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Design and Development of Oversteer Prevention System in Four-Wheelers

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Abstract - *An active safety system works to forestall associate degree accidents. They embrace traction management, electronic stability management, and braking systems. During this paper, we tend to investigate a system of steering that has the potential of rising stability management by achieving control oversteer and reduced possibilities of risk throughout vehicle driving. A system wherever active front steering is on the market and proposes a model prophetic management strategy to coordinate the actuators.*

Key Words: **(active safety, steering, rising stability, prophetic management strategy)**

1.INTRODUCTION

A bigger vehicle offers high resistance for steering the wheel. Thus, a large amount of torque is required to be applied by a driver for steering the wheels. Hence to reduce the efforts of the driver some power assistance is provided to steer the wheel. Electric Power Steering (EPS) may be a full electrical system, which reduces the number of steering efforts by directly applying the output from an electrical motor to the mechanism. When the manual effort at the steering wheel exceeds a pre-determined value the power steering becomes operative.

In case of any failure of power steering the driver is still able to steer the wheels but with much larger efforts. Electric power steering (EPS) system may be a vital component for rising automotive handling and stability. AN EPS system includes mechanical system and electronic and management system, and it's to figure in the full vehicle system. within the development process of the EPS system, completely different subsystems need to be developed in parallel thus on scale back time and price of system development. Cooperation between engineers for developing completely different subsystems is additionally required. Therefore, a model-based development may be a rational manner for this parallel development and cooperation. one among the foremost important components of the EPS system is that the electrical management system, that receives signals collected by sensors for vehicle speed, steering angle, steering torsion, and controls the assistant motor for giving needed assistant torsion. A model-based development technique for the EPS system has been explored. A model for the EPS system has been established during a full vehicle system setting.

This research is aimed at developing steering ability and stability improving the real-time performance of the EPS system. In this paper structure and working principle of the electric power steering system are studied. This paper first presents a model consists of a steering column, shaft, assist motor, open belt drive, and power electromagnet. In this model, friction in the steering system is modeled and basic control strategies are also analyzed.

1.1 Literature Review:

Mayank Mishra, Abhishek Tiwari, Siddharth Maurya, done work on, Electronic Stability Control System and its possible contribution to Indian road safety, according to his study, many traffic safety organizations all around the world like EURO NCAP, NHTSA, ADAC have strict safety norms for Road vehicles. Now and then Indian Cars have also been tested by these authorities and less than 5% of these Indian cars have been declared Safe by these authorities. Where airbags and seatbelts and ABS are all offered only in the deluxe models of these Indian cars as if they were a luxury, Electronic Stability Control or ESC, is not even an option in even the most premium Indian Cars. This paper targets the Indian audience and seeks awareness as to how important ESC is in Modern Driving Conditions and demands ESC being mandated in all Road Vehicles in India too, just like numerous countries all over the world [1].

Stefano Di Cairano, done the work on, Vehicle Yaw Stability management by Coordinated Active Front Steering and Differential Braking within the Tire Sideslip Angles Domain; in line with his study, Vehicle active safety receives ever-increasing attention within the commit to succeed zero accidents on the road. Investigate design that has the potential of up yaw stability control by achieving quicker convergence and low-impact on the longitudinal dynamics. contemplate a system wherever active front steering and differential braking are on the market and propose a model prognostic management (MPC) strategy to coordinate the actuators. Then formulate the vehicle dynamics with relevancy to the tire slip angles and use a

piecewise affine (PWA) approximation of the tire force characteristics. The ensuing PWA system is employed as a prediction model in an exceedingly hybrid MPC strategy. once assessing the advantages of the projected approach, we tend to synthesize the controller by employing a switched MPC strategy, wherever the tire conditions (linear/saturated) are assumed to not amendment throughout the prediction horizon [2].

Li Zhai, Rufei Hou, Tianmin Sun, and Steven Kavuma, done the work on, Continuous Steering Stability management supported associate Energy-Saving torsion Distribution formula for a Four in-Wheel-Motor Independent-Drive electrical Vehicle, per his study, never-ending steering stability controller supported associate energy-saving torsion distribution formula is projected for a four in-wheel-motor independent-drive electrical vehicle (4MIDEV) to boost the energy consumption potency whereas maintaining the steadiness in steering maneuvers. The controller is intended as a data structure, together with the reference model level, the superior controller, and therefore the lower-level controller. The superior management adopts the direct yaw moment control (DYC), which is intended to figure unceasingly throughout the steering maneuver to raised guarantee steering stability in extreme things, instead of operating solely when the vehicle is judged to be unstable [3].

Benjamin Hirche, done the work on, A Model-Free Stability Control Design Scheme with Active Steering Actuator Sets, according to his study, presents the appliance of a planned fuzzy abstract thought system as a part of a stability management style theme enforced with active steering mechanism sets. The fuzzy abstract thought system is employed to notice the extent of overseer/understeer at the high level and a speed-adaptive activation module determines whether or not a vigorous front steering, active rear steering, or active 4-wheel steering is suited to boost vehicle handling stability. The ensuing model-free system is capable of minimizing the number of model standardization throughout the vehicle stability management development method similarly as up vehicle performance and stability over a good vary of car and road conditions. A simulation study is going to be bestowed that evaluates the planned theme and compares the effectiveness of active front steer (AFS) and active rear steer (ARS) in enhancing the vehicle performance. each time and frequency domain results are bestowed [4].

Miguel A. Vilaplana, Oliver Mason, Douglas J. Leith, William E. Leithead & Jens Kalkkuhl, done the work on, Non-Linear Control Of Four-Wheel Steering Cars With Actuator Constraints, according to his study presents a brand new non-linear steering controller for cars equipped with 4-wheel steer-by-wire that tracks reference sideslip and yaw rate signals describing the required lateral dynamics. The projected controller mechanically rejects any disturbances in sideslip and yaw-rate, Associate in Nursing incorporates an anti-windup theme to cut back the consequences of the saturation of the rear steering actuators. The management style relies on the Individual Channel Analysis and style (ICAD) methodology. Associate in the Nursing analysis of the sturdy stability of the system is bestowed. Results from a close non-linear simulation model are given parenthetically the controller's performance. This paper has bestowed a steering controller whose structure relies on the essential physics of 4-wheel steering. The controller incorporates an Associate in Nursing anti-windup theme to mitigate the consequences of the potential saturation of the rear steering actuators. The sturdy stability of the ensuing non-linear system has been incontestable victimization tools from non-linear analytic thinking and its hardiness has been illustrated through simulation. Future work can embody a close hardiness and integrity analysis along with validation experiments on an automotive equipped with a 4-wheel steer-by-wire [5].

Daniel D. Eisele & Huei Peng, done the work on, Vehicle Dynamics Control with Rollover Prevention for Articulated Heavy Trucks, according to his study, Rollover and jack-knifing of articulated heavy trucks are serious threats for motorists. Active safety technologies are incontestable to their potential to cut back or forestall the prevalence of those forms of accidents. The Vehicle Dynamics Management (VDC) system utilizes differential braking to affect vehicle response and is quite effective in dominant vehicle yaw response. during this paper, a VDC system that improves yaw, lateral, and roll stability is conferred. The objectives of this VDC style are to stop or scale back the probability of change and jack-knifing and to create the vehicle a lot of closely follow the driver's supposed path. A linear root locus study is Performed to tune controller gains in a very systematic fashion. nonlinear dynamics simulations of a generic articulated serious truck are run with the MATLAB /Simulink software system to check the performance of the planned VDC algorithmic program [6].

2. Problem Statement:

If the oversteering condition occurs, it may lose complete control of our vehicle. This dangerous mistake can also cause the vehicle to roll over, especially if we are driving an SUV or truck. To avoid a potentially fatal accident, it is necessary to reduce the problem of loss of control on steering at high-speed vehicle running conditions. To overcome this problem of oversteer control we introduce an oversteer prevention system in a four-wheeler.

2.1 Objective:

1) To scale back the matter of loss of management on steering at high-speed vehicle running conditions to avoid accidents.

2) To produce create reliable steering which can simply synchronize with today's steering mechanism system.

3) To maintain the response time of the steering system & to maintain driver safety in case of an accident.

3. Experimental Technique

3.1 Methodology & Process Flow Chart:

The below Methodology shows the serial operation/steps that may be performed throughout the project method

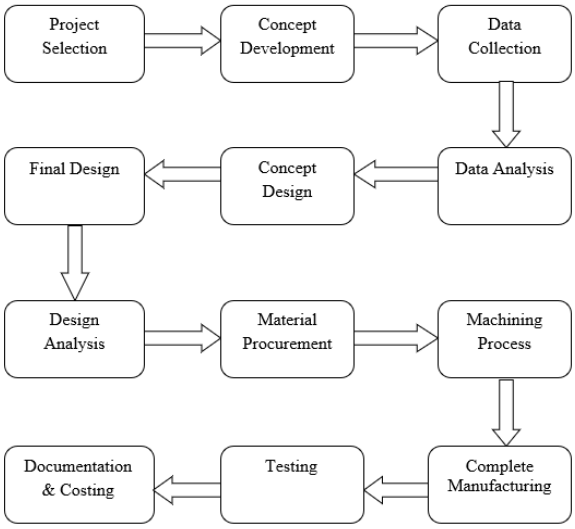

Chart.1- Process flow chart

3.6. Construction:

The oversteer prevention system is mainly consisting of the following components are given below;

1.	power electromagnet
2.	motor and VFD
3.	pedestal bearings
4.	shaft
5.	Nut and Bolt
6.	washer
7.	IR Sensor
8.	Steering

3.7. Working

A drive system is consisting of an induction motor, VFD, belt transmission & shaft. At first, the shaft is rotating with the power of the induction motor & VFD, at that point electromagnet is OFF because of the low-speed vehicle. The speed of the shaft is often will increase by using VFD, this speed of the shaft will continuously sense by the IR Infrared sensor & give feedback to the controller. When the speed of the vehicle exceeds the limit value then, the electromagnet is energized by the supply where the magnetic field produced is used to provide the prevention of oversteer in the steering mechanism. When the electromagnet isn't energized, the rotation of the steering is free and accelerates uniformly beneath the action of effort to that the shaft is connected. When the electromagnet is energized, the magnetic field is produced thereby applying resistance to oversteer by retarding the rotation of the steering column. The AC motor makes the shaft rotate using pulleys connected to the shaft. The control panel is employed to regulate the performance of the system speed by varied No. of turns of the coil, Current through coil ultimately the magnetic properties are going to change.

3.8. Result:

While concluding this project we have given the different tests to verify the performance of magnetism produce by the coil & measure voltage & current at the input of the coil & plot the graphs given below,

Test results at 12volt coil supply.

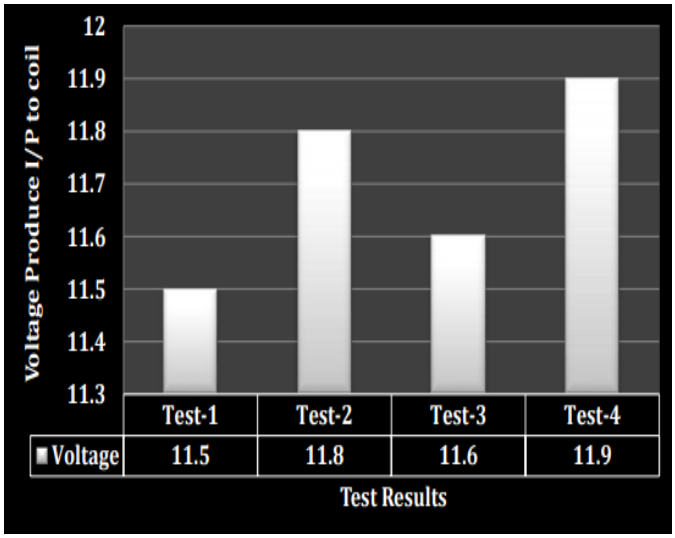

Chart.2- Voltage Produce I/P to coil

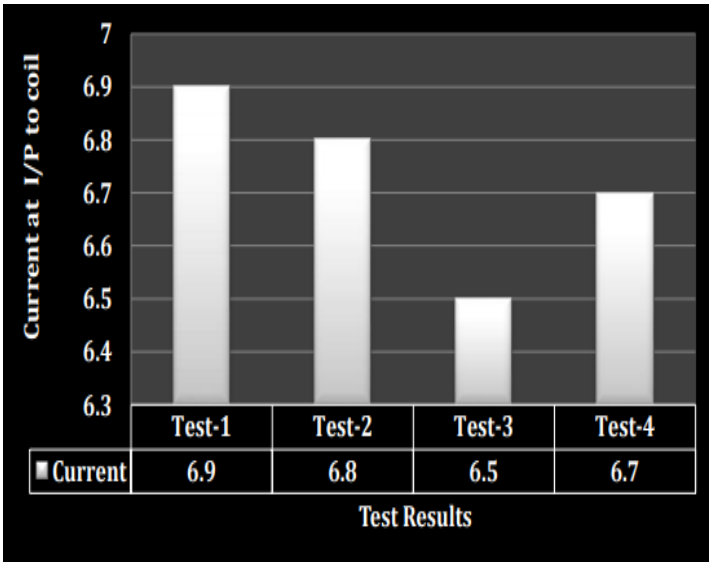

Chart 3 – Current at I/P to coil

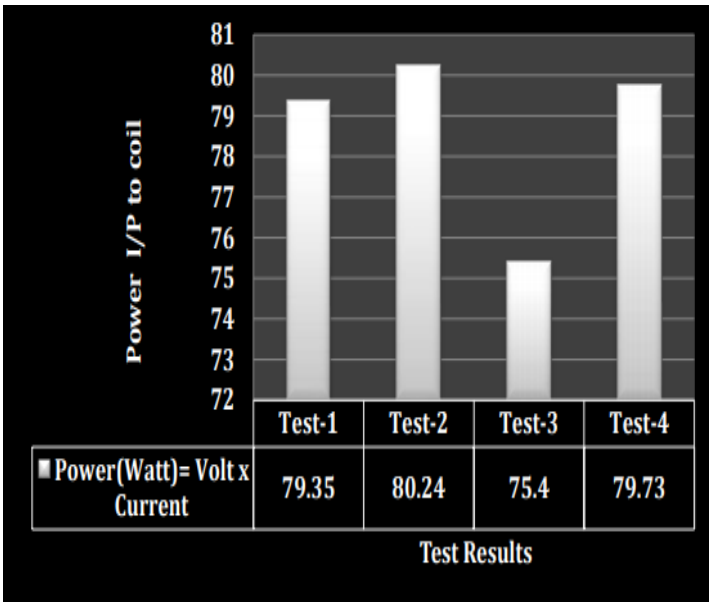

Chart 4 – Power I/P to coil

4. ADVANTAGES, LIMITATIONS & APPLICATIONS

4.1. Advantages:

1) The operation of the new system is well controlled.
2) Well-balanced system.
3) It minimizes misalignment & less floor space is needed.
4) It will increase the security and dealing conditions.

4.2. Limitations:

1) The system develops by us is the only demonstration of an oversteer prevention system.
2) The system developed by us is having a rotary wheel demonstration model to which speed can be sensed by the infrared sensor, but in actual practice, this IR sensor will locate in the disc caliper in the stationary brake part.
3) The performance can be affected by electromagnetics device working.

4.3. Application:

1) It is used for the safety of commercial vehicles like Cars, Buses & Trucks with a steering automation system.

5. Conclusion:

We have concluded that applying electromagnet around the steering column for controlling the oversteer steering became reliable for safe driving. It reduces the problem of loss of control on steering at a high-speed vehicle at the running condition to avoid accidents.

6. Future Improvement:

Automated steering by using electronics control units:

The steering developed by us is electromagnetics operated. Thus, in old steering, it is needed to give full attention to the worker to operate the steering during emergency conditions. This steering can be modified to fully automate the oversteer preventive steering column by using the controls and programming. This automated steering can perform any specified work in minimum time, speed, reliably, and with high accuracy in operation so that it does not need any regular attention for steering in oversteer condition to avoid an accident.

Actual steering Prototype:

We developed just a model of oversteer prevention in the steering column. In this, we have used precise control with required specifications. But if we want to develop actual steering that is to be used in the car, we can use the electronic stability controls with higher efficiency of the steering system.

7. References:

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