Analysis and Optimization of Electronic Control Technology of Intelligent Diesel Engine

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Abstract: With the shortage of energy in the world, the international environmental protection organization is increasingly strict in environmental protection. In order to meet the requirements of energy conservation and emission regulations, the research on intelligent electronic control technology and optimization of diesel engine is carried out. Firstly, the electronic control technology of the intelligent diesel engine is analyzed, the common rail pressure is adjusted, the feedback values are formed into map atlas, the injection time is calibrated in map atlas, and the injection timing is realized. When optimizing the electronic control technology, the correct design of the connection direction of the electric control technology, forming the adjustment circuit. In the adjustment circuit, a control solenoid valve is designed to control the voltage around the coil to complete the optimization of the electronic control technology. The experimental results show that compared with the traditional electronic control technology, the optimized electronic control technology has less fuel injection and is more suitable for the control of diesel engine.

Keywords: Intelligence; Diesel engine; Electronic control technology; Optimization

1. Introduction

Diesel engine is a prime mover, it has a hundred years of vitality, high thermal efficiency, can adapt to a variety of working environment, safe and efficient [1]. With the continuous development of industry, agriculture and transportation, diesel engine has gradually infiltrated into more fields with its unique safety properties. After entering the 21st century, the society is constantly strict with the environmental protection requirements, and people's awareness of environmental protection is constantly enhanced, which puts forward higher requirements for the environmental protection of diesel engine. Therefore, the research on intelligent diesel engine can improve the reliability and emission of diesel engine. The research on electronic control technology of diesel engine based on intelligent diesel engine can enhance the performance of diesel engine. Electronic control technology is the core of diesel engine electronic control, and also the essential control technology of the core speed control system. To study the electronic control technology of diesel engine is to master the operation technology core of diesel engine.

With the continuous development of science and technology, the integration degree of microprocessors used in electronic control technology has been enhanced. With the continuous improvement of integration degree, more and better performance alternative materials have been found for diesel engines, and the cost of microprocessors has been gradually reduced. With the continuous popularization of diesel engine in various fields, the structure of the electronic control system for controlling diesel engine is becoming more and more complex, which requires higher and higher electronic control technology. Using computer-aided processing can solve this problem and provide another good control form for the electronic control technology of diesel engine. Design a reasonable conditioning circuit, under the control of solenoid valve, optimize the electronic control technology. The optimized electronic control technology solves the shortcomings of traditional electronic control technology and conforms to the concept of green development [2].

2. Analysis of Intelligent Electronic Control Technology of Diesel Engine

2.1. Control common rail pressure

Under the control of electronic control technology, the diesel engine can form a running system. When the diesel engine is working, the common rail pressure in the dual common rail electronic control system can determine the fuel injection pressure and quantity of the diesel engine. The common rail pressure mainly affects the movement speed and opening volume of the gas distribution components. Therefore, when controlling the common rail pressure, the common rail oil pressure control module is divided into two control modules accord-

ing to its different functions. Two modules are set as common rail oil pressure module and common rail pressure control module. Firstly, the common rail oil pressure module is designed, and a signal circuit is designed in the oil storage part of the diesel engine. The signal output of the circuit is designed as 4-way output and 1-way input. According to the different working conditions of the diesel engine, adjust the rotating speed of the valve components. When the rotating speed is high, keep a few times of oil supply, constantly adjust the water temperature in the diesel engine, and keep the water temperature in a stable state [3].

Before the design of the common rail pressure control module, the injection parameters of different rotational speeds in the diesel engine are integrated into a map Atlas of common rail pressure, the control objectives are adjusted continuously, and different types of diesel engines are used for adjustment. The parameters in the map atlas are applied to the electronic control technology of the diesel engine, and then the cooling water temperature of the diesel engine is corrected. Record the data fed back by the common rail oil pressure regulating module, compare the actual value fed back by the sensor installed on the common rail pipe, use a certain calculation equation to calculate the control as an expression, and then continuously debug the output control signal to ensure that the common rail pressure is the same as the target pressure. The two constant parameters with the same pressure value are retained and sorted into the equation expression for controlling the common rail pressure [4].

2.2. Control injection timing

The pre calibrated timing map can control the injection timing of the diesel engine. Controlling injection timing can improve fuel economy and fuel combustion efficiency. Fuel injection timing mainly delays the injection of diesel engine, so that the fuel can enter the cylinder of diesel engine under high temperature and pressure, reducing the delay period of fuel. In this way, in the actual combustion of diesel, the combustion temperature is reduced, the emission of pollutants and the noise caused by combustion are reduced. In order to control the pressure drop in the diesel engine caused by injection timing, the injection timing is adjusted in the MAP diagram to reduce the fuel economy [5].

The crankshaft signal in the diesel engine is taken as the reference of integral tooth counting for fuel injection timing and fuel supply timing. Adjust the crankshaft signal to 90 signal, and set 180 signals when the tooth counter rotates for two turns. At this time, the ECU in the map set will calculate the speed according to the interval of the signal, synthesize the fuel injection signal, use a byte to store the interval between the signals, use variable to store the signal number, and number the number signal from 0 to 179 sent by the tooth counter. The global variable in the program during control is set as the command of adding one to every crankshaft signal interruption and clearing every 180 times. In case of coding error, in order to prevent timing disorder, turn off the fuel injection command and fuel supply enable flag. The cam signal is converted into six compression up pointing signals and the cylinder judgment signal before the compression up dead center of cylinder 1. At this time, the ECU will judge the multi tooth position according to the signal interval time. After getting the first multi tooth position, it will be calibrated as 0. With the calibrated 0 position as the reference of fuel supply timing, the control of fuel injection timing is completed [6].

3. Optimizing Electronic Control Technology of Intelligent Diesel Engine

3.1. Design conditioning circuit

To judge whether the optimized electronic control technology is optimized, mainly from the performance of the controlled diesel engine, or from the electronic components and the circuit composed of electronic components. When designing the conditioning circuit, it is important to design the connection direction of the electric control technology and select the high quality electronic devices [7]. The quality, technology and structure of electronic devices are integrated, and excellent technology is used to eliminate the electromagnetic noise interference caused by the improper connection of the cables and improve the reliability of the conditioning circuit. The actual connection mode of regulating circuit is shown in Fig. 1 below:

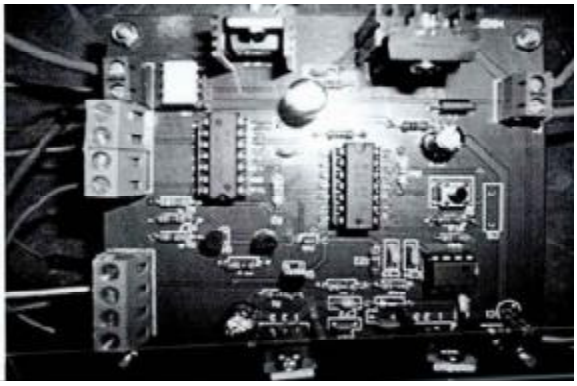

Figure 1. Practical conditioning circuit

3.2. Design control solenoid valve

The driving mode of the solenoid valve of diesel engine is very special. The resistance of the high-speed solenoid valve in the solenoid valve is low, and the current on the coil in the solenoid valve is large, which causes a lot of power loss. Adjust the current waveform of the solenoid

valve to the waveform. To solve the problem of short fuel injection time, increase the number of magnets in the solenoid valve, so that the electromagnet can produce strong suction to overcome the pull of the return spring. The change of electromagnetic attraction is proportional to the coil current, and the parameters of the solenoid valve structure are set to make the current increase rapidly in a short time. Control the voltage around the coil to ensure the quick opening of the solenoid valve [8].

According to the principle of electric heating, the coil of solenoid valve will be heated by a large current in the solenoid valve. In order to avoid overheating of the solenoid valve, when the solenoid valve is opened, immediately control the current in the coil to a smaller value, maintain the opening state of the valve, and reduce the efficiency to the minimum. In order to ensure the long-term operation of the whole fuel injection system and reduce the power loss in the current opening stage, the current working mode is changed to the subsection working mode to further reduce the unnecessary function loss.

4. Experiment

4.1. Experimental preparation

Three diesel engines with the same parameters are prepared for the experiment. The main parameters of the diesel engine prepared for the experiment are shown in the table below:

Table 1. Diesel engine for experiment

Serial number	Parameter name	Parameter value
1	Cylinder diameter	600mm
2	Piston stroke	2250mm
3	Design maximum continuous working condition	16520kW/114r/min
4	Maximum continuous working condition of the contract	16520kW/114r/min
5	Mean effective pressure	1.95MPa
6	Maximum burst pressure	15.5MPa
7	Overload power	18172kW/117.7r/min
8	Fuel consumption rate	170g/KW.h+5%
9	Outline size	Length:9.25m, Width:3.70, Height:10.54m
10	Dry weight	About 375 tons

Using three kinds of electronic control technology to operate the diesel engine with the parameters in the table above, the fuel injection situation of the diesel engine under three kinds of electronic control technology environment is analyzed.

4.2. Experimental result

Before the control of the three electronic control technologies, set the original diesel quantity in the diesel engine as 5L, and control the initial combustion efficiency of the diesel engine as 75%. The experimental results of the fuel injection quantity of the diesel engine under the control of the three electronic control technologies are as follows:

As shown in the result chart above, when the combustion rate of the diesel engine is controlled at 75%, with the gradual decrease of the combustion rate, the fuel injection quantity of the traditional electronic control method 1 and the traditional electronic control method 2 reaches 100ml after the combustion rate is reduced to 30%, while the intelligent electronic control technology of the diesel engine finally controls the fuel injection quantity of the diesel engine at about 40ml with the decrease of the combustion efficiency, and the fuel injection quantity of the diesel engine At least, it reduces unnecessary waste of diesel oil and is more suitable for practical use.

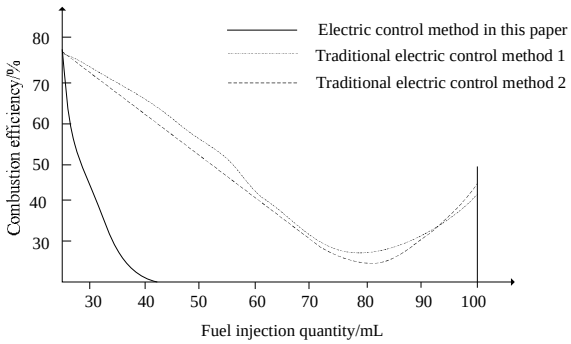

Figure 2. Fuel injection test results of diesel engine with three kinds of electronic control technology

5. Conclusion

In the future, diesel electrical control technology will certainly develop in the direction of intelligence and digitalization. The use of digital control in electronic control technology can realize the intelligentization of electronic control technology. The future electronic control technology will certainly be applied to more complex diesel engine control systems, and electronic control technology will also be developed in the direction of virtual reality technology. Control the common rail pressure and injection timing, design the adjustment circuit of the diesel engine, design a solenoid valve in the ad-

justment circuit, and complete the optimization of the electronic control technology. Experiments show that under the same parameters of the diesel engine, compare the two traditional electronic control methods, The optimized electronic control technology has the least amount of fuel injection at the same combustion rate, which reduces the waste of the diesel engine and is more suitable for actual use.

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