Flow Control (Universal Traction Control)

Ashwath Narayan¹, Vijayendra Anil Menon²

¹ICT, SASTRA UNIVERSITY, Thanjavur, India
²Mechatroncis, SASTRA UNIVERSITY, Thanjavur, India

Abstract- Our idea is on an advanced traction control system called FlowControl which uses real time data to control a vehicle at any time. It controls the suspension, brakes and ride height. It performs calculations and decides which set of brakes to be applied and also decides which set of suspensions should be stiffened or loosened to balance the vehicle during high speeds and while cornering. Also, based on the terrain, the ride height of the vehicle is increased or decreased automatically. This ensures efficiency and stability of the vehicle.

The brains behind this traction control resides in the midsection of the car, it monitors the G-Force, center of gravity, terrain quality, suspension stiffness, brakes etc. and performs calculations to control the vehicle. Infrared sensors placed on the sides of the car, create an image of the surrounding and this image is sent to the system. The system uses these images to understand the vehicles surrounding and perform calculations.

Keywords- Traction control, brakes, suspension, realtime, dynamic, IR sensors, control unit.

I. INTRODUCTION

Current generation traction control systems provide control for vehicles by monitoring the engine and focus’ on avoiding the locking of brakes when braking. This methodology provides only basic traction control with no real time understanding of the terrain or position of the vehicle. Hence, the current generation traction control systems fail to guarantee a safe path or best path to evade danger or prevent an accident, it only assists in keeping the vehicle stable, and keep all the wheels on the ground. This does not always provide a safety and reliability. The current generation traction system is not dynamic, it follows a set of predefined instructions. Hence, it does not include external factors like the environment and terrain conditions or the wear and tear of the components.

II. CONCEPT

Our concept is based on a traction control system which synchronises the brakes and suspension together and also, this system is self-learning and it learns the style of the driver. Using a sensor for monitoring the centre of gravity of the vehicle as the basic parameter, the FlowControl uses the designed algorithms to decide the apt set of brakes, ride height and stiffness of suspension at any given point of time.

III. CONCEPT DESIGN

Our solution uses a system to monitor the stability factors of a vehicle, the suspension and braking. Our system name “FlowControl” will provide state of the art traction control. The FlowControl uses an infrared beam at the corners of the vehicle to get an understanding of the environment and current alignment of the wheels. This provides a real time situation for the FlowControl to work on. The FlowControl monitors the environment at regular intervals and adjusts the suspension and braking of the vehicle automatically. It also adjusts the ride height of the vehicle to make the ride more efficient and keep the centre of gravity at an optimum level. This improves handling of the vehicle substantially.

During cornering at high speeds, the FlowControl detects the angle of the curve and banking using the sensors and an algorithm decides the set of brakes to be applied for cornering. The dynamics of the terrain scanned helps to decide the ride height and also to decide the stiffness of the suspension during cornering or for a general ride.

Since the FlowControl is independent, none of the problems that affect the other electrical components in the vehicle can affect the FlowControl. Hence, it is free from bugs and electrical faults once it is set up.

The critical design aspect for our traction control system to exist is independent braking and suspension. The brake pedal is connected to the FlowControl and the FlowControl, based on the current situation decides the correct set of brakes to be applied to keep the vehicle stable. The FlowControl uses an algorithm that calculates the force and friction experienced at each tyre and also calculates the required retardation to keep the vehicle on track. This algorithm will be suitable for all types of cornering and braking. Also, the time taken for the FlowControl to compute the solution will be minimum. This is key to the functionality of the traction control.

The same concept is applied to the suspension. The main data for deciding the suspension characteristics will be the information from the infrared sensors. The infrared sensors are chosen because they have very good fidelity and hence the information obtained is of high quality. The benefit of our design is that, the suspension FlowControl, brakes etc. are all independent parts and hence can be replaced and maintained easily. Also, the FlowControl can compute suspension changes for most suspension types.
The infrared sensors have a wide field of view, hence can cover the entire side of the vehicle. This helps to get a perfect image of the surroundings quickly and can be easily decoded by the FlowControl. There are four infrared sensors on the vehicle. One at the mid-point on each side of the vehicle. They provide a 360 degree view of the vehicle’s surroundings which is fed to the FlowControl.

The data about the brakes and suspension in the vehicle should be fed into the FlowControl before the FlowControl can actually function. This helps the FlowControl for performing the calculations. The details for suspension include:
1 Design of the control arm.
2 Type of shock absorber.
3 Steering linkage.
4 The type of spring used and the spring constant.

If pneumatic or any other type of suspension Flow Control is used, the data of the FlowControl should be fed into the traction control system.

Once the stock configuration details of the suspension system is fed. The FlowControl can detect if there are any damages in the suspension as any change in the default specs will alter the results generated by the algorithm. Hence making sure the suspension system and stability of the vehicle is ensured at all times.

For the brakes, the main details that need to be fed to the traction control system are:
1. The type of brake pad used. Example organic, ceramic, metallic etc.
2. The coefficient of friction of the brakes.

This is used to detect if the brake pads are faulty. The coefficient of friction will change if the brakes are getting worn out. This will help detect when to change the brake pads.

A small sensor at on the brake gives the RPM of the wheel attached to it. This is of prime importance as this sensor accurately gives the RPM of the individual wheels of the vehicle, which is crucial to decide the set of brakes to be applied.

IV. APPLICATION

This design can be incorporated in all 4 wheeler vehicles and can also be used in trucks. The system needs to be modified for larger vehicles. Our design is best suited for sedans, hatchbacks and sports cars.
VI. RESULTS

FlowControl can theoretically improve traction control significantly by providing a synchronization between the brakes and suspension. This makes sure, the vehicle adapts to the situation and uses real-time data to decide the optimal solution. Since the reaction time is around 3-5µs, it is very quick to calculate the best approach. This system can be installed in existing vehicles with little adjustments. Limited memory is required since neural networks are used, they update the existing algorithms without occupying large space.

VII. SUMMARY

The use of FlowControl improves the overall handling of the vehicle and since it is an individual component, it can be installed on existing cars as well. This makes it user-friendly. Also, there are very few moving parts, making the design long-lasting and requiring minimum maintenance.

REFERENCES


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