Dynamics Simulation Analysis of Pull-rod Lifting Mechanism Based on Adams and Ansys

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Abstract

In this paper, a three-dimensional model is established by UG, Adams is used to simulate the structure of self-loading and unloading truck, and Ansys is used to optimize the simulation of key components. The simulation results are analyzed, and finally the key optimization scheme of the parts is given, which is of guiding significance to the actual production of the rod lifting device.

Keywords

Rod - type lifting mechanism, dynamic simulation, finite element analysis, effectiveness.

1. Introduction

With the development of rural urbanization, according to the characteristics of the urban population, various environmental protection departments use barreled trash cans for the collection of urban garbage. In view of the fact that the urban garbage bins are relatively discrete, the self-loading garbage trucks can be widely used because they can realize mechanical automatic loading and unloading of garbage, good sealing performance and large loading capacity.

The trolley-type lifting device for loading and unloading garbage trucks is a key device for collecting garbage in the whole vehicle, and has a high frequency of use in the process of collecting garbage. In actual use, the problem of damage of key components often occurs. This paper mainly studies the tie rod lifting mechanism of the self-loading garbage truck, and uses UG to carry out three-dimensional modeling of the tie rod lifting mechanism, and then introduces it into Adams for dynamic simulation, and analyzes the force curve of key components to obtain the maximum force. Value, and based on the study of the force of Jane Kim, the effectiveness of the analysis, and then through Ansys analysis of statics, to optimize the design of key components.

2. Organization of the Text

2.1 Composition and Working Principle of Self-Loading and Unloading Truck Pull Rod Lifting Mechanism.

A schematic diagram of the tie rod lifting mechanism is shown in Figure 1. The lifting mechanism is mainly composed of hydraulic cylinders, lifting arms, tie rods, lifting frames, turning frames, remote rods, rollers and main guides.

The lifting arm is respectively connected to the box body, the hydraulic cylinder (piston rod end) and the tie rod through the hinge point; the other end of the hydraulic cylinder is hinged on the box body; the other end of the rod is hinged with the lifting frame; the lifting frame passes the four rollers on both sides along the flip frame The auxiliary rail moves; the flip frame and the remote sensing are combined to form a linkage pair by the hinge, and then the flip frame and the respective rollers on both sides of the remote sensing move along the main rail welded on the box body.

The working principle of the lifting mechanism is as follows: the hydraulic system pushes the piston rod of the double-acting hydraulic cylinder through the power provided by the hydraulic pump, and the lifting arm and the piston rod of the piston rod swing around the hinge point of the box, and the lifting arm drives the rod to move upward. After the trash can is pressed against the pressure plate on the flip frame, the flip frame is driven to move up along the main rail. When the upper roller of the flip frame is blocked and stopped, the pull rod continues to pull up the lifting frame, so that the axis of the roller at the upper end of the flip frame is turned over by the dumping shaft until the garbage is automatically dumped. After emptying the garbage, the oil is reversely injected through the double-acting hydraulic cylinder, the piston rod begins to retract, and the lifting arm swings in the opposite direction, which is the process in which the trash can returns to the initial position to complete the automatic filling of the garbage. The working principle of the lifting mechanism is as follows: the hydraulic system pushes the piston rod of the double-acting hydraulic cylinder through the power provided by the hydraulic pump, and the lifting arm and the piston rod of the piston rod swing around the hinge point of the box, and the lifting arm drives the rod to move upward. After the trash can is pressed against the pressure plate on the flip frame, the flip frame is driven to move up along the main rail. When the upper roller of the flip frame is blocked and stopped, the pull rod continues to pull up the lifting frame, so that the axis of the roller at the upper end of the flip frame is turned over by the dumping shaft until the garbage is automatically dumped. After emptying the garbage, the oil is reversely injected through the double-acting hydraulic cylinder, the piston rod begins to retract, and the lifting arm swings in the opposite direction, which is the process in which the trash can returns to the initial position to complete the automatic filling of the garbage.

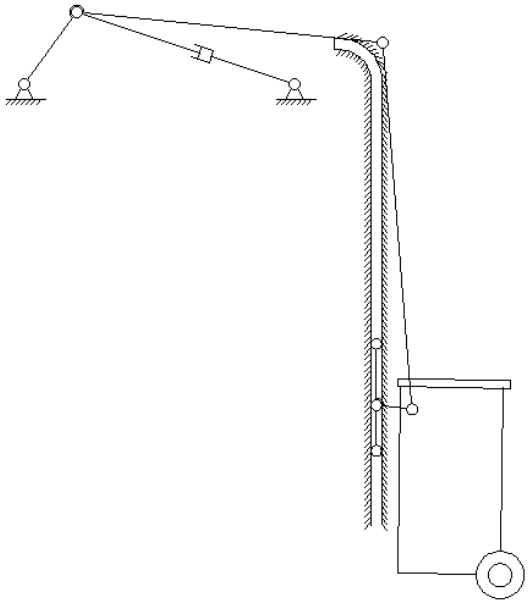

Figure 1. Schematic diagram of the mechanism of the tie rod lifting mechanism

2.2 Adams Simulation Model is Established.

The three-dimensional model of the trolley-type lifting mechanism of the dump truck is established by UG. Figure 1 shows that the result of the trolley-type lifting mechanism of the dump truck is more complicated, and there are more parts. The model is based on the analysis of the working principle and actual work of the trolley-type lifting mechanism. Simplify and export the .x_t 3D format file and import it into the shown Adams for dynamic simulation. In the UG software, the three-dimensional model of the dump truck type lifting mechanism is built and assembled. As shown in Fig. 1, the interference check is performed and saved into the Parasolid format and imported into the Adams software. The parts are modified according to the actual materials, and the constraint relationship and load are added. Without affecting the simulation results, the internal parts of the dump truck type

lifting mechanism are simplified as necessary, and the lifting frame is attached with the load of the trash can to simulate the real working state of the lifting mechanism.

Figure 2. 3D model of the tie rod lifting mechanism

2.3 Draw-type Lifting Mechanism Virtual Simulation and Load Curve.

The virtual lifting process of the lifting process of the dump truck type lifting mechanism was carried out. The speed of the mechanism hydraulic cylinder was set to 0.1 m/s during the simulation. The force curve at point O is shown in Fig. 3. The broken line is the force in the Y direction of the O point, and the solid line is the force in the X direction of the point O. At this time, the moment when the trash can is mentioned at the end of the main rail starts to dump the garbage. status.

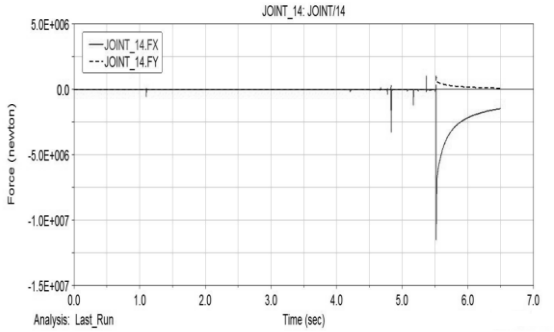

Figure 3. o point force curve

2.4 Analysis of Vulnerable Parts by Finite Element Analysis.

In the actual position of the lifting mechanism support position (Fig. 4), the failure fracture failure often occurs. For this reason, the strength is analyzed by Ansys software, and the corresponding optimization scheme is proposed.

Figure 4. Lifting mechanism support position

2.4.1 Analysis Process and Results

The lifting mechanism support position, that is, the point o of the mechanism figure 5, has been obtained by Adams simulation. In order to establish the finite element model, the model is first built by UG, and then saved into the Ansolid workbench software in Parasolid format. The load is 1.1X10^7N in the x-axis direction and 1.2X10^6N in the y-axis direction to obtain the deformation cloud map. And the stress cloud diagram are shown in Figure 5, respectively.

The minimum safety factor S is 0.1588, S<Skp, and the conclusion is that the strength is not applicable. The maximum deflection Ymax is 0.4613, Ymax < Y, and the conclusion is that the stiffness is satisfied. The maximum stress is 1388.9MPa.

Among the above analysis results, the minimum safety factor indicator is not applicable and there are great safety hazards. Must propose improvements to the structure.

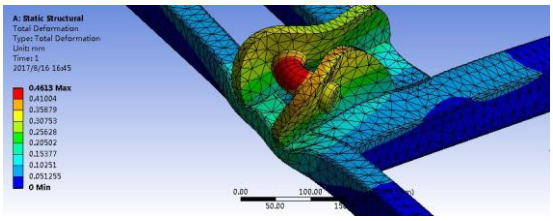

Figure 5. deformation cloud

2.4.2 Improvement Plan

Through the Ansys stress distribution image (Fig. 6), it is possible to focus on the strength of the inner side wall of the support structure by thickening. This improvement is consistent with the actual practical use and the tear damage of the bottom bracket. To some extent, it shows the effectiveness of the program improvement.

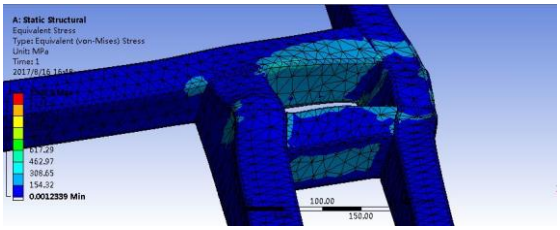

Figure 6. Internal mechanism stress cloud diagram

3. Literature References

References are cited in the text just by square brackets [1,2]. (If square brackets are not available, slashes may be used instead, e.g. /2/.) Two or more references at a time may be put in one set of brackets [3, 4, 5]. The references are to be numbered in the order in which they are cited in the text and are to be listed at the end of the contribution under a heading References, see Table 1.

Table 1. Three Scheme comparing

Numble	Scheme 1	Scheme 2	Scheme 3
1	456	456	123
2	789	213	644
3	213	654	649

4. Conclusion

The accurate establishment of the simulation model of the dump truck type lifting mechanism directly affects the correctness of the simulation results. The suitable contact force was established in Adams, and the parameters such as the solver were set reasonably. The whole process of dumping the garbage by the trolley-type lifting mechanism of the dump truck was simulated, and the stress curve of the

vulnerable point was obtained. Ansys software is optimized to get an improved solution for wearing parts.

Acknowledgements

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