Steering Control of the Autonomous Guided Vehicle Driving System for Durability Test

o Jong Won Jeong*, Young Jin Lee*, Kang Sup Yoon**, and Man Hyung Lee***

* Department of Intelligent & Mechanical Engineering, Pusan National University Keumjung Ku , Pusanl, 609-735 Korea
(Tel : 82-51-510-1456; Fax : 82-51-512-9835 ; E-mail: jongwonj@hanmail.net)

** School of Automotive, Industrial and Mechanical Engineering, Taegu University Jinyang, Kyungsan, 712-714 Korea
(Tel : 82-53-580-6674; Fax : 82-53-850-6549 ; E-mail:kasyoon@taegu.ac.kr)

*** School of Mechanical Engineering, Pusan National University Keumjung Ku , Pusanl, 609-735 Korea
(Tel : 82-51-510-1456; Fax : 82-51-512-9835 ; E-mail: mhlee@hyowon.cc.pusan.ac.kr)

Abstract

Among durability tests, the accelerated durability test has been widely used to evaluate the durability of vehicle structure and chassis parts in a short period of time on the designed road which has severe surface conditions. However it increases the drivers fatigue mainly caused by the severe driving conditions. The drivers difficulty of maintaining constant speed and controlling the steering wheel reduces the reliability of test results. The durability test includes the position and distance sensing system for the recognition of the absolute and relative driving position, the driving control system for the control of whole driving circumstance, the emergency system for responding to system errors. AGVDS (Autonomous Guided Vehicle Driving System) was proved to facilitate the development of new car projects. Therefore the AGVDS we propose will help make the fundamentals for all future traffic systems.

1. Introduction

The development of AGVDS has started in the U.S.A., Europe and Japan during the 1960s. The last decade has seen the development of electromagnetic and intelligence technologies. Technologies like magnetic coil sensing and vision type camera have been playing great roles in AGVDS. Now the researchers are focusing on the ITS(Intelligent Transportation System) to develop efficient and stable driving systems. Automobile makers and researchers are working on the AGVDS for the solution of several traffic problems such as traffic jams, accidents, and drivers fatigues.

AGVDS also makes the development of a new car more efficient. The accelerated durability test is performed to evaluate the durability of vehicle structure and chassis parts over a short period of time.

Sometimes this test leads to the accumulated physical fatigue of the test driver and takes a long time. Therefore maintaining desired speed becomes difficult. AGVDS was introduced to solve the problems.

The durability test is conducted on straight sections and curved sections of the road. The different sections (straight and curved) of the road make the need for driving control algorithms.

We also took electro-mechanical noise such as static-electricity, mechanical vibration and shock into consideration because they disturb the normal operation of the driving system.

The test system was carefully designed in terms of safety, endurance, convenience and easy installation. It can be applied to every type of vehicle that needs to be tested.

2. AGVDS SYSTEM

In this paper, the purpose is steering control of the AGVDS. So the AGVDS is composed of two major systems designed to drive vehicles at a given speed on the guided road. The first one is installed in the car and the second on the road.

In the vehicle, there are a power supply, a steering control mechanism and an emergency stop system for safety.

The power system converts DC from the battery into AC and provides power to each system. To maintain constant power out of the unstable power sources, the steering and the pedal actuators use torque servo motors. Everything was designed for the convenience of installation and operation.

The steering angle estimated from tracking error and the angle the vehicle makes with the guided line are computed from the analog signal. The analog signal from four MPC sensors attached to both sides of the front and rear bumper is converted into the digital signal with filtering and amplification.

The control box consists of an industrial PC board, a motion controller for motor operation, an ADC board, and the DIO board.

In the road, the guide line is installed. It is for vehicle guidance. And the signal generator and amplifier generates 12 kHz signal which circulate the tracking error.

Fig.1. shows the AGV system and Fig.2. is a block diagram of the experimental system.