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Analysis of the Performance of Aerial Work Platform Working Device Based on Virtual Prototype and Finite Element Method

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Abstract

In this paper, a model of aerial work platform working device based on virtual prototype and finite element method was established. Through the software ADAMS kinematic simulation, we got the moving velocity and acceleration. The moving velocity and acceleration showed that the aerial work platform working device met the standards of the national safety standard. Through the dynamics simulation, we got the joints force between working device, we input the joints force into the finite element model established by the software of Hyperworks. The simulation result of working device stress distribution showed that the chose material met the working requirements; the structural design of working device was reasonable.

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Keywords: aerial work platform; working device; virtual prototype; finite element; strength

1. Introduction

The aerial work platform is a mechanical equipment that delivers worker to the designated location [1]. During aerial work platform working process, the staff controlled the working device in the work platform. Due to the high working environment, the performance of aerial work platform working device related to the safety of worker and the device normal operation, so the performance of working device are necessary to study [2].This paper introduce a method to analyze the safety of aerial work platform and structural design of working device. We used kinematic method to analyze the working performance whether met the safety standard or not and we used dynamics and finite method to analyze the working device whether met the strength requirement or not.

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2. Aerial Work Platform Structure and Working Principle

Figure 1 demonstrates the aerial work platform working device. There are two oil cylinders to make the lower arm and the upper arm to work. The lower arm is moved by the lower oil cylinder. The lower arm range of angle is form 0° to 75°. The upper oil cylinder do not works until the lower oil cylinder stop to work. When the lower oil cylinder stops to work, the upper arm oil cylinder began to work. The upper arm range of angle is form 0° to 66°. In the process of work, the work platform kept horizontal all the time to ensure the safety of staff.

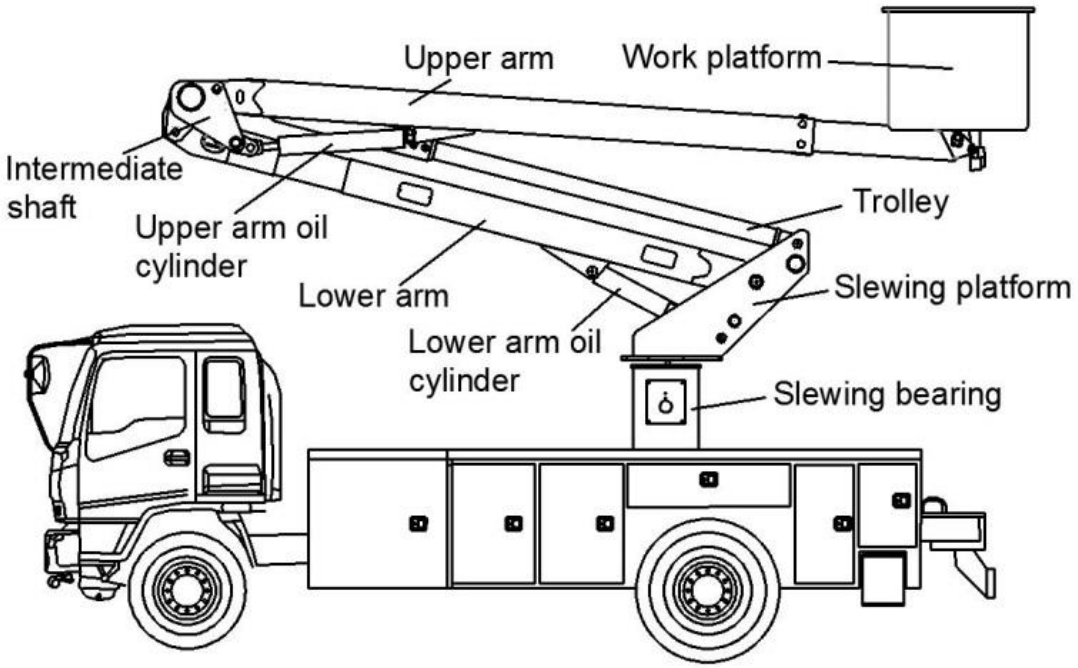

Fig. 1. (a) Aerial work platform working device

3. Establish the Virtual Prototype of Working Device

We used the virtual prototyping software of ADAMS to establish virtual prototype model of aerial work platform [3, 4]. Through the kinematic simulation, we got the moving velocity and acceleration values during the aerial work platform working. The moving velocity and acceleration values compare with national safety standards to check out whether pass the standards or not [5]. Through the dynamics simulation, we got the force between the hinge points of each working device. The force of joints was input to the finite model to analyze of the working device stress of the aerial work platform.

According to the maximum load quality of aerial work platform, this article is applied perpendicular of downward force of 2000N at the bottom of the work platform.

3.1. Simulation analysis of working condition