VOLUME-6, ISSUE-7, JULY-2017 • ISSN No 2277 - 8160

Original Research Paper

Engineering

MODELLING & DEVELOPMENT OF ANTILOCK BRAKING SYSTEM

Tribhuwan Singh	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India
Mohammad Muzabbir Khan	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India
Mohd Aasif	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India
Md Shaique Alam	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India
Md Jakiullah	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India
Mayank Menghani	Department of Mechanical Engineering IIMT College of Engineering, Greater Noida, UP, India

ABSTRACT

Antilock braking systems are used in modern cars to prevent the wheels from locking after brakes are applied. The dynamics of the controller needed for antilock braking system depends on various factors. The vehicle model often is in nonlinear form. Controller needs to provide a controlled torque necessary to maintain optimum value of the wheel slip ratio. The slip ratio is represented in terms of vehicle speed and wheel rotation.In present work first of all system dynamic equations are explained and a slip ratio is expressed in terms of system variables namely vehicle linear velocity and angular velocity of the wheel. By applying a bias braking force system, response is obtained using Stimulant models. Using the linear control strategies like P - type, PD - type, PI - type, PID - type the effectiveness of maintaining desired slip ratio is tested. It is always observed that a steady state error of 10% occurring in all the control system models.

KEYWORDS :

INTRODUCTION

Anti-lock brake systems (ABS) prevent brakes from locking during braking. Under normal braking conditions the driver controls the brakes. However, during severe braking or on slippery roadways, when the driver causes the wheels to approach lockup, the antilock system takes over. ABS modulates the brake line pressure independent of the pedal force, to bring the wheel speed back to the slip level range that is necessary for optimal braking performance. An antilock system consists of wheel speed sensors, a hydraulic modulator, and an electronic control unit. The ABS has a feedback control system that modulates the brake pressure in response to wheel deceleration and wheel angular velocity to prevent the controlled wheel from locking. The system shuts down when the vehicle speed is below a pre-set threshold.

1.1 IMPORTANCE OF ANTILOCK BRAKING SYSTEMS

The objectives of antilock systems are threefold:

1. To reduce stopping distances,
2. To improve stability, and
3. To improve steer ability during breaking.

These are experienced below Stopping Distance. The distance to stop is a function of the mass of the vehicle, the initial velocity, and the braking force. By maximizing the braking force the stopping distance will be minimized if all other factors remain constant. However, on all types of surfaces, to a greater or lesser extent, there exists a peak in fiction coefficient. It follows that by keeping all of the wheels of a vehicle near the peak, an antilock system can attain maximum fictional force and, therefore, minimum stopping distance. This objective of antilock systems however, is tempered by the need for vehicle stability and steerability.

Stability Although decelerating and stopping vehicles constitutes a fundamental purpose of braking systems, maximum friction force may not be desirable in all cases, for example not if the vehicle is on a so-called p-split surface (asphalt and ice, for example), such that significantly more braking force is obtainable on one side of the vehicle than on the other side. Applying maximum braking force on both sides will result in a yaw moment that will tend to pull the vehicle to the high friction side and contribute to vehicle instability, and forces the operator to make excessive steering corrections to counteract the yaw moment. If an antilock system can maintain the slip of both rear wheels at the level where the lower of the two friction coefficients peaks, then lateral force is reasonably high, though not maximized. This contributes to stability and is an objective of antilock systems.

SteeRability Good peak frictional force control is necessary in order to achieve satisfactory lateral forces and, therefore, satisfactory steerability. Steerability while braking is important not only for minor course corrections but also for the possibility of steering around an obstacle.

Tire characteristics play an important role in the braking and steering response of a vehicle. For ABS-equipped vehicles the tire performance is of critical significance. All braking and steering forces must be generated within the small tire contact patch between the vehicle and the road. Tire traction forces as well as side forces can only be produced when a difference exists between the speed of the tire circumference and the speed of the vehicle relative to the road surface. This difference is denoted as slip. It is common to relate the tire braking force to the tire braking slip. After the peak value has been reached, increased tire slip causes reduction of tire-road friction coefficient. ABS has to limit the slip to values below the peak.

value to prevent wheel from locking. Tires with a high peak friction point achieve maximum friction at 10 to 20% slip. The optimum slip value decreases as tire-road friction decreases

Major Parts Of ABS

Ultrasonic sensor

Shaft

Bearings
Wheel
Relay Driver
Microcontroller

Advantages Of ABS

- Anti-lock braking system (ABS) guarantees stable braking characteristics on all road surfaces, hence avoids overturning of the vehicle.
- ABS reduces friction on wheels and road, thus increases the efficiency of tires (up to 30%).
- The Vehicle with ABS can be stopped at a lesser distance than a non ABS vehicle.
- Steering control is effective, i.e., the vehicle can be steered smoothly while braking. Thus minimizes the accidents.
- A driver without experience can drive ABS vehicle effectively, then an experienced driver on the non ABS vehicle.

Disadvantages Of ABS

- Initial cost for Anti-lock braking system (ABS) vehicle is high.
- Maintenance issues arise as the whole braking system is controlled by engine control unit.
- On concrete roads, the ABS vehicle stopping distance might be needed more

Reference:

1. Valient Automotive Market Research. Archived from the original on 23 June 2015. Retrieved 22 June 2015.