Study on Characteristics of Electro-hydraulic Proportional Multi Road Valve Based on Cutting Platform Lift System

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Abstract

Taking the load sensitive electro hydraulic proportional multiway valve as the research object, this paper analyzes the working principle and structural characteristics of the electro hydraulic proportional multiway valve applied to the lifting control of the cutting platform of the large-scale combine Harvester, and designs the electro hydraulic proportional multiway valve structure. Through AMESim's HCD module, the loading sensitive multiway valve and the combine Harvester's cutting platform lift hydraulic system are simulated and the basic action curve of the cutting platform is obtained, so that the model can truly simulate the application of the large combine Harvester's cutting platform lifting system in actual working conditions. The feasibility and energy saving of the load sensitive system applied to the hydraulic system of cutting platform lifting are verified.
Keywords.

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AMESim, large combine Harvester's cutting platform, the hydraulic system.

1. Introduction

In recent years, large-scale agricultural equipment such as large-scale joint harvesting machine has developed rapidly. These high-end equipment need to be equipped with a large number of high-performance and high-reliability electrohydraulic scale components and systems, and then in the domestic, the electro-hydraulic infrastructure supporting high-end equipment industry is almost empty. Most of the lifting control of the cutting platform of the domestic joint Harvester still uses manual operation control, and its hydraulic system uses happy quantitative pumps, which is laborious and energy-saving.

In this paper, a load sensitive electro hydraulic proportional multicircuit valve is designed, its structure form is determined, its structure principle is analyzed, and a simulation model is established using the HCD module provided by AMESim. The reliability and energy saving of the hydraulic system of load sensitive multiway valve and combine Harvester are analyzed. At the same time, the load sensitive electro hydraulic ratio multi-circuit valve is designed using electromagnetic pilot drive technology, which reduces the labor burden of workers.

2. Structure Principle and Modeling Analysis of Electro-hydraulic Proportional Multi Road Valves with Sensitive Load

Load-sensitive electro-hydraulic proportional multi-circuit valve is an important part of electro-hydraulic control system, which is mainly composed of electromagnetic valve and liquid-controlled reversing valve. The solenoid valve acts as the pilot valve, switches the control oil path, and the liquid valve acts as the main valve. It is used to switch the main oil path of the system, so as to realize the electric signal control large flow system. As one of the key hydraulic parts of the joint Harvester, the

main function of the load sensitive electrohydraulic proportional multiway valve is to carry out hydraulic multiway output control and adjust the lifting and lifting speed of the harvester.

The pilot valve core, main valve core and movable valve core are all fitted with a structure, and the pilot valve oil path is arranged inside the valve body. The hydraulic lock can improve the sealing ability of the system. At the same time, it can fix the cutting table in a certain position. During the long working time, the cutting table will not slowly fall.

When the cutting platform needs to be lifted, signal is applied to the proportional electromagnet, the pilot valve core is moved 4 left, the pilot pressure oil enters the left cavity of the main valve core, and the main valve core is pushed to the right. The pressure oil passes through the triangle throttle into the movable valve core left cavity from the P port., one-way throttle valve opens, At the same time hydraulic lock movable valve core is pushed to the right. On the contrary, when the cutting platform falls by gravity, the main valve core moves to the left, the pressure oil enters the right cavity of the main valve core, and then enters the hydraulic lock to move the valve core right cavity, pushing the movable valve core to the left until the one-way valve is topped off, and the hydraulic cylinder pressure oil is returned from Exit A and enters T1 to return to the fuel tank.

3. Structure and Principle of Load Sensitive Variable Pumps

Load sensitive pumps are connected in series with the three-way pressure compensator of the load sensitive electrohydraulic ratio multi-channel valve in the cutting platform of the combine Harvester. The pressure required for the load is fed back to the sensitive cavity of the sensitive control valve and variable pump control mechanism, so that the displacement of the variable pump changes. The pressure parameter of the pump outlet changes with the load pressure, so that it provides the hydraulic power required for the load to the system, which can reduce power consumption.

When the proportional overflow valve opening is unchanged, the pump outlet displacement is maintained at a constant value. When the load pressure is too large, the pump outlet flow decreases rapidly. From Figure 7, it can be seen that during the normal operation of load sensitive pumps, the pump outlet pressure is always greater than the load pressure, and a fixed pressure difference is maintained.

4. Modeling and Simulation Analysis of Hydraulic Elevation System of Cutting Platform of Combined Harvester

The hydraulic lifting system of the cutting platform of the combine Harvester generally adopts a single-acting hydraulic cylinder, and the descent process depends on the gravity of the cutting platform. This design prevents the cutting table from falling too fast, resulting in excessive inertia and breaking the machine. The figure shows the schematic diagram of the hydraulic lifting system of the cutting table of the combine Harvester.

5. Conlusion

The displacement curve of the hydraulic cylinder is basically the same as that of the actual working process, and the hydraulic cylinder descent process is driven by its own gravity. It can be seen from Figure 11 that during the hydraulic cylinder lifting process, the flow rate of the pump is always slightly greater than the inlet flow of the hydraulic cylinder, and changes with the change of flow rate at the inlet of the hydraulic cylinder; When the hydraulic cylinder descends, the pressure oil enters the right side of the hydraulic lock movable valve core, pushes the valve core to the left, opens the one-way valve, and causes the hydraulic oil in the lower part of the hydraulic cylinder piston to quickly return to the cylinder. Figure 12 shows that the outlet pressure of the hydraulic pump is always greater than the inlet pressure of the hydraulic cylinder. The pressure of hydraulic pump changes with the pressure change of the inlet of hydraulic cylinder, and the system energy saving is realized.

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