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A Review Paper on Pneumatic Controlled ABS

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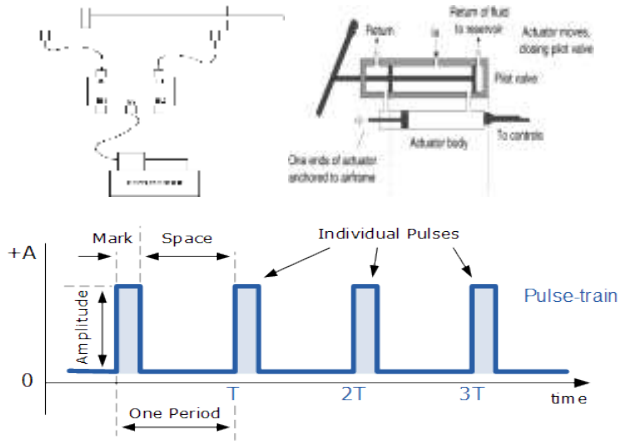
Abstract - *In today's fast moving world, automobiles are facing challenges in terms of having to survive road accidents, increasing traffic, bad road-conditions and high/express ways. Brake systems play a vital role in controlling the vehicle speed while avoiding road accidents. The conventional brake systems consist of basically an actuator, transmission and frictional parts. This system is difficult for manipulated control by the driver during emergency and panic braking situations. In particular road and environmental conditions, it requires certain skill to have safe and effective brake control, which is always not possible from all drivers. Wheel locking is a predominant phenomenon during panic braking and this will cause vehicle skidding resulting in injuries and road accidents. In the case of a two wheeler, being a single-track vehicle, skidding is one of the major causes for fatal road accidents due to loss in lateral balance. As the road safety regulations are becoming more stringent, the anti-lock brake systems (ABS) will replace the conventional brake systems in all road vehicles to avoid accidents and to improve vehicle safety.*

Key Words: Pneumatic Brake, Anti-Lock Braking system, Pneumatic cylinder, Air Brakes, Traction Control Unit, pneumatic cylinder

1. INTRODUCTION

Usually driven by the vehicle engine, the air compressor is the source of energy for the air Brake system; for the air brake system the air compressor builds the air pressure. By the engine coolant system cools the air compressor is typically cooled and lubricated by the engine oil supply. (Certain models have self-lubricated and/or air-cooled versions available.) Note: Air compressor shafts can rotate neither direction, at atmospheric pressure, the vehicle's compressor draws in filtered air from the outside (or already at an increased pressure, from the engine turbocharger where permitted), and compresses it. The brake system needs a supply of compressed air between a preset maximum and minimum. The governor (along with a synchrony valve for the air compressor) monitors the air pressure in the supply reservoir and controls when the compressor needs to pump air into the air system (also known as the "air build cycle" - the compressors "running loaded") and when the compressor should simply turn over without building pressure ("running unloaded").When the air pressure becomes greater than that of the preset "cut-out", the governor controls. The unloaded mechanism of the air dryer to purge. As the service reservoir air pressure drops to the "cut-in" setting of the governor, the governor returns the compressor back to building air and the air dryer to air drying mode. As the atmospheric air is compressed, all the water vapor originally in the air is carried along into the air system, as well as a small amount of the compressor lubricating oil as vapor.



Block Diagram of PABS

2. LITERATURE REVIEW

S.Mithun Et al. (2014)[1] An air brake system is used in heavy commercial vehicles for the purpose to stop or slow down the vehicle. The effective braking depends mainly on the response time of the entire system. The brake system layout configuration has to be designed in such a way that the response time should meet the vehicle safety standard regulations. This paper describes the detailed modeling of the individual brake system products, right from the actuating valves, control valves, actuators and foundation brakes. Response time prediction for a typical 4X2 Heavy commercial vehicle has been done. Also a study on comparing the transient torque generated by the existing drum brake and an equivalent disc brake model was carried out. The layout was modeled in one of the commercially available multi-domain physical modeling

software employing bond graph technique and lumped system.

Sahil Jitesh (2014)[2] (ABS) is used in advanced automobiles to prevent slip and locking of wheel after brakes applied. It is automobile safety system, the controller is provided to control the necessary torque to maintain optimum slip ration. The slip ration denote in terms of vehicle speed and wheel rotation. It's an automated system that run on principles of threshold braking and cadence braking which were practiced by skillful drivers with previous generation braking system. It response time is very faster so that makes easy steering for the driver. ABS generally offer advanced vehicle control and minimize the stopping distance in slippery and dry surface, conversely on loose surface like gravel or snow covered pavement, ABS can significantly increase braking distance, although still improving vehicle control.

Ayman A. Aly Et al. (2014) [3] Many different control methods for ABS systems have been developed. These methods differ in their theoretical basis and performance under the changes of road conditions. The present review is a part of research project entitled "Intelligent Antilock Brake System Design for Road-Surfaces of Saudi Arabia". In the present paper we review the methods used in the design of ABS systems. We highlight the main difficulties and summarize the more recent developments in their control techniques. Intelligent control systems like fuzzy control can be used in ABS control to emulate the qualitative aspects of human knowledge with several ad-vantages such as robustness, universal approximation theorem and rule-based algorithms.

Mr. Kushal V. Gawande Et al. (2017)[4] Vehicle accidents are ubiquitous in recent years. This is because of heavy increase in population of vehicles, due to its high demand. They pose a serious threat to life and property. A system must be designed to minimize the effects of these accidents. The aim of the present study is to design a device which can successfully scan the surroundings during driving and apply brake to avoid front end collision of the vehicle, along with extension of bumper. The technology of pneumatics plays a major role in the field of automation and modern machine shops and space robots. The aim is to design and develop a control system based intelligent electronically controlled automotive bumper activation and automatic braking system is called automatic bumper system. IR sensor provided on the front end of the vehicle detects the presence of the obstacle. The use of pneumatic system can prove to be useful in automation due to its simplicity and ease of operation. So, the aim is to design and develop a system based on automatic control of vehicle. So, we aim to design "Automatic Pneumatic Braking System".

Robert D. Hoover Et al. (2009)[5] According to instructions issued to Medicare contractors by CMS, one must consider the broad range of available evidence and evaluate the quality of the evidence. This exercise reviewed peer-reviewed, published clinical trials, guidelines and consensus statements from clinical experts and medical associations, position statements from organizations with expertise in the subject of lymph edema treatment and other evaluations of pneumatic compression technology. With regard to the quality of the evidence, numerous authors commented that the studies supporting the use of pneumatic compression devices are universally poor. There are few randomized, prospective, controlled trials and the ones that were reviewed had conflicting results. Most clinical guidelines and position statements relied upon expert opinion and consensus; however, all were lacking in specificity with respect to the questions at hand.

Mhatre Ketan .H(2018) [6]

Electro-pneumatic braking system uses laws of pneumatics to apply the brakes. When any hurdle is sensed in the path by the sensors, it will apply the instant brake in seconds, So that it will reduce the accidents which are caused by human unawareness's. So basically whenever the Bike senses any object ahead, it will apply automatic brakes by determining the distance, which we put in sensors. We have used Pneumatic breaking circuit and IR sensors to perform these operations. The circuit can break the vehicle within seconds running at a high speed. Automatic brake with the electro-pneumatic system will provide extra safety to the two-wheelers. This project has been made to perform the required task in shortest time and to add some innovation in the automobile Industry.

Divyata Khachane(2016)[7] Antilock braking system (ABS) is one of the safety feature provided by automobile industry. Due to the use of this safety feature, braking distance of vehicle is reduced as well as stability of vehicle is increased. Due to the use of ABS tyre efficiency is also increased as there is less friction in between road and tyre. However this system does not work effectively for adverse road condition. To overcome this disadvantage automobile industry recently come up with the new advancement known as electronic brake-force distribution (EBD). Electronic brake-force system works efficiently even if road conditions are adverse i.e. icy, watery etc. It also reduces braking distance and increases stability of vehicle by just adding functionality in control unit.

Kartik Bhasin(2019)[8] With the headway of innovation, the security issues that are associated with the vehicles and automation has been considerably attenuated, thought of one amongst such technology is Anti-lock braking

system popularly remarked as ABS system. Through the event of this technology, a number of injuries had been attenuated. However, this method will no longer work correctly for hindering street circumstance. To conquer this disadvantage, the vehicle business got here up with the new technology as well as EBFD, ECS, TCS. During this paper, we tend to speak the strategies of ABS and its advanced technology.

Dr. Deepak Kumar [9] With the advancement of technology the protection problems which have been related to the vehicles and automation has been significantly decreased, considered one of such technology is anti-lock braking system popularly referred to as ABS system. Through the development of this technology some of injuries had been decreased. However this system does now not work correctly for detrimental road situation. To triumph over this disadvantage vehicle industry got here up with new technology including EBFD, TCS, ESC. In this paper we speak the methods of ABS and its advance technology.

Karan Dutt(2013)[10] This paper mainly talks about PNEUMATICS' working and components. The main emphasis is given on its various components' functioning and working. Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical motion. Pneumatic systems are used extensively in industry, and factories are commonly plumbed with compressed air or compressed inert gases. This is because a centrally located and electrically powered compressor that powers cylinders and other pneumatic devices through solenoid valves can often provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators. This paper also talks briefly about the ELECTROPNEUMATIC system and all the components and the symbols associated with it.

Mansaf Ali Abro Et al. (2018)[11] Fatal road accidents are increasing day by day. The life of people while driving on roads is becoming dangerous. Researchers have come to know that accidents occur due human error but majorly due to mechanical fault. This research paper primarily focuses on development of such a mechanical system which can control vehicle automatically and save human lives. Therefore development of such a system is depicted in this research paper. Initially the system model is developed using Simulink in Mat lab and results are obtained in last. The modeling is such that the individual components of model are formed from the equations which are shown and discussed separately. The components of model include (tire model, quarter car model, brake actuator and PI controller). Furthermore the model shows robustness of controller where it is implemented in continuous time. In continuous time it behaves robustly to control vehicle when excessive slip occurs. The results obtained in this research work are validated with published work. However, the system can be adopted rudimentary for Anti-lock braking system (ABS) and anti-slip regulatory system (ASR). Sometimes driving the vehicle on slippery or icy surfaces causes it to get out of control. Therefore major focus of this research is to get vehicle under control when slip occurs. Keywords: Anti-lock braking system, slip, PI controller, Quarter car model.

Vu Trieu Minh Et al. (2016)[12] This paper develops a real laboratory of anti-lock braking system (ABS) for vehicle and conducts real experiments to verify the ability of this ABS to prevent the vehicle wheel from being locked while braking. Two controllers of PID and fuzzy logic are tested for analysis and comparison. This ABS laboratory is designed for bachelor and master students to simulate and analyze performances of ABS with different control techniques on various roads and load conditions. This paper provides educational theories and practices on the design of control for system dynamics.

Ayman A. Aly Et al. (2011)[13] Many different control methods for ABS systems have been developed. These methods differ in their theoretical basis and performance under the changes of road conditions. The present review is a part of research project entitled "Intelligent Antilock Brake System Design for Road-Surfaces of Saudi Arabia". In the present paper we review the methods used in the design of ABS systems. We highlight the main difficulties and summarize the more recent developments in their control techniques. Intelligent control systems like fuzzy control can be used in ABS control to emulate the qualitative aspects of human knowledge with several advantages such as robustness, universal approximation theorem and rule-based algorithms.

Saurabh.S.Murkute Et al. (2018)[14] Antilock Breaking System (ABS) is utilized in cutting edge vehicles to counteract slip and bolting of wheel after brakes connected. It is car wellbeing framework; the controller is given to control the fundamental torque to keep up ideal slip proportion. The slip proportion means regarding vehicle speed and wheel turn. It's a computerized framework that keep running on standards of limit braking also, rhythm braking which were honed by able drivers with past age braking framework. It reaction time is quicker so makes simple controlling for the driver. ABS for the most part offer propelled vehicle control and limit the ceasing separation in tricky and dry surface, on the other hand on free surface like rock or snow secured asphalt, ABS can altogether increment braking separation, albeit as yet enhancing vehicle control.

Stanisˇsa Lj Et al. (2014)[15] In this paper we introduce a new approach to the sliding mode control design based on orthogonal models. First, we discuss the sliding mode control based on a model given in controllable canonical form. Then, we design almost orthogonal filters based on almost orthogonal polynomials of M¨untz-Legendre type. The advantage of the almost orthogonal filters is that they can be used for the modeling and analysis of systems with nonlinearities and imperfections. Herein, we use a designed filter to obtain several liberalized models of an unknown system in different working areas. For each of these liberalized models, corresponding sliding mode controller is designed and the switching between controls laws depends only on input signal. The experimental results and comparative analysis with relay control, already installed in laboratory equipment, verify the efficiency and excellent performance of such a control in the case of anti-lock braking system.

Zhou Kun Et al. (2017) [16] This article describes the structure and working principle of pneumatic balancer emergency braking system, the braking effect of the emergency braking system theoretically calculated and analyzed by finite element software ANSYS line of brake system crash simulation analysis of its structure optimized to improve the braking system in unexpected braking reliability and safety when falling, pneumatic balancer to promote domestic research and to break the foreign monopoly of the pneumatic balancer technology is of great significance happened lifting objects.

Patil Pratik Et al. (2016)[17] Nowadays vehicle accident is a major problem. This braking system introduced innovative idea for the prevention of accidents usually seen in restricted roadways. In this system controlling is done automatically by using proximity sensor and relay coil. It further actuates pneumatic cylinders which results in braking and bumper movements. Hence it is referred as pneumatic braking system with pneumatic bumper protection. The system consists of two mechanisms; a proximity sensor is provided which senses the vehicle come in front of our vehicle system which may cause the accidental damaged. With the feedback from sensor through the relay coil, actuation of pneumatic cylinder take place and brake gets apply in disc brake sense

3. CONCLUTIONS

- After reading the above research papers it can be judged that the response time for actuating the brake differs in every individual vehicle.
- ABS generally offers advanced vehicle control and minimize the stopping distance in slippery and dry surface, conversely on loose surface like gravel or snow covered pavement, ABS can significantly increase braking distance, although still improving vehicle control.
- The use of pneumatic system can prove to be useful in automation due to its simplicity and ease of operation. Also IR sensors to perform these operations.
- Centrally located and electrically powered compressor that powers cylinders and other pneumatic devices through solenoid valves can often provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators.
- Pneumatic actuators also have long life and perform well with negligible maintenance requirement throughout their life cycle. Initial cost is less; hydraulics equipment cost as much as twice the price of pneumatic equipment
- Above all, pneumatic provide spring effect when brakes are actuated, thus prove less jamming of disk in heavy vehicles carrying a huge load.

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