Analysis of Sanitation Vehicle Hydraulic System Based on AMESim

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Abstract

In this paper, using the AMESim simulation software to study the sanitation vehicle hydraulic system modeling, and configuration parameters for the established model and running simulation, get the oil cylinder displacement curve, the system pressure and flow curve. To analyze the simulation curve, can verify the actions necessary to achieve system, required to complete its function, and in the whole running simulation system in the process of pressure and flow rate can meet the design requirements, is obtained by analyzing the sanitation vehicle hydraulic system running stability.d.

Keywords

Fast forward function; working feed function ; AMESim simulation; The hydraulic system.

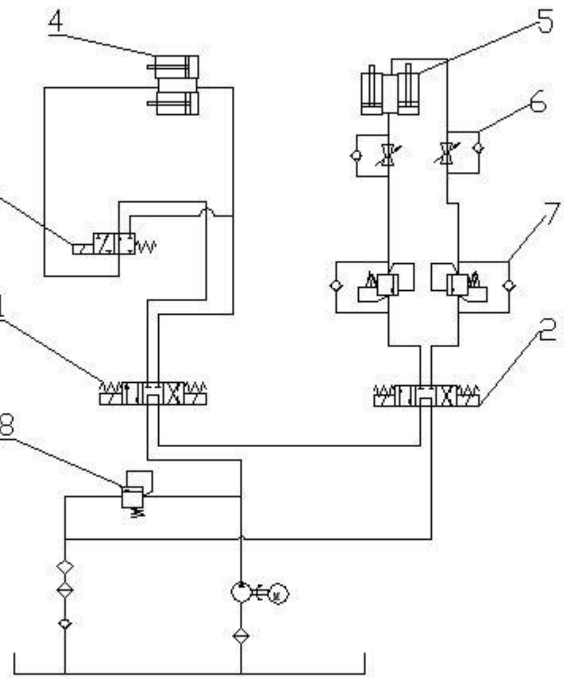
1. Brief Analysis of the Hydraulic System of the Sanitation Vehicle

The hydraulic system of the sanitation vehicle is shown in figure 1, and the main technical parameters of the system are shown in table 1. The lifting and pushing of the bucket oil cylinder used in the hydraulic system can be realized through the lifting and lifting of the bucket oil cylinder and the work, fast forward and return actions of the pushing oil cylinder.

Table 1. The main technical parameters of hydraulic system

Motor speed rpm	Pump delivery car	Maximum load N	System flow L/min	Maximum working Pressure MPa
1450	10	4000	14	25

The working principle of the hydraulic system is as follows: the hydraulic system is mainly composed of two circuits, which are the bucket oil cylinder circuit and the pushing oil cylinder circuit [3]. The rotary bucket oil cylinder circuit adopts three - way four - way electromagnetic directional valve of m-type median function for hydraulic circuit commutation. And through the use of one-way valve and throttle valve to realize the quick lift and slow down of the bucket oil cylinder. Skip cylinder column 5 liters, electromagnetic directional valve 1 in the median, electromagnetic directional valve 2 in the left, the hydraulic oil by the electromagnetic reversing valve through the balance valve and hydraulic lock, into the skip cylinder 5 inferior vena, cavity on the back to liquid, oil cylinder rise at this time. When the inverted bucket oil cylinder 5 drops the column, the electromagnetic reversing valve 2 is in the right position, and the hydraulic oil enters the upper cavity of the bucket oil cylinder, and the lower cavity returns the liquid, and the oil cylinder drops.



1. 2.M type middle position function three - way four - way electromagnetic directional valve;3.Two position four-way electromagnetic directional valve;4.Push oil cylinder;5.Skip the oil cylinder;6.Hydraulic lock;7.Balancing valve;8.The overflow valve

Fig 1. Hydraulic system of sanitation vehicle

The push cylinder circuit adopts m-type medium function three-position four-way electromagnetic commutator valve 1 and two-position four-way electromagnetic commutator valve 3 to cooperate, so as to realize the operation, fast forward and return.

Push oil cylinder 4 workers into the electromagnetic directional valve in the median, 2 electromagnetic directional valve 1 at this time in the right place, two electromagnetic four-way reversing valve 3 in spring, the oil in the hydraulic solenoid directional valve 1 inflows push oil cylinder cavity, after 4 cavity before back to the fluid. Push oil cylinder fast forward, the electromagnetic directional valve 1 in the right place, change to electricity, electromagnetic directional valve 3 after the cavity into the liquid, the hydraulic oil by former cavity flow, the two electromagnetic four-way reversing valve 3 into the loop, into the cavity, after achieve fast forward function. On the return trip, the electromagnetic reversing valve 3 is in the spring position, and the electromagnetic reversing valve 1 is in the left position.

2. Calculation of Main Parameters

2.1 Calculation of Hydraulic Cylinder Inner Diameter

According to the load F is 4000N, and the system pressure is about 20MPa. The inner diameter of the hydraulic cylinder can be calculated by the formula:

$$D = \sqrt{\frac{4F}{\pi p}}$$ =11.4mm Rounded to12mm.

Take piston rod diameter d=0.7 d. D =8.4mm rounded to 8mm.

2. Amnesia Modeling and Simulation of the Hydraulic System of the Sanitation Vehicle

2.2 Establishment of the AMESim Model of the Hydraulic System of the Sanitation Vehicle

In Amnesia, the Amnesia model of the hydraulic system of the sanitation vehicle is established using the hydraulic module, mechanical module and signal module [4] (as shown in figure 2). The system parameters are configured [4] (as shown in FIG. 3 and 4, etc.). During the operation of the dump cylinder, the lifting time of the uplift column is set to 10 s. When reaching the position, the uplift is kept at 4 s to verify the function of the balance circuit of the hydraulic system. The drop time is set to 10 s. When the push cylinder works, make its push program enter first and then fast-forward quickly, set its push program enter time to 7 s, fast-forward time to 7 s, and return time to 30 s. Run the model.

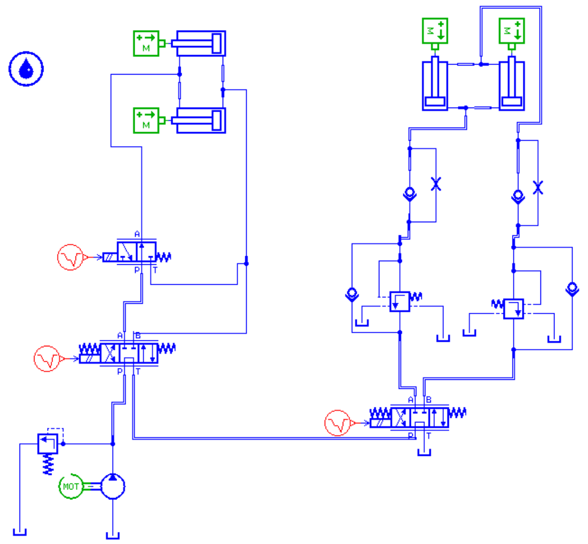


Fig 2. Amnesia model of hydraulic system of sanitation vehicle

2.3 Analysis of Operating Results of Amesim Model of Hydraulic System

After setting the system parameters, run the model [8]. Simulation results are as follows: figure3 for the oil cylinder displacement simulation curve, the curve that [s] of zero to 10, skip up column performance of oil cylinder, the tilting cylinder stable rise, 10 s in position, in 10-14 [s], electromagnetic reversing valve in the median, at this point, the tilting cylinder at a predetermined position.

The push cylinder starts from 24 s. In [24-31 s], the push cylinder keeps working progress, and its running speed is relatively stable. In [31-38 s], the thrust cylinder is in a fast-forward state. At this time, the cylinder operation is relatively stable. The simulation results show that the hydraulic system operates smoothly and can complete the required actions.

For hydraulic cylinder and hydraulic system leak exists some error error of two hydraulic cylinder motion there is a certain error, but the error in small range, so the push oil cylinder operation is stable, the action is more accurate.

By the system pressure characteristic graph4, you can see that the system's maximum pressure in tilting cylinder, the maximum pressure is about 21.5 MPa, the system allows maximum working pressure for 25 MPa, therefore, pressure meet the requirements.

As shown in figure 5, as the system flow chart, the chart can be seen, skip cylinder flow fluctuation is relatively stable, stay in a small range of fluctuation, at each stage, its flow change relatively quickly, and does not appear bigger error, therefore, skip not present oil leaked oil cylinder, its action in accordance with the required. Push oil cylinder at work flow is relatively constant, less volatile, but some wobbles when reversing, consider its load is bigger, and combined with the displacement characteristic curve, its operation is stable, therefore, push oil cylinder although flow exist some fluctuations, but still can be a very good complete the required actions.

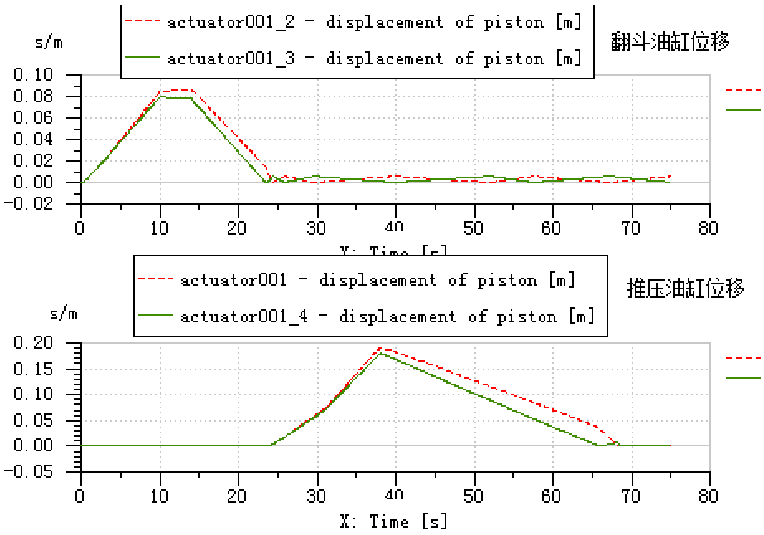


Fig 3. Displacement curve of cylinder

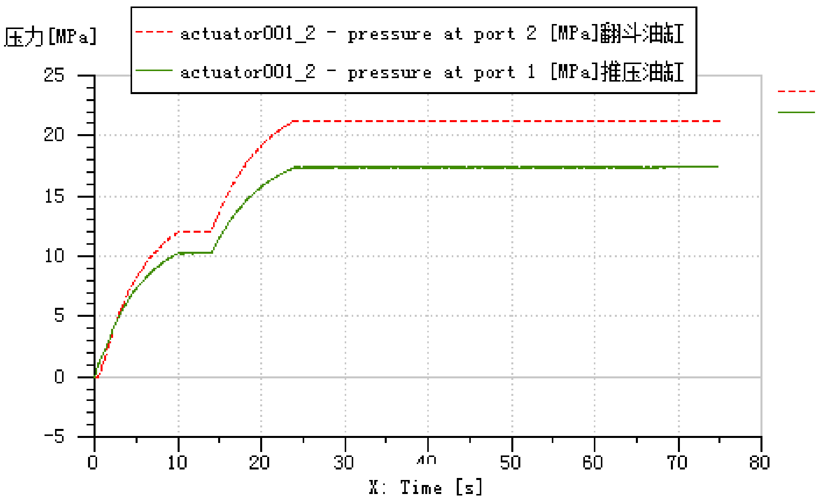


Fig 4. Pressure curve diagram of bucket oil cylinder

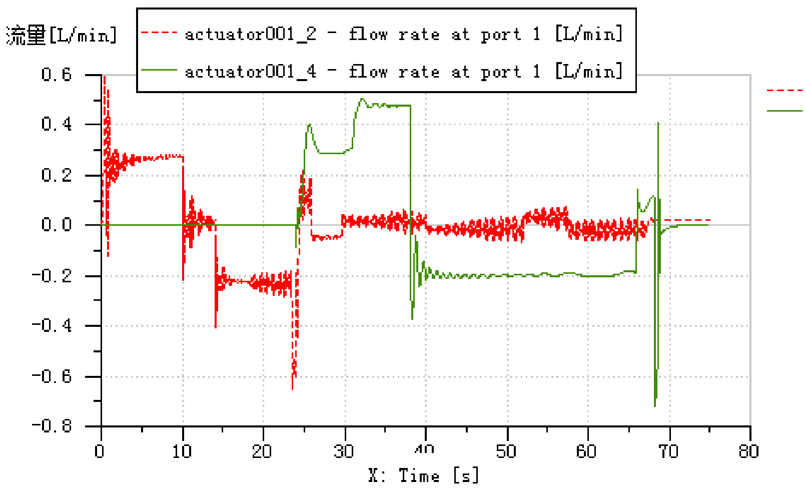


Fig 5. Flow characteristic curve of the system

3. Conclusion

The hydraulic system used in this paper has been proved to meet the technical requirements through modeling and simulation, and the required actions can be effectively completed. In the course of operation, there is a certain error, but the error is kept in a small range, which will not have a great impact on the work of sanitation. However, such errors should be reduced in the design of the hydraulic system to meet user requirements and maintain the stability of the hydraulic system.

References

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