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A RESEARCH REVIEW ON EXCAVATOR BUCKET BEHAVIOUR ON HIGH WORKING STRESS.

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ABSTRACT: EXCAVATOR BUCKET ALWAYS UNDERGOES THE HEAVY LOADING CONDITIONS. MANY TIMES, IT FAILS DURING WORKING. HENCE THE LIFE OF BUCKET IS LESS THAN THE DESIGNED LIFE SPAN. IT ALL HAPPENED ONLY DUE TO THE EXTENSIVE STRESSES, VIBRATIONS AND THE HEAVY LOADING CONDITIONS. DEFORMATION AND STRESSES INDUCED IN BUCKET STRUCTURE MUST BE STUDIED WELL SO THAT THE LIFE OF BUCKET CAN BE IMPROVED.EXCAVATOR BUCKET IS DESIGNED FOR HEAVY DUTY WORK. HENCE THE SUDDEN JERKS, STRESSES, DEFORMATIONS ARE USUALLY ACCURSE DURING WORKING. DUE TO SUDDEN JERKS AND IMPACT WITH ROCKS OR TOUGH MATERIALS, VIBRATIONS INDUCE. THESE VIBRATIONS ARE MEASURED IN THE FORM OF NATURAL FREQUENCY OF A BUCKET. CONTINUOUS IMPACT OF SUCH VIBRATION RANGE MAY AFFECT THE BUCKET LIFE. AND HENCE THE CRACKS CAN BE DEVELOPED WHICH LEADS TO FAILURE OF BUCKET. IT CAN BE DONE BY CONDUCTING LOAD TEST BY USING CAE SOFTWARE. NOW A DAY'S CAE SOFTWARES ARE MORE RELIABLE AND GIVING MORE APPROXIMATE RESULTS. HENCE THE EXCAVATOR BUCKET MATERIAL IS TOUGH. HOWEVER THIS SELECTION IS NOT SUFFICIENT FOR DESIGNED BUCKET LIFE. IN BUCKET OBSERVATIONS, WE FOUND CRACKS AND TEAR AREAS ON BUCKETS WHICH FAILED DURING WORKING. IN THIS PAPER RESEARCH DONE TO IMPROVE BUCKET LIFE IS DISCUSSED ALONG WITH STEP BY STEP LIFE JOURNEY. IMPORTANT CONCLUSIONS WERE DRAWN FROM THIS STUDY.

Index Terms **- CAE Software, CAD Model, Loading Condition**

I. INTRODUCTION

A bucket (also called a scoop to qualify shallower designs of tools) is a specialized container attached to a machine, as compared to a bucket adapted for manual use by a human being. It is a bulk material handling component.The bucket has an inner volume as compared to other types of machine attachments like blades or shovels. The bucket could be attached to the lifting hook of a crane, at the end of the arm of an excavating machine, to the wires of a dragline excavator, to the arms of a power shovel or a tractor equipped with a backhoe loader or to a loader, or to a dredge. Excavator bucket is the important part which is responsible for work. It is used for digging, trolley felling, Heavy duty work etc..

II. LITRATURE REVIEW

Till date research shows us that the design of excavator bucket is improved and brought to withstand heavy duty work. But till it fails to do so, just because of beyond capacity loading conditions. To avoid these the proper capacity buckets are to be utilized. Further research about bucket dynamics, stability, design and optimal working conditions is discussed as follows.

2.1 Literature Review.

MilošTanasijević is discussed about Life-cycle of bucket wheel excavators which is analyzed in his study. He have concentrated on quality of servicecharacteristics. He have also concentrated on a model for quality of

service evaluation which is based onfuzzy sets theory.In his study Evidential reasoning is developed by using quality of service evaluation and dependabilityperformance is co nsidered as a measure for quality of service. [1]

The above paper summary is based for on analysis of Excavator bucket and it is helpful for reference.

NedeljkoVukojević, Fuad Hadžikadunić have discussed about SH630 Excavator which are specially used in mines. According to his stress analysis results, the main body of bucket remains undeformed in normal working condition. Actual part which comes under stresses is the joints and corners where the stress value slightly less than allowable stresses. Dynamic stress changes taking place around a relatively low medium stresswith small stress amplitude, which is desirable from the standpoint of strength. Stress changecharacter fully agrees with the expected changes caused by normal operating excavator operations. [2]

In normal working conditions, stress values are under control and need not to worry about cracks on bucket. So we have need to work on normal working conditions but we have to work on other conditions like heavy duty work, rough handling, etc

Santosh Gudagunti have studied for the reduction of cycle time for the manufacturing of bucket, this will also reduce the rejection rate and to increase the throughput by applying the lean principles and lean, tools time study is carried out for all the process in manufacturing of excavator bucket. The process improvement is done for the process which has the high cycle time. Along with savings in time the research also helped in saving in labors. The lean principles are followed in his study to eliminate the waste in an industry. [3]

Complete manufacturer guidelines are explained in this paper and gives exact manufacturing requirements. So we can keep in mind the all points in mind from this paper and constructing the buckets with manufacturer requirements and satisfaction.

Janmit Raj1 and Gaurav Saxena2 in their review they have reported studies in the field of FEA (Finite Element Analysis) consisting the design of the boom, structural analysis, fatigue analysis, modal analysis, shape optimization and CAD/CAE system integration with the required softwares for carrying out the analysis work with an emphasis on the publication in the last 13 years (2002-2015). This literature haveprogressively discussed about the softwares, research methodology and the outcome of the discussed researches and is intended to give the readers a brief variety of the researches carried out on the excavator boom. [4]

All the requirements of performing FEA analysis are discussed along with the sample results. Hence this paper can be utilised for the reference purpose.

Vishwajeet A. Patil, M.R.Khodake have studied that there is rapid growth in the earth moving machine industries as the construction work is rapidly growing is assured through the high performance of construction machines. This study focuses on the evaluation method of digging forces required to dig the terrene for light duty construction work. This methods gives the force calculation and further it is used for the carrying out the fatigue analysis to calculate fatigue life of bucket and its failure. Further the work regarding the optimization of bucket to give maximum fatigue life for the digging at the desired force conditions. An analytical approach provided for static force analysis of excavator bucket. [5]

Calculation and evaluation of digging forces are discussed in brief in this paper. Applied force can be taken as a reference from this paper.

Bhaveshkumar P. PATEL have focuses on the evaluation method of bucket capacity and digging forces required to dig theterrain for light duty construction work. This method provides the prediction of digging forces and can be applied forautonomous operation of excavation task. The evaluated digging forces can be used as boundary condition and loading conditions to carry out Finite Element Analysis of the backhoe mechanism for strength and stress analysis. Ageneralized breakout force and digging force model also developed using the fundamentals of kinematics of backhoemechanism in context of robotics.

An analytical approach provided for static force analysis of mini hydraulic backhoeexcavator attachment.

[6] Backhoe mechanism of excavator bucket is explained well as the crack developed on them during high stress values and therefore we have to design suitable high stress value to avoid cracks and improve life of excavator bucket. Mr. Mundane Sagar R. have focuses on study of actual productivity against the theoretical productivity to demonstrate the loss of productivity. This real time monitoring of the heavy equipment can help practitioners improve machine intensive and cyclic earthmoving operations.

[7] Bucket capacity calculations and digging forces required are calculated and explained well in this paper. Hence it is one of the importance reference. Dhaval Kumar A Patel have discussed about kinematics of excavator machine which is helpfulto doing the kinematic modelling of the excavator machine. Kinematic modelling is helpful forunderstanding behavior and improving the operating performance of the hydraulic excavator machine.

[8] Kinematics of digging and earth moving operations are very important balancing point Of view. This paper provide balancing operations and it's implementation method.

Neeraj Chandrakar, Shadab Imam have aimed their study on the influence of Boron carbide and chromium variations on analysis ofBucket Teeth. FEM analysis are carried out and it is observed that best results are found by adding coating ofChromium and boron carbide of coating 2mm. the excavator bucket teeth which fail due to abrasive wear and impactload is protected against abrasive wear by using four different types of hard facing materials using manual metal arcwelding process. They have used

Excavator bucket teeth using finite element method (FEM). FEM is selected as thecomponent size is complicated and the process is an all-position process, highly versatile and user friendly. TheResult of Boron carbide and chromium steel having almost same result on Equivalent stressand deformation. TheResult of the same is having higher Than High tensile steel by almost 0-1%. The Process of FEM is being used forCoating and without Coating of Excavator Bucket teeth. [9]

Variation in boron carbide and chromium plays important role in bucket manufacturing. It is important to keep proper proportion of them. Also we can work on which material is suitable or not, and what is in proportion.

2.2 Outcomes from Literature Survey:

Most of the researchers have focused on CAE softwares.

Stresses induced in Bucket are more at the joints.

Vibrations are also responsible for failure.¬

III. CONCLUSION

In the view of structural failure of the excavator bucket it is found that the life of bucket can be improved by reconstruction of bucket. A thru study of static dynamic analysis is required and with addition of material strips the life and performance of bucket can be improved..

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