Based on the Hook Balancer Braking Parametric Analysis of the Event

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Abstract

Build the braking system to parameterize analyse to the braking process of the hook balancer by using the ADAMS simulation software based on the system structure and braking principle. It proves that the system is influenced differently by every parameter ang by analyzing the experiment, it is proved that the simulation results are right. The conclusion verify the feasibility of braking system and provide the basis for the hook balancer design and improvement.

Keywords

The Hook Balancer, ADAMS, Parameterize Analyse, Torque, Angular Velocity.

1. Introduction

Braking performance is one of the important properties of the hook balancer and good braking performance is an important guarantee for the safe operation of modern hook balancer, At present, there are three main types of brake system of the hook balancer: mechanical brake, hydraulic brake and electromagnetic brake. The brake parameters are the key factors that affect the braking performance.In this paper, the mechanical brake hook balancer as the research object, through the modeling and Simulation of the braking performance and the influence factors were analyzed and the experimental results verify the correctness of the simulation, which provides a reference for the optimization of braking system.

2. The composition and working principle of mechanical braking system

2.1 Brake system components

The brake system is composed of two parts: the brake disc (as Figure 1)and the fixed frame(as Figure 2). Emergency brake discs are the upper and middle, turf, centrifugal block, spring, rotating pin and other components, the centrifugal block can rotate around the rotating pin.

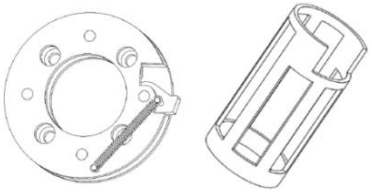

Figure.1 Brake disc Figure 2. Fixed stop

2.2 Working principle of emergency braking system

In normal operation, the centrifugal block is in a retracted state under the action of the spring tension. When suddenly from the hanging hook falling, drive the emergency brake disc to produce a larger angular acceleration, angular acceleration in the centrifugal block under the action of instantaneous a radially outward inertia force, the inertia force can overcome the spring force, the inertia force is greater than the spring force, the centrifugal block can rotate and be rotated around the rotating pin thrown when the centrifugal block after being thrown, quickly stuck in the groove of the fixed retaining frame, so as to realize the function of emergency braking.

The process of mechanical braking is divided into two stages: the initial braking stage and the complete braking stage. Because the motion equation of the centrifugal block in the initial stage is

difficult to be calculated by the theory, this paper analyzes the influence of the initial value of the torque and angular velocity on the initial stage of the braking process.

3. Dynamic performance simulation

3.1 Virtual prototype model

The establishment of 3D model by 3D software and the virtual prototype, a virtual prototype model is the basis of simulation analysis, after the establishment of complete virtual prototype model to create constraints in various parts, adding flexible force and collision model after the completion [1], as shown in figure 3.

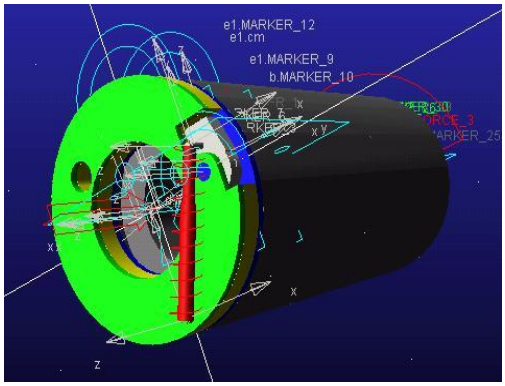

Fig. 3 Brake model

3.2 Set sensor and define design variables

Parametric analysis of the event is to understand the effects of the parameters on the performance of the prototype, according to the simulation results of torque and angular velocity of the initial value of the degree of impact on the whole braking system, in order to make the simulation more accurate, we use the sensor to replace the retainer, 1 for weight from the definition of variables when the hook roll angular velocity, torque definition 2 variables for heavy objects out of hook when the drum.

3.3 Design and research of braking system

In order to study the effect of the initial angular velocity on the braking system, the torque of the drum is set to be constant, and the initial angular velocity is changed at each test. The test results are shown in figure 4.

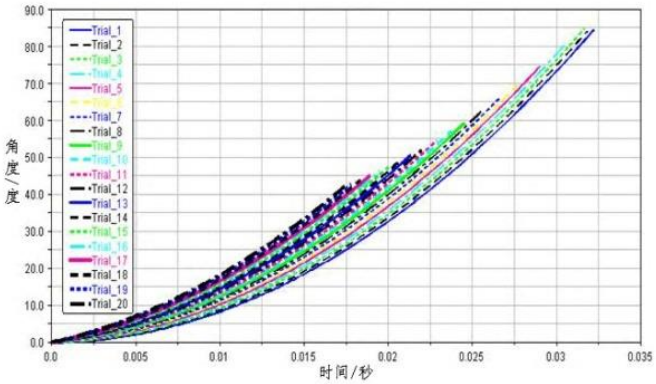

Fig. 4 Rotor rotation angle

As can be seen from Figure 4, the larger the initial value of the angular velocity, the smaller the angle of rotation of the rotor, the shorter the braking time.

In order to study the effect of the torque on the braking system, the initial value of the angular velocity of the drum is set to be constant, and the torque of the drum is changed every time. The test results are shown in figure 5.

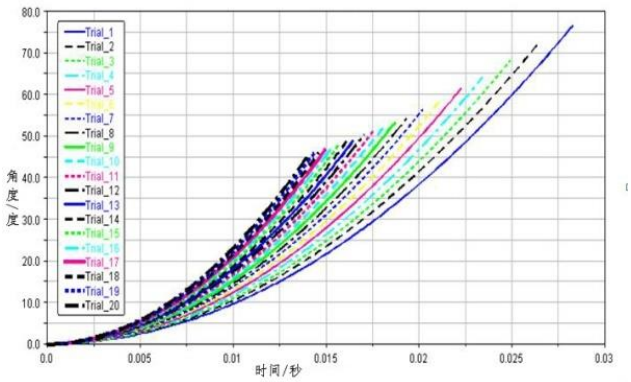

Fig. 5 Rotor rotation angle

As can be seen from Figure 5, the greater the torque of the rotor, the smaller the angle of rotation of the rotor, the shorter the braking time.

3.4 Brake system design

The design study is to take into account the impact of a single variable on the objective function, if we want to consider the impact of multiple design variables on the objective function, we need to use the method of experimental design [2].

Design test study, the variables 1 and the research parameters are consistent, the variable range of 60000-100000 $N \cdot mm$, for the 50 test, set up ten times for a group of experiments. The results of the experiment are analyzed in Matlab, and the results are shown in figure 6.

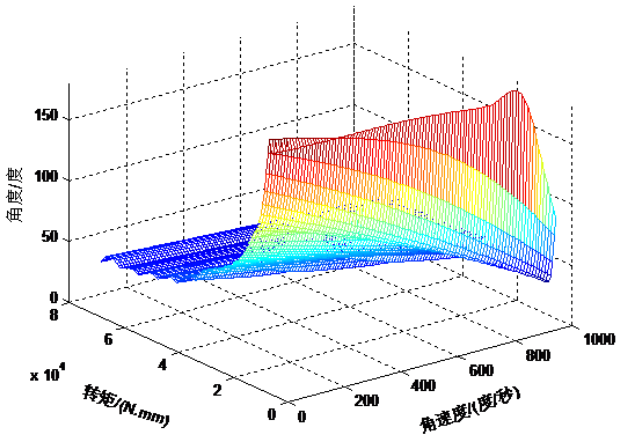

Fig. 6 test results

Conclusions can be analyzed from the test results in the Figure 6: when a constant angular velocity, torque and torque to a certain extent, a relatively large impact on the braking angle; when a certain torque, with the increase of the angular velocity of the rotor relative rotation angle. Since the angular velocity of the weight is removed from the hook, the torque is considered as the key factor affecting the braking.

4. Experimental verification

In order to further verify the accuracy of the simulation results, the 60Kg series pneumatic balancer is taken as an example, as shown in figure 7. By adjusting the air pressure of the size, so as to control the torque, torque of decoupling experiments under different conditions, as shown in Figure 8 of the size of the torque and braking time, the accuracy of simulation results are verified by experiments.

Fig. 7 the pneumatic balancer of hook

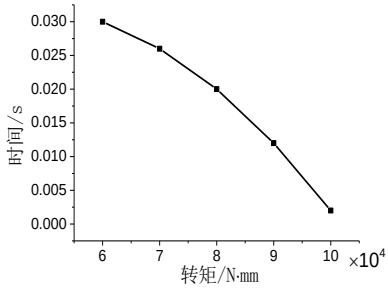

Fig. 8 torque and braking time

5. Conclusion

Through the analysis of the principle of braking hook balancer, establishing virtual prototype model, and the influence on braking performance parameters of brake were analyzed through the experimental design and experimental research verified the effect of the different parameters of the brake system to various degrees, in order to improve the braking performance, brake performance is safe and reliable, in the design of its structure parameters, should the torque is considered as the most important parameter affecting the brake performance, while the experiment also verified the correctness of the analysis results.

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