wheel torque. We carry out an investigation of the pole location and a computer simulation for the 4WS vehicle as a steering wheel torque input system that has a feedback path to the control system through the dynamics of a steering system. Furthermore, proving ground tests are conducted with a real 4WS vehicle. The results show that the feedforward control system has an effectiveness to stabilize the vehicle motion

[4] A series of closed–loop tests was conducted on a lateral motion simulator and a proving ground to find out how the driver's control performance would be affected by the steering response characteristics of the vehicle. In any existing automobile with a conventional front–wheel steering system, the yaw and lateral acceleration responses can hardly be separated from each other. During the tests, these two characteristics were set independently by using a special experimental vehicle that could steer both the front and rear wheels. This permitted us to examine separately the roles that each of the two response characteristics play in a driver–vehicle system

III. METHODOLOGY

A chassis consists of an internal framework that supports a manmade object in its construction and use. It is analogous to an animal's skeleton. An example of a chassis is the under part of a motor vehicle, consisting of the frame. Sometimes the goal of using a gear motor is to reduce the rotating shaft speed of a motor in the device being driven, such as in a small electric clock where the tiny synchronous motor may be spinning at 500 rpm but is reduced to one rpm to drive the second hand, and further reduced in the clock mechanism to drive the minute and hour hands

Fig 2: Wheels motor Alignment

. Here the amount of driving force is irrelevant as long as it is sufficient to overcome the frictional effects of the clock mechanism. A wheel is a circular component that is intended to rotate on an axial bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines.

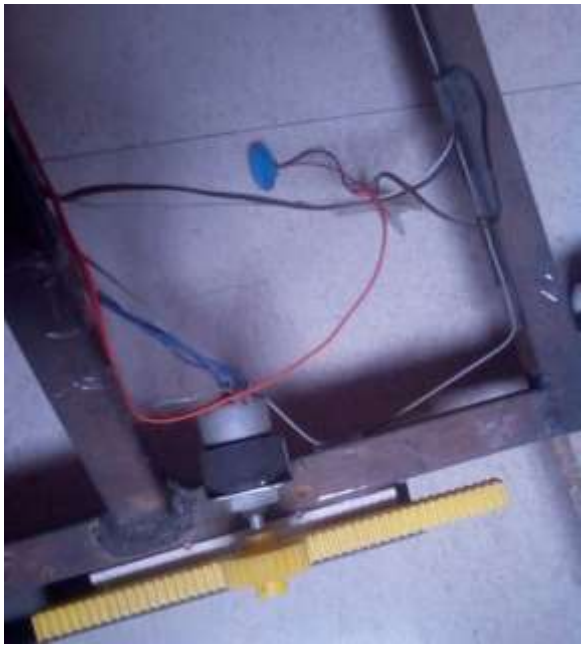

Fig 3: Rack And pinion Arrangement

Fig 4: Piezoelectric Sensor

Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. A stepper motor (or step motor) is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application.

Fig 5: Display And Sensing recorder

Fig 6: Battery operations

Fig 7: Chasis Construction

IV. CONCLUSION

Pressure sensors helps to provide automatic control of the steering system. This helps in reducing accidental cases on roads. As the pressure on the steering system has increased during abnormal conditions the brakes are applied automatically. This control can proof to be highly beneficial to handicapped persons who unable to fully operate the mechanical arrangement. Moreover, the system is diver friendly, eco friendly with more efficient and fast operation of steering mechanism

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