Research on control system of live working vehicle

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ABSTRACT: This paper according to real grid power maintenance needs put forward a kind of live working robot, live working robot is developed for distribution live line work of a safe and reliable live working equipment. The live working robot vehicle control system, software and hardware realization of the motion control system. At last, the paper introduces the system of position servo control and force / position hybrid control, and through the MATLAB simulation of two kinds of control method of position tracking, simulation curves prove with force feedback the control effect is better.
KEYWORD: Live working; robot; position tracking; MATLAB simulation

1 INTRODUCTION

Distribution of the live working technology is to ensure the safe and reliable operation of the power supply equipment, improve the economic efficiency of power grid and service quality as an important means of maintenance. Currently, China charged operation mode is still manual live operation, operation personnel work in high voltage and high altitude environment, poor working conditions, easily lead to accidents. Therefore, the development of a 10 kV high-voltage live line work robot has important significance.

2 LIVE WORKING CAR INTRODUCTION

The live working vehicle is designed according to the crank arm type self walking aerial work vehicle, and introduces the technical specification of the live working and the high voltage insulation technology into the design, so that the type aerial vehicle has the function of live working. Adhering to safety, flexible and reliable purpose, in the chassis design, garment design, bucket design, control system design etc. aspects of use the advanced technology, combined with high-altitude vehicles in the existing design and manufacturing standards, determine the overall scheme, as shown in Figure 1 below.

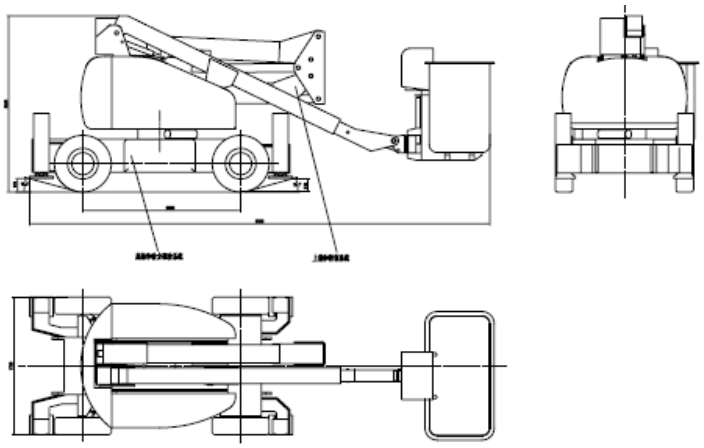

Fig.1 Operating vehicle structure diagram

Vehicle chassis, jacket and insulation work. The telescopic arm and the end working bucket are made of insulating material to ensure the insulation level of 10kv. The working bucket part can move 50cm in the vertical direction, and can satisfy the layout of all kinds of high voltage lines[1].

2.1 *Chassis And Power Drive System*

As the vehicle chassis installation base, structure stability, deformation and the need to meet the conditions required strength of arm car. Power driven

The system is powered by battery, the motor is used for driving, the crank arm is raised and the vehicle is adjusted by hydraulic power.

The motion of each functional unit is realized by the system. The basic structure of this system is as follows 2

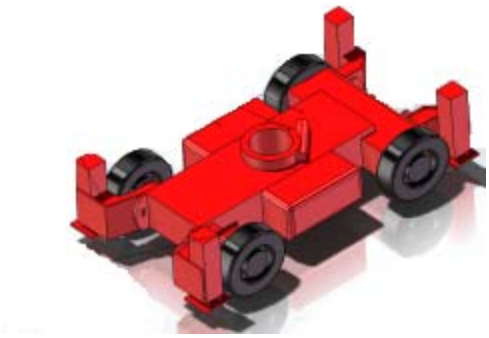

Fig.2 Chassis structure

Fig.3 Upload assembly

2.2 *Upload Assembly*

The top coat assembly comprises a rotary table, a lower folding arm, an upper folding arm, a basic arm, a telescopic insulating arm, an insulating working platform and a liquid. Pressure motion system. The jacket assembly is the main function component of the bucket arm vehicle, it is required to work stably, safely and reliably. Dynamic. All parts are required to carry out safety check, keep enough safety margin. Schematic diagram is as follows 3.

2.3 *Electric Control System*

Electrical control using PLC control, the use of battery powered. Including the turntable and chassis electrical system and electrical system platform. The two systems to platform electrical system as a priority, according to GB / T 9465-2008 (the "high-altitude car", when people work in the platform, chassis control platform function disabled. At the same time, it is equipped with tow line control box, which is convenient to move and adjust the position of the vehicle[2]. An electrical system principle diagram as shown below:

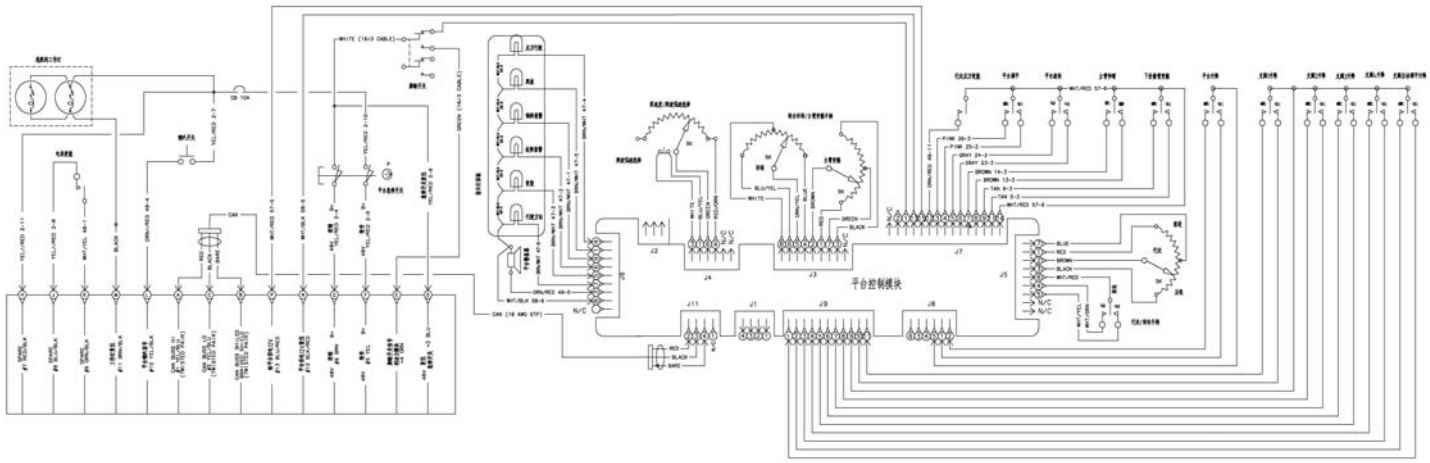

Fig .4 Electric principle diagram of the platform

2.4 *Hydraulic Control System*

The operating vehicle is powered by batteries, and the hydraulic system performs the function of movement. In addition to walking, the operating vehicle is driven by hydraulic pressure in the direction of the steering, the rotation, the folding lifting, the telescopic movement and the like. The hydraulic system has the characteristics of stable operation, large load capacity, safety, reliability, control technology maturity and so on. Operating vehicle hydraulic control system diagram is as follows:

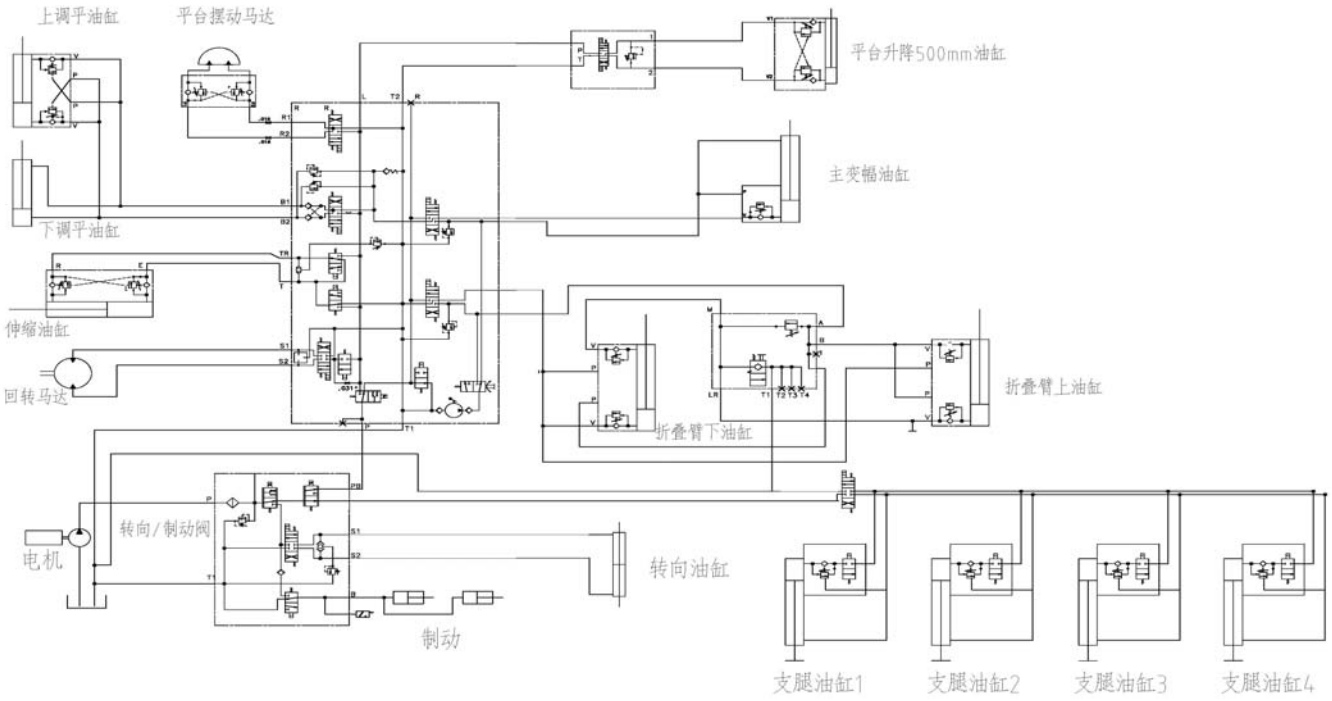

Fig.5 Hydraulic control system

3 TEST

Position tracking test is test for pure position servo control and with force feedback of force / position hybrid control method for a given signal tracking, and then select the better control strategy. For convenience, choose sine signal for a given signal, such as shown in Figure 6.

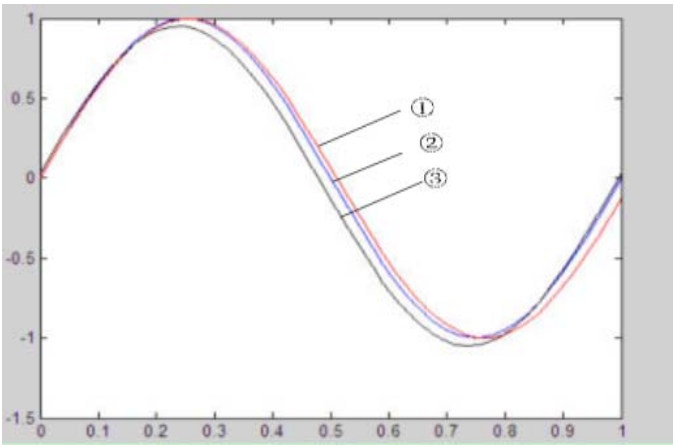

Fig.6Simulation diagram

4 SUMMARY

With the improvement of the development of information technology and automation level, the teleoperation of robots instead of humans to complete tasks in a dangerous situation has become very common, technology has gradually matured, but some control mode is still in the exploratory stage. The position force hybrid control strategy, not only to retain the advantages of position servo control, and make the system with force telepresence. And the control method is proved by the MATLAB simulation curve.

REFERENCES

[1] Imaida T, Yokokohji Y, Doi T, Oda M, Yoshikawa T. Groundspace bilateral teleoperation of ets-vii robot arm by directbilateral coupling under 7-s time delay condition. IEEE Trans. Robotics Automat, 2010, 20:499 511).

[2] Zhou FY, Wu AG, Li YB. An inspection robot running on110kV power transmission line, Electric Power; 2008-03.