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Theoritical Survey on 22Ton Class Excavator Swing Braking System

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Abstract:
The present theoretical survey is carried out to find the suitable methods used for designing and analyzing the 22 Ton class excavator swing machine. Complete working principle of the excavator data is collected. It differs in working environment, purpose and amount of the load acting on it. Theoretical survey is done based on reviews, industrial requirements and standard specifications. Suitable procedure is found for modelling the excavator parts.

Keywords: Attachments, excavator, meshing, modelling, swing.

I. INTRODUCTION

An excavator are heavy vehicle used in earth working, lifting of heavy parts, demolition and handling of materials. It consists of body of the excavator where operator works with wheels under it, track and attachments above the body part consists of arm, boom and bucket to work. Attachments with the arm depend on purpose of usage. The movement of rotation is called swing where hydraulic driving system is used. The excavator is normally a diesel engines where many hydraulic pumps are driven. This pumps supplies oil flow to the system that operates the different working function along with driven transmission. This swing is hence driven by the hydraulic motor that creates motion of rotation that can rotate upto 360 degrees. When it is used for earth working its characteristics is to dig at one position and rotate for required angle, dump the load and move back. A heavier load will be noticed by the operator since pressure needs to built up for a long time hence the joysticks operation will feel different. This is the reason for open centre systems are still employed in larger excavators. Another feature in separate circuit for the slew drive consisting of a closed loop hydrostatic transmission (HST). The swing can be controlled without values and with less throttling losses. Separation of slew gear from the working hydraulics prevents mutual influences in case of parallel movements. This type of system is also common in heavier excavators where the loads are high. Modern hydraulic excavators come in a wide variety of sizes. The smaller ones are compact excavators. This weighs around 930kgs. The largest model CAT 6090 weighs around 979,900 kgs, and bucket as large as 52.0 m^3. Weights of the attachments will depend upon the purpose of use. For different purpose different types of excavators are used.

2. LITERATURE REVIEW

Yang Xianping as studied on Hydraulic excavator structure model in virtue of Ansys [1]. The nature frequency and the model of vibration were studied to access its dynamic characteristics by model analysis results and found that the connecting shafts at models was easily to produce abrupt, thereby enhancing the performance of hydraulic excavator. Zhang Wobo and et.al., constituted the solid model of SLWY-60 excavator and the work and motion state model of excavator was build based on unigraphics(UG) and transmitted into Automated Dynamic Analysis of Mechanical System (ADAMS) [2]. The size and positions of work devices were parametric. Stimulation model for work state was established by means of defining different joints and motion driving. Naresh N.Oza carried out the finite element analysis (FEA) and optimization of earth moving attachment as backhoe.[3] G.Wszolek presented a numerical vibration of analysis of the excavator model. This model with a discrete distribution of parameters was attracted to kinematic and dynamic exhibitions [4]. The analysis was made in GRAFSIM program. Zygmunt Towarek discussed that the dynamics of a spatial model of a single bucket excavator on a caterpillar chasis [5].The strain of foundation is being taken into consideration. A flexible multibody system power of the excavator process of the hydraulic excavator was presented by Imanishi and et.al., in their research [6]. It was obtained that excavator working process of the deformation characteristics of the device and is verified the dynamics simulation for the excavator design and performance analysis for the whole machine. Research work carried out by Shi Qinglu and et.al., conducted comparative analysis on the intensity of the excavator boom by finite element method [7]. The analysis results shown that local stresses of the boom were relatively higher under offset loads and transverse loads. There are higher stress at some parts working under two conditions.

3. PROBLEM DEFINATION

The type of excavator used during working depends upon the purpose of work. When the 22 Ton class excavator is used during working, the machine should stop between 30-35 degree angle when brake is applied. But due to high inertia force acting on it this is not happening. Hence machine productivity is affected because of stopping angle shift experience. To solve this first we should study about the swing machine inertia of excavator which includes study of Dynamic condition of the swing machine. Later the stability analysis of the equipment, working of swing machine is essential.

4. SOFTWARES

The tool used for designing the components is INVENTOR software. For meshing the solid HYPERMESH software is

used. To study and analyse the effect of forces on solid ANSYS WORKBENCH software is used. Later to do dynamic analysis ADAMS is used to find the swing motion, stability, dynamic stress variations in model.

5. USER BENEFITS

User will adapt due to lot of warranty claims. Failures will be reduced. User will appreciate if the machine availability is more than 85% throughout the year. Hence machine availability should be achieved more than 85%. Hence customer will be satisfied.

6. THEORITICAL SURVEY

Study of swing torque, inertia force, stability and centre of gravity analysis of excavator swing machinery analysis should be done in the project work. To understand the excavator dynamics and physics, the analysis to be carried out for

- Static Analysis
- Dynamic Analysis

This analysis is done by using modelling and analyzing software. By using the software the best theoretical output may be obtained. Static analysis is carried out using inventor software where it generates the result automatically when the geometry or modelling is imported or created as per the requirements. By using the standard values which are available in the data hand book of software library will be used for the further analysis. Study of inertia force, centre of gravity and stress distribution during duty cycle with the excavator swing machinery is analysed. Also stability calculation, inertial tool and swing torque loads data to be collected. The results are merely upon the method of usage of the software's plays major role in the output of the project work. A detailed learning of the software's likes Inventor, Ansys workbench, ADAMS and Hypermesh is important. Major problem faced during working in software is to import the file from one software to other. This problem can be solved by using various technique like converting the model to STEP file or PARASAOLID file and importing to ADAMS.

During analysis the following steps are followed for inputting modelling and analysis

- 3D Modelling in Inventor
- Ansys Workbench
- Hypermesh for meshing
- ADAMS for static and dynamic analysis

ADAMS is preferred to design the break clutches, total number of clutches required, size of clutches required during machine is swing at 90 degree and 360 angle can be solved. By considering weight of hydraulic tank required, engine weight, attachments of bucket weight to be calculated and resultant dynamic torque is arrived.

7. CONCLUSION

Data obtained during theoretical survey are collected and used during modelling and analysing the excavator machine. Suitable methodology is followed for the better result and Trial and error method is followed for the better distribution of weights of excavator body and attachments.

8. REFERENCES

[1]. Yang, X.P., and Liu, S.D. (2005). Analysis on Structural Dynamic Characteristics of Hydraulic Shovel. *Machine Tool and Hydraulic, Vol. (11),* (87-88).

[2]. Zhang,W.B., Yang, J.F., Wang, J.M., and Zhang, Q, (2008). Simulation and Application on Work and Motion state of Excavator. *Transactions of the Chinese Society of Agricultural Engineering, Vol.24(2),* (149-151).

[3]. Naresh Kumar, N.O. (2006). *Finite Element Analysis and Optimization of an Earthmoving Equipment Attachment-Backhoe*. Nirma University Institute of Technology, Ahmedabad.

[4]. Wszolek,G.(2004). Vibration Analysis of the Excavator Model in GRAFSIM Program on the Basis of a Block Diagram Method. *Journal of Materials Processing Technology, Vol.(157-158),* (268-273).

[5].Towarek, Z.(2003). Dynamics of a Single Bucket Excavator on a Deformable Soil Foundation during the Digging of Ground. *International Journal of Mechanical Sciences,Vol.45(6-7),* (1053-1076).

[6]. Pan, Y.,Cheng,H.T. and Jiang,D.Y.(2009). Design and Optimize Based on ADAMS for Excavator Working Device Simulation. *Coal Mining Machinery,Vol.30(3),* (15-17).

[7]. Shi, Q.L., Zhang, F.S., and Lian, J.Y.(2009). Comparison Analysis for Boom Strength of Excavators.*Construction Machinery and Equipment, Vol.40(7),* (40-43).