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A Review Paper on Electric Assisted Steering System for Automobiles

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ABSTRACT

Electric Assisted Steering system is an Electric System, which reduces the amount of steering effort by directly applying the output from the electric motor to the steering system.In this system the mechanical link between the steering wheel and road wheels of an automobile are replaced by a control system consisting of sensors, actuators and controllers seem to offer great advantages such as enhanced system performance, simplified construction, design flexibility etc.It offers greater vehicle safety by adapting variable steering ratios to human needs, filtering drive train influences and even adjusting active steering torque in critical situations. In addition, it can make cars even lighter and more fuel efficient when compared to those using hydraulic steering systems. The central electronic elements of today's steering systems are modern microcontrollers

INTRODUCTION

The steering system of an automobile serves two main functions: firstly it allows the driver to make the vehicle follow a desired path or trajectory without requiring excessive physical effort and secondly, it assists the driver to judge the driving conditions by allowing some feedback. The latter is a subtle aspect of the steering system, with the driver in the feedback loop striving to minimize the error which the vehicle may have from the desired path [1]

One of the most important parts of the EPS system is the electric control system, which receives signals collected by sensors for vehicle speed, steering angle, steering torque and controls the assistant motor for giving required assistant torque. The key of this control system is to find a boosting curve to embody the assist characteristic. Most researchers of EPS emphasize on the control strategy. Few of assist characteristics is studied. [2] A model-based development method for EPS system has been explored. A model for the EPS system has been established in a full vehicle mechanical system environment. A straight line boost curve was designed and evaluated in this environment to improve the performance of EPS system

The EPAS systems can be extremely compact, light and require little maintenance. They are easily designed and packaged in modular forms, and they can be easily tuned to requirements of a particular size and type of vehicle, and even to the driver's habits. This type of steering assistance becomes viable even for the smallest of automobiles. [1]

During the past ten years, EPAS has been introduced in gradually increasing numbers. Although electric power steering systems offer significant advantages over their hydraulic counterparts, electric motor technology and

controls had not reached the point where they could be used in this application until just recently. In the mid-1980's, for example, TRW had a working electric power steering system but it had the unfortunate tendency to completely drain the battery during a single parking maneuver. New generations of materials, sophisticated computerized electronic control systems and advancements in power management have all contributed to making electric power steering assist a reality.[1]

The global EPAS market in 2010 already totaled 26 million units, and it is expected to almost double by 2015. This trend stems from the rapidly increasing technological development of electrical and electronic components and safety concepts, which can be used in small-range to topof-the-range vehicles, and from the expansion of EPAS technologies in high growth markets such as China and Brazil.[3]

. The electric power steering, EPS, does not have any beltdriven steering pump constantly running, so it is lightweight and the motor consumes energy only when the steering wheel is turned by the driver, and this leads to improvement in fuel efficiency. Also, the elimination of a belt-driven pump Output torque = Steering force (manual torque) + Assist torque[4]

Failures in the EPS system that could lead to severe potential effects are loss of torque control and unintended motor torque. During this failure, the EPS system is unable to assist in steering the vehicle possibly because of a short or an open circuit in the motor coil, a damaged motor driver, or failures in the microcontroller.[5] During this failure, either the EPS system steers without input from the driver or the assisted torque is significantly deviated from driver's demand. This failure can be caused by a browned-out MCU, failures in the digital logic, and other causes.

OBJECTIVES

To completely eliminate the mechanical (connecting) rod from steering system or to reduce the size of connecting rod. Arranging some electrical connections which will turn the front wheels directly as the steering wheels is rotated.

RELATED WORK

Paul Yih et.al (2005) Recent advances toward steer-by-wire technology have promised significant improvements in vehicle handling performance and safety. While the complete separation of the steering wheel from the road wheels provides exciting opportunities for vehicle dynamics control, it also
presents practical problems for steering control. One of the most attractive benefits of steer-by-wire is active steering capability. When supplied with continuous knowledge of a vehicle's dynamic behaviour, active steering can be used to modify the vehicle's handling dynamics.

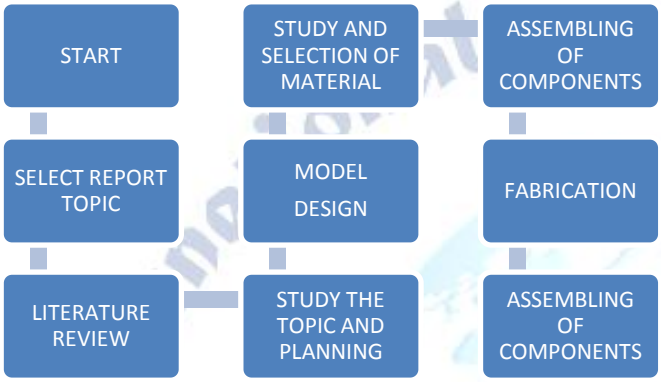
Adam Kader(2006) The automotive industry has already implemented many advanced computer systems in an attempt to increase safety and comfort of drivers. In parallel with these advancements we see a big shift from mechanical systems to electrical systems and steer-by-wire is another implementation that is very promising in terms of safety and functionality. Already, there are some commercial prototypes of such 'by-wire' systems and there is a lot of research, both academic and commercial, in the field. For my Engineering Senior Design Project at Swarthmore College, I chose to work on a steer-by-wire system to gain more insight into control theory and I thought the double-control system that provided the crucial feedback to the driver was an interesting engineering problem.

Uday Mandhata, John Wagner, Fred Switzer, Darren Dawson, and Joshua Summers, (2010) Dynamic control of the steering system's haptic feedback is required to provide human drivers the appropriate "feel" in steer-by-wire vehicles. A customizable haptic feedback control system architecture that can adjust the steering wheel torque responses to meet the operator's need for vehicle steering while tailoring the driving experience is presented. The feedback and reference mathematical models, as well as servo-controller, establish a basis to modify the force feedback in the human-vehicle interface. These validated models will be integrated into a real time steer-by-wire test bench for human subject calibration to evaluate the provision of adequate road "feel" to the human operator.

Hao Chen, YaliYang, Ruoping Zhang, (2011) Electric Power Steering (EPS) is a full electric system, which reduces the amount of steering effort by directly applying the output from an electric motor to the steering system. This research aims at developing EPS boost curve embody into the assist characteristics, improving steer portability and stability. A model for the EPS system has been established, including full vehicle

mechanical system, EPS mechanical system, and EPS electric control system. Based on this model, a straight line boost curve was designed and evaluated in this environment to improve the performance of EPS system. Results showed that EPS system with the designed boost curve reduced reacting time and overshoot value, thus ensure the dynamic reaction and stability.

METHODOLOGY



FUTURE SCOPE AND CONCLUSION

EPS can be incorporated into all passenger car and truck platforms. Since this system is compact and lightweight, it finds wide application in sports cars. Similar type of system is employed in India on Maruti-Suzuki Versa van, Zen VXI and Wagon R LXI etc. Electric power steering can be found on the Acura NSX (which was the first production car with this feature), the Honda S2000, Toyota Prius and Toyota RAV4, plus numerous GM models including 2004-2009 Chevrolet Malibu, 2005-2009 Chevrolet Cobalt &Equinox, 2006-2009 Chevrolet HHR, 2005-2009 Pontiac G6 (except the Convertible, GTP and 2007 GT models), 2006-2009 Pontiac Torrent, 2007-2009 Pontiac G5, 2002-2009 Saturn VUE, and 2003-2008 Saturn ION.

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