

Research on the material and structure of the intelligent clutch control system

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Abstract. With the continuous expansion of the road network, the construction growth rate of car ownership is also increasing. Although automatic transmission car owners increase rapidly, manual transmission cars are still the main car in the middle and low level car market. However, due to traffic congestion and other problems, driving fatigue to the driver's manual transmission exacerbate, the driver's driving pleasure is weakened. This paper analyzes the development situation in China and abroad, the technical material and structure of intelligent control system for the clutch, and analysis of the existing system of technical defects, introduces a new material and structure style intelligent clutch control system at last.

Introduction

Traffic congestion has become a worldwide problem, It is definitely not an easy job for the drivers as the vehicles frequently start and stop in a traffic block street. Therefore, consumers shifted the focus on simplify the operation and control automation direction. The drivers who drive manual transmission strongly appeal to the birth of a smart clutch.

In addition, with the rapid social and economic development, people are increasingly strong demand for cars, the rapid increase in car ownership. Currently, in China, car ownership has reached several thousand million, the annual output has reached 10 million. The rapid growth in the number of cars, lead to oil consumption growing at the same time, automobile exhaust emissions has become a global warming and increased pollution culprit.

Therefore, energy conservation has become the focus of vehicle development and research. Many countries have also introduced incentives for energy saving vehicles, such as: to encourage research and development on low fuel consumption products; encourage the consumers to purchase low-emission cars, the implementation of policies on tax relief for the purchase of low-emission cars. Small displacement (1.6 liter) cars, with respect to the big cars, the fuel consumption savings of up to 50%, and compared with the manual transmission models automatic transmission vehicle fuel consumption savings of about 20%. In the current technical conditions, small cars are mostly applied manual transmission gearbox. However, manual speed gearbox convenience and comfort far less automatic transmission, which greatly restricted the manual models to buy and popularity. Therefore, the combination of economics and manual gearbox automatic gearbox comfort convenience, a lot of car users appeal to research the intelligent control system strongly.

Research Status, Levels and Trends

In a strong proponent of "resource-saving and environment-friendly" premise and the high international oil community background, people are more concerned about vehicle fuel consumption, fuel requirements for the rational use of increasingly vocal, motor vehicle fuel consumers become more coming increasingly concerned about technical indicators. In addition, in the mountains with the manual transmission car, because of the driver's driving skills, poor road conditions and other reasons,

will cause the car to a "sneaked" and other serious security risks, many automobile manufacturers have research on cars on energy efficiency and driving safety.

The Intelligent Clutch Control System Technology Research Status. At present, the majority researchers have tried through research clutch own characteristics, to establish mathematical model to constructed clutch, friction and vibration performance [1-5].

Among them, the market has been sold and has greater influence by a Hong Kong China company research and development of automobile clutch automatic control system (As Fig. 1 shows).



Fig. 1 Mainly parts of the intelligent clutch control system designed by Hong Kong company.

According to the specification of the system: The system is an intelligent control system for the manual transmission models developed without changing the original installation of a stand-alone system based on the vehicle gearbox and clutch. However, after the project team members after more than a manual transmission and the driver's experience, we found that there is a problem of the system:

(1) The system is easy to have some errors, shortly after carrying the display system will display "28" error code in the car after running;

(2) Long-term use of the system and found that when compared with vehicle fuel consumption is not installed improved nearly 15%. After inspection found that the phenomenon is due to a system of clutch engagement is slow, resulting in slow and long-term shift the engine is idling due. In addition, due to slow clutch engagement, also led to poor driving experience and so on.

(3) Interactive features of the system are poor. The system self-learning function entirely on complex operated by the driver. For example, to install the system on a new car, we need to first throttle in the end, and then to read the relevant parameters of the engine by precisely, repeatedly press the brake pedal, then match. If improper operation, it will need to be repeated several times.

(4) The system uses Infineon's 8-bit microcontroller, the microcontroller is low precision, which will seriously affect the driver's driving experience.

Due to the limited processing power of the chip is used, which requires additional integrated operational amplifier circuit of the system to improve the speed signal acquisition, processing power, resulting in a reduced cost of the system.

In theoretical research, by collecting scholars engine speed, throttle opening, vehicle speed signals and brake, gear change signals and some other information, according to certain evaluation system to get the most appropriate control strategy, then in accordance with the control strategy using reasonable the control algorithm to precisely control the clutch actuator, so that a smooth clutch engagement. However, results showed that only some of the characteristics of the engine into account the results of the clutch engagement does not meet the law required car comfort. Because of the real driving situations complicated, this method can not be fully and accurately reflected, and this method is not the nature of vehicle dynamics in detail and profound analysis.

Europe's Intelligence Clutch Control System Technology Research Status. Saab in 1993 by the company for the first time to study the electrically controlled clutch system. After this, it sets off a

massive foreign research and development of electronically controlled clutch boom. Some companies began to develop its own electronically controlled clutch products. On the current application situation, poor binding properties of electronically controlled clutch, shift identification signal unstable situation [6-8].

In 2013, Bosch introduced an electronically controlled clutch, which allows the driver to drive a manual transmission car without shifting clutch in case of realization of stop-go traffic (As Fig. 2 shows).



Fig. 2 Mainly parts of the intelligent clutch control system designed by BOSCH.

Consideration Progress

Although a few enterprises, electronically controlled clutch scholars have studied the intelligent clutch system, but from the test results, the control is not very good. In addition, most of the electronically controlled clutch for a vehicle design, versatility is not very strong. Although Bosch introduced electronically controlled clutch having a good effect, but the price is expensive, which will lead to manual transmission car owners can't accept.

Based on existing research, can be considered on the basis of maintaining a manual transmission car stalls original structure and characteristics, the development of a manufacturing cost and maintenance cost are low clutch intelligent control system, which uses 32-bit embedded chip, four times the processing power 8-bit processor, and effective control of the electric current driver chip, effectively reduce the heat driver chips to enhance the control of motor speed to optimize clutch speed, so that the driver's driving experience better and improve the economic performance of the car. In addition, the system also key consideration interactive features, ease of operation is provided with interactive switch and control interface, making the system self-learning function quick and easy to complete. By precisely controlling the clutch position and speed, the clutch intelligent control, effectively prevent the vehicle sneaked dangerous driving and reduce driver stepped on the clutch frequently; by improving the accuracy of clutch engagement to achieve a manual transmission car energy-saving features. Successfully developed intelligent clutch system will enhance the low-emission fuel efficient, which can let manual transmission vehicles can be more used.

Intelligent Clutch Control System Technology

1) From the point of view of energy saving, because the vehicle traveling in complicated road, clutch engagement process and clutching speed fluctuations easily lead to increased fuel consumption, exhaust emissions and other issues of excess produce. The intelligent control system can detect a clutch position control signal in accordance with the vehicle, the engine speed signal, a clutch position signal, manual / automatic switching signal, reverse signal, the throttle signal, the brake signal and the shift signal sensor signal, realized accurately. This will then reduce the car's fuel consumption and emissions in large part, to achieve the purpose of energy saving.

2) Due to the mountainous terrain, mainly in mountainous areas with a manual transmission car, because the driver's driving skills, vehicle power is poor and poor road conditions and other reasons, will result in car the "sneaked" and other serious security risks. The research and development of

intelligent clutch control system because it can accurately control the position of the clutch, thereby greatly enhance the safety of cars.

3) In order to achieve the popularization and application of intelligent control system for the clutch, select a manual transmission car models for the study, the model for the structure of the braking system, engine structure, the structural characteristics of the accelerator pedal, the clutch control system design intelligent machine body;

4) Depending on the selected models of the engine, brakes and mechanical properties of structural control characteristics, combined with fuzzy control technology, the symposium becomes the principle of building system control model, and the use of AMESim, Matlab and Mathematica software for simulation and optimization models;

5) Development of appropriate conditioning module speed, clutch position feedback signal conditioning circuits, engine speed control module, power modules, combined with the control system model, a corresponding control strategy, and achieve through the program;

6) Orthogonal experiment method, scientific and rational design of the test table, and to carry out road test, performance test vehicle intelligent control system for the clutch and the like;

7) The use of extension evaluation method and RS theory, developed by intelligent clutch control system security, energy efficiency evaluation, to provide reliable basis for the successful promotion of smart clutch control system.

The Structure of the Intelligent Clutch Control System

As Fig. 3 shows, we have designed a new intelligent clutch system, it includes the motor, power valve, sensors, cable and controller. This system can operate alone, which will not intervene the original clutch. The vehicle assembles the intelligent clutch control system, the vehicle owners will have two choices. If he likes to touch the clutch pedal, he can not use the system. But if he wants to use the system, he only needs to turn on the switch button which is equipped on the vehicle instrument panel, the system can work.



1- piston valve; 2-electrical switch; 3-sensor;4-motor
Fig. 3 Intelligent clutch control system.

Conclusions

With the continuous expansion of the road network, the construction growth rate of car ownership is also increasing. Although automatic transmission car owners increase rapidly, manual transmission cars are still the main car in the middle and low level car market. However, due to traffic congestion and other problems, driving fatigue to the driver's manual transmission exacerbate, the driver's driving pleasure is weakened. This paper analyzes the development situation in China and abroad, the technical characteristics of intelligent control system for the clutch, and analysis of the existing system of technical defects, and introduce a new style intelligent clutch control system.

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