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Conceptual Design and Stress Analysis of Hammer Mill

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Abstract: A conventional hammer mill is a device consisting of a rotating head with free-swinging hammers, which reduce rock, grains or similarly hard objects to a predetermined size through a perforated screen, hammer mills can be used for grinding grain into fine flour or into coarse meal for animal feed production. This project is focused on the design, development, and testing of a hammer mill that has a small scale production capability. The conceptual design was based on the principle of design by analysis. The methodology adopted was to examine the most critical defects of conventional hammer mills and provide solutions. The major components of the new hammer mill are Inlet tray, Throat, Magnetic chamber, Rotor, Crushing chamber, Hammer mill body, Hammers/Beaters, Screen, Bearings, Discharge, Table or stand, Mechanical drive, Pulleys. The preliminary tests carried out on the new hammer mill confirm that this mill is capable of performing the same function as that of the huge hammer mills used in the industries, as well as the same function as the conventional hammer mill which usually produce coarse, medium and fine particles, thus quality control and monitoring is needed. To assist the designer in modeling of blades of miller tool suite provides built in routines for modeling either standard or modules manufactured from alternative materials. This module of hammers is being designed by the modeling software like CATIA V5; it is being done analysis by using ANSYS Workbench. The designer ability to model single or multi-stage blade levels and calculate valuable sizing information regarding performance.

Keywords: CATIA (Computer Aided Three-dimensional Interactive Application), CAD.

I. INTRODUCTION

Sledge process is any breaking gadget that you can make without a lot of trouble starting with one site then onto the next and that you use to change over into fine powder. There are many distinctive sorts of plants (in the future, we'll allude to a mallet process as only a factory). Mallet factories with moving strong sledges. Such plants may utilize diesel fuel, gas, or power. Most can be controlled by one administrator. Sledge factories ended up mainstream in the United States beginning in the 1970s, when the 1973 vitality emergency and the back to the land development had prompted recharged enthusiasm for little bits of items and in independence. Their fame developed exponentially since 1982, when the main Hammer process was concocted.

A. Hammer Process/Operation

A Hammer factory's fundamental task is much similar to those of several years prior; an item enters toward one side and dimensional fine powder exits on the opposite end. After size particles are chosen for gather, the following stage in logging is felling the particles, and kicking them to powder. Items are taken by a log drive to the mallet process. These are scaled either while in transit to the factory or upon landing in the plant as shown in Fig.1. Debarking expels bark from the item. Decking is the procedure for arranging the logs by species, size and end utilize (chips). A machine utilizes a head, head apparatus or essential sledge to break the item into cants (incomplete logs to be additionally prepared) and fitches (incomplete). Contingent on the species and nature of the log, the cants will either be additionally separated by are Scheme of the water-driven Roman Hammer process at Hierapolis, Asia Minor. The third century process is the most punctual known machine to fuse a wrench and interfacing bar instrument. Representation of a human-controlled Hammer process with a pack material distributed in 1582. Or on the other hand a group edger into various fitches as well as sheets. Edging will take the flitch and trim off every single unpredictable edge leaving four-sided material. Trimming squares the finishes at ordinary material lengths. Drying expels normally happening dampness from the material. This should be possible with furnaces or air-dried. Arranging smoothes the surface of the material leaving a uniform width and thickness. Transportation transports the completed item to showcase.

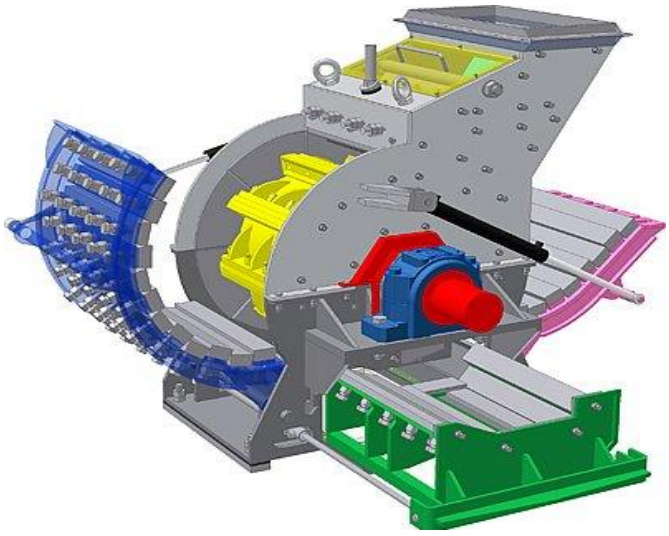

Fig.1. Hammer process.

B. Project Points And Destinations

This task concentrated on three goals:

- To audit the effective cutting techniques, identifying with the utilization of convenient Hammer factories
- To recognize and assess the basic components prompting the ideal execution of Hammer factories; and
- To devise doable procedures and convey these to key partners on the most proficient method to build the gainful results of versatile Hammer processes in the area.

II. LITERATURE REVIEW

The principal compact Hammer plants were the "Small time Farmer's Hammer processes." These factories included huge round cutting edges and were showcased amid the mid twentieth century by organizations like Sears, Montgomery Ward and JC Penney. These machines were all "private mark" machines fabricated by the Belmaterial Company. Numerous early Hammer plants were intended to be belt-driven from a steam footing motor (which could likewise be utilized to transport the material). Preceding the approach of the convenient 'plant, little scale Hammer factories were by and large cobbled-together undertakings built and worked by (quite often) two men with a propensity for tinkering. This was, and remains, a customary occupation for Amish men; not at all like most mechanical frameworks, little Hammer processes regularly don't utilize power.

A. Portable Hammer Factories Come Full Circle

The round Hammer factories were the convenient ones. They were typically steam controlled, albeit some had a factory lake and water turbine control. In later circumstances, such factories have been controlled by fuel and diesel motors, power and homestead tractors as shown in Fig.2. The Frick, American, Lane and Corley plants are great cases of the sort. These factories were made in modules with material en outlines and were amassed into an entire factory. The three modules were; containing the entire factory. The three modules were; containing the material arbor and carriage feed works; log carriage, and tracks. A fourth module was the power supply, however this was the duty of the proprietor and was not provided with the factory. A larger part of these factories additionally incorporated a board edger, accessible from the plant producer, yet numerous got by edging on the enormous sum. Conveyability involved point of view. A team of six to eight men could disassemble and reassemble one of these "versatile" factories in around four days relying upon how far they were moving. It was for the most part thought about that as at least one-half million board feet was required to legitimize moving a plant.

Advantages: These plants can be customized and set up nearby, alongside the trees being cut. A few organizations transport their plant to reap urban where moving the logs would be illogical.

Uses: The distinction between the measures of waste residue made between customary Hammer plants and the fresher band Hammer factories.

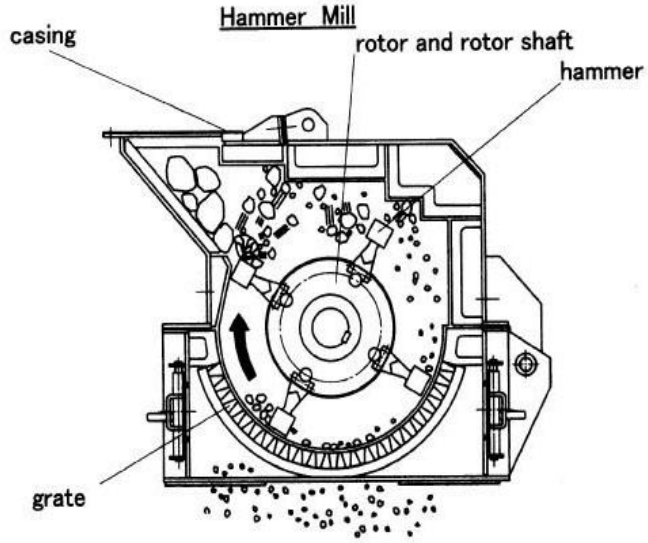

Fig.2. Product Hammering Size/length.

The factories can cut material with speed and exactness, however the resulting ventures of arranging and drying must at present be performed to create completed material. Product material in standard sizes can be made thusly. The more typical utilize, in any case, is in the creation of strength timber items not promptly accessible through material yards. The most widely recognized ways they are utilized to produce a wage are - clients as a versatile administration, cutting and offering material locally, and cutting material that is straightforwardly used to make a last item. Compact plants are especially viable for truing up logs for use in log building, supplanting the conventional utilization of a drawknife, which is exorbitantly tedious. They are additionally utilized for low-volume generation of claim to fame hard materials utilized as a part of furniture, and can be utilized to create the substantial timbers utilized as a part of post-and pillar surrounding methods.

III. METHODOLOGY ON RESEARCH SRATEGY

A. Definition of 'Mallet Factories'

Mallet factories are generally lightweight machines that can be dismantled, conveyed into the woodland to the site of a felled tree, and after that reassembled to process the storage compartment of that tree. The material in lengths of timber is then transported out of the woodland in different ways. This expulsion might be to the closest street for transportation to a urban place available to be purchased, or to a town network for an assortment of employments, including for building development as shown in Fig.3. The material factory is then dismantled and physically conveyed to another work site. A refinement could be made between Hammer factories; anyway the terms are frequently utilized synonymously and here the term 'convenient' remains a bland descriptor. Portable Hammer plants have a tendency to be worked on or off trailers utilizing existing streets and woods arrivals. Their utilization is in this manner significantly more limited than that of versatile Hammer plants and in the Pacific they have been utilized just in Fiji.

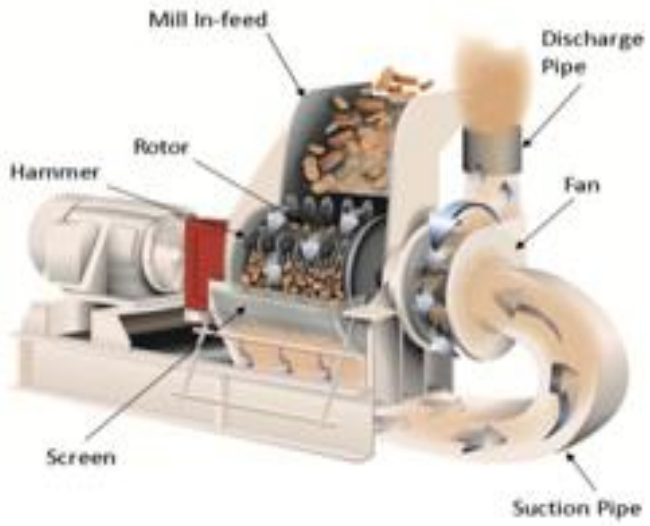

Fig.3. Hammer process.

Five fundamental sorts of compact Hammer process are utilized as a part of the Pacific district. These are:

- Chain-Hammer process,
- Single Hammer process,
- Horizontal band-Hammer process,
- Twin round Hammer process, and
- One-man seat compose factories

As of now there are three principle brands of Hammer plants being utilized as a part of PNG and the SI. These are the Peterson, the Lucas and the Alaskan Chain Mill. The Peterson and Lucas factories are single round plants; the Alaskan plant is chain process. While different brands of Hammer process likewise exist, these three overwhelm the residential deals in the two nations overviewed. The Alaskan plant is the sort most ordinarily utilized as a part of PNG and SI.

IV. DESIGN METHODLOGY OF HAMMER MILL

CATIA (Computer Aided Three-dimensional Interactive Application) is a multi-stage CAD/CAM/CAE business programming suite created by the French organization Dassault Systems. Written in the C++ programming dialect, CATIA is the foundation of the Dassault Systems item lifecycle administration programming suite. CATIA contends in the top of the line CAD/CAM/CAE showcase with Cero Elements/Pro and NX (Unigraphics).

A. Modeling of Hammer Mill in CATIA V5

This Hammer Mill is outlined utilizing CATIA V5 programming. This product utilized as a part of car, aviation, buyer merchandise, overwhelming designing and so on it is intense programming for planning muddled 3d models, utilizations of CATIA Version 5 like part configuration, get together outline. The same CATIA V5 R20 3d display and 2d drawing model is appeared underneath for reference. Measurements are taken from as shown in Figs.4 and 5. The outline of 3d display is done in CATIA V5 programming, and after that to do test we are utilizing beneath specified software's.

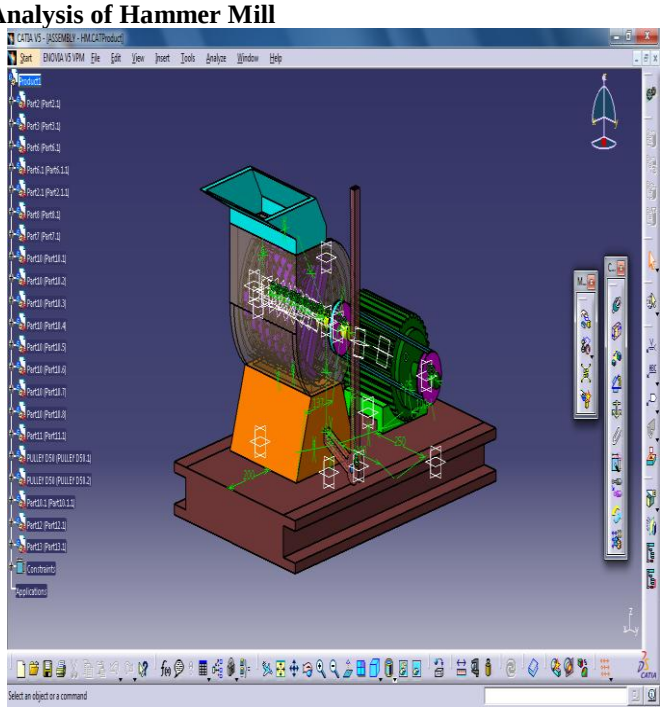

Fig.4. Model outline of HM in CATIA-V5.

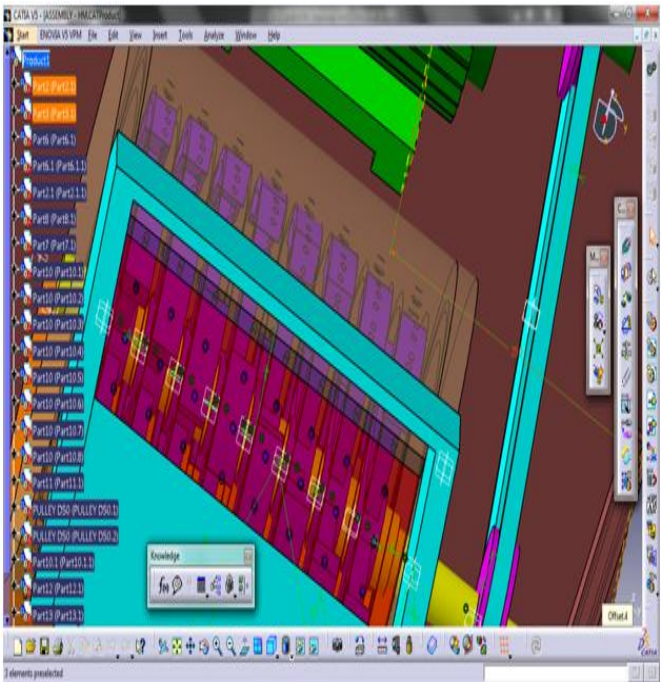

Fig.5. Model course of action of pounding component in CATIA-V5.

B. Assembly Modeling of Hammer Mill

In this displaying every last part get amassed together with the methods for requirements, fortuitous event, contact, balance, edge, settle segment, adaptable, control, and so forth.

Control: This order is utilized to control/turn/pivot the part in any requried bearing according to the need/reasonable limitations are to be connected on the segment as shown in Fig.6.

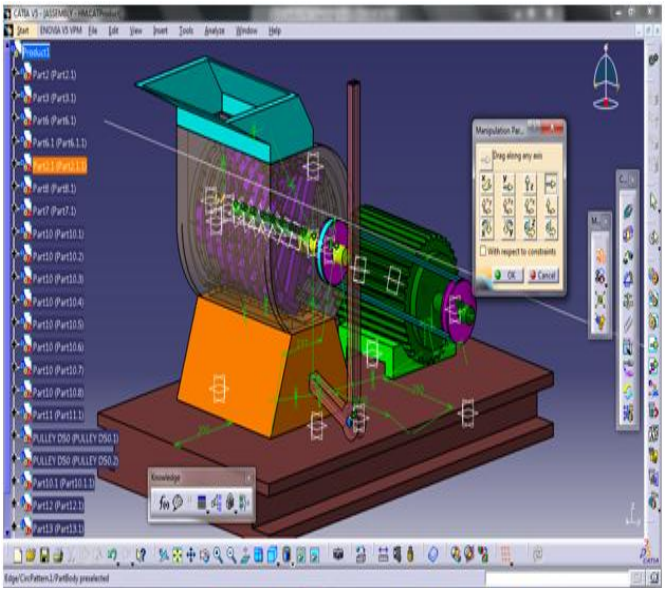

Fig.6. Using Manipulate Command.

Multi View: This is the order in which every one of the perspectives of the part/model can be shown on the screen at a same time, they can be altered under the workbench as shown in Fig.7.

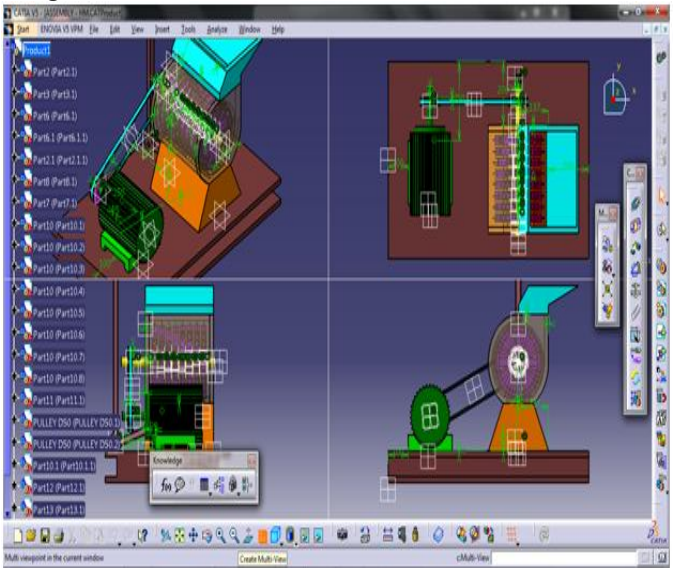

Fig.7. Using Multi View Command.

V. ANALYSIS OF HAMMER MILL

A. Procedure for FE Analysis Using ANSYS

The examination of the Railings, Pulleys, V-belt, shafts are finished utilizing ANSYS. For contend gathering isn't required, engine and joined pulley transmission framework is to completed by applying minutes at the revolution area along which pivot we have to say. Settling area is base legs of material factory gathering machine.

B. Preprocessor

In this stage the accompanying advances were executed:

Import Record in ANSYS Window:

Record Menu > Import> STEP > Click alright for the flew up discourse box > Click.

Peruse" and pick the document spared from CATIAV5R20 > Click alright to import the record.

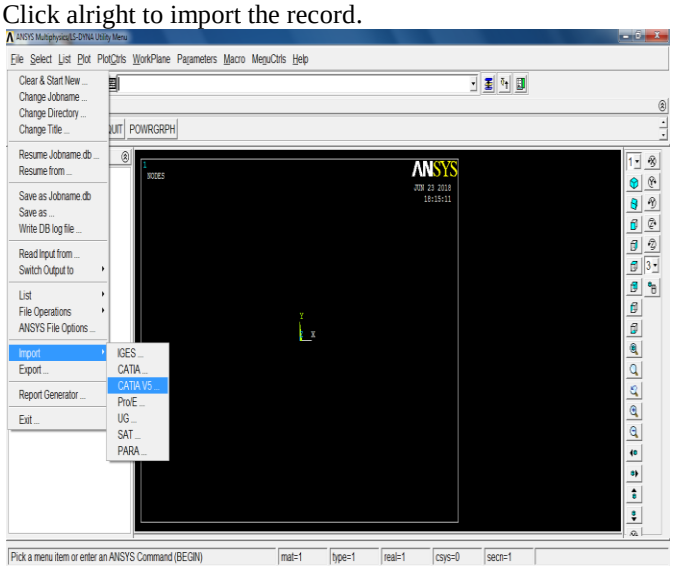

Fig.8. Import board in Ansys.

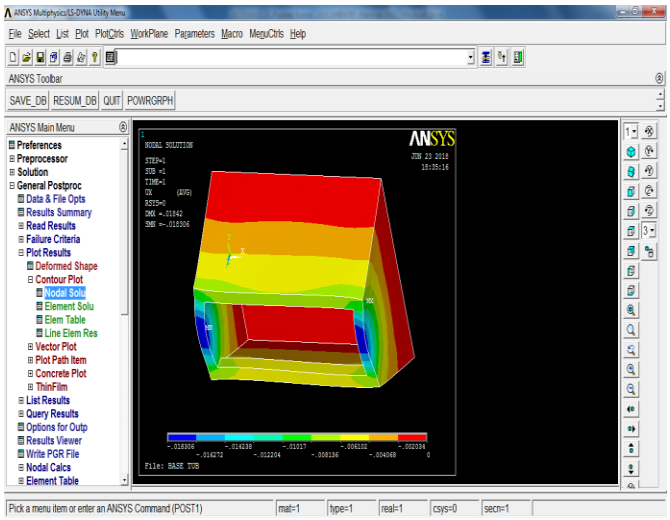

Fig.9. Displacement picture.

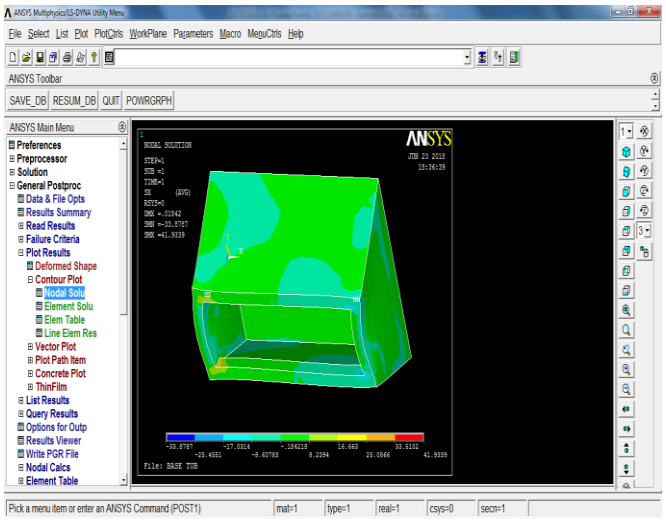

Fig.10. Stress picture.

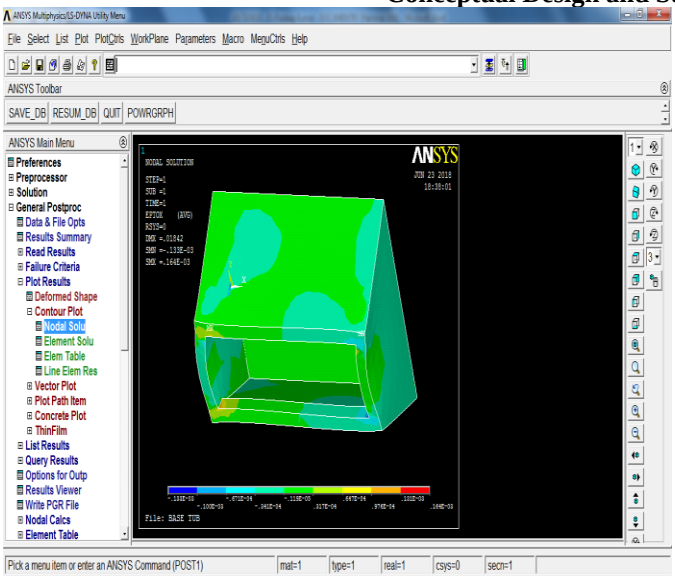

Fig.11. Strain picture.

Shafts are demonstrated with 1d component and appeared as above and gathered with neighboring parts as shown in Figs.8 to 11. Barely any segments are unraveled utilizing Rotational Force Analysis for checking the pressure and relocations while pivoting. Subsequent to finishing the cross section of every gathering segments next is to do investigation in light of the OEM (Original Equipment of Manufacturer) application. So every one of the models which are pivoted along which hub that we have to specify in the Analysis programming to get exact outcomes according to the first part. A portion of the parts are should have been settled utilizing static investigation. Which is specified underneath what parts are expected to do which kind of examination? Load is connected and settling at the base key area, was approved. The material and geometric properties are recorded.

VI: DISCUSSION ON ANALYSYS RESULT

Results of this paper is as shown in Figs.12 to 17.

A. Results of Displacement Examination

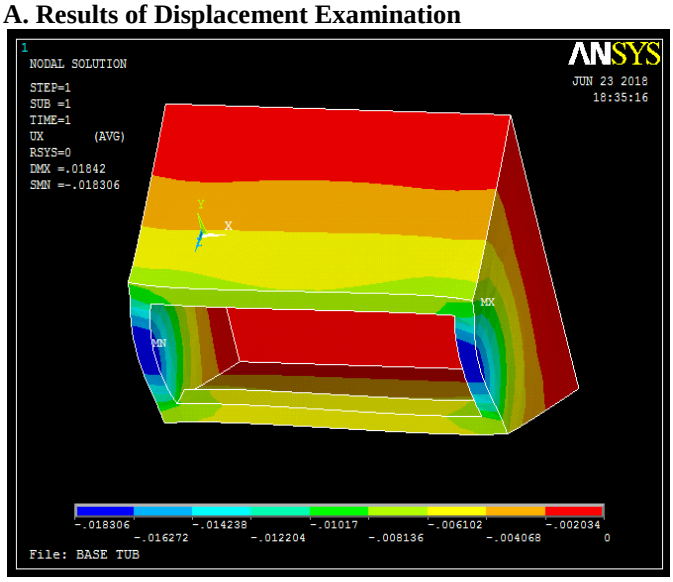

Fig.12.

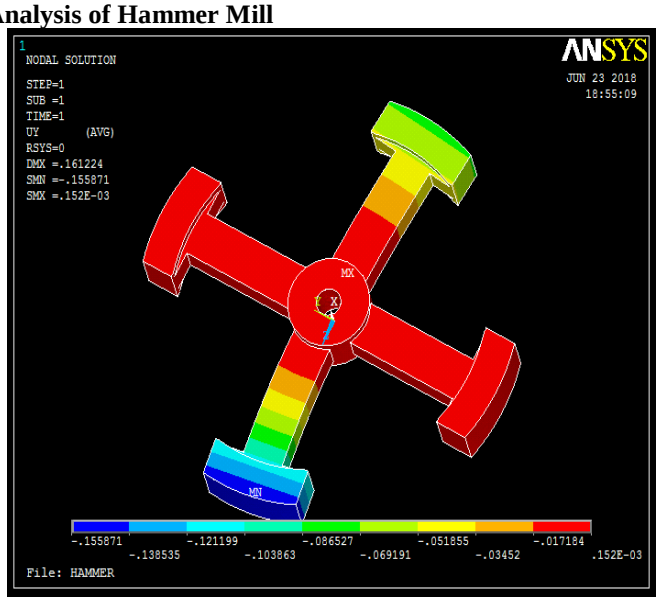

Fig.13.

B. Results of Stress Investigation

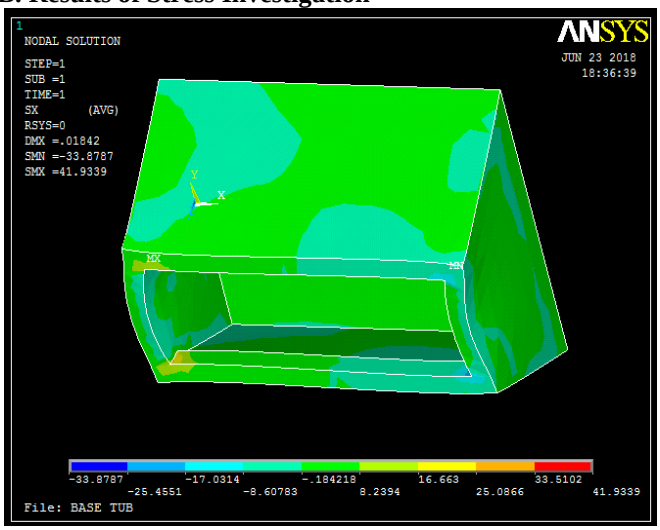

Fig.14.

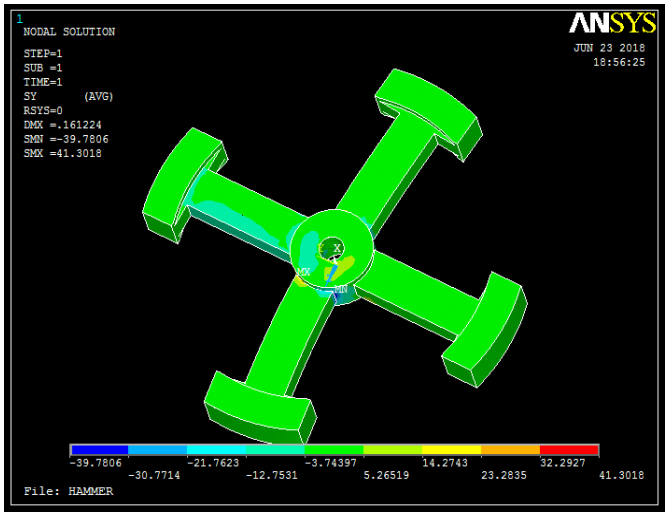

Fig.15.

C. Results of Strain Investigation

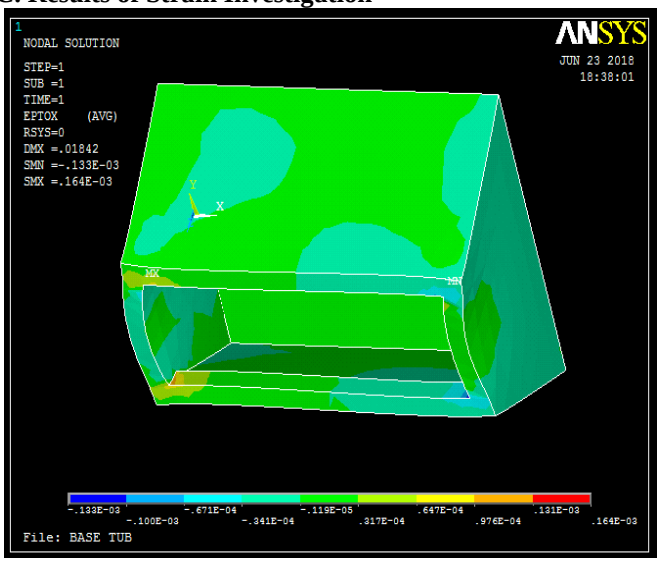

Fig.16.

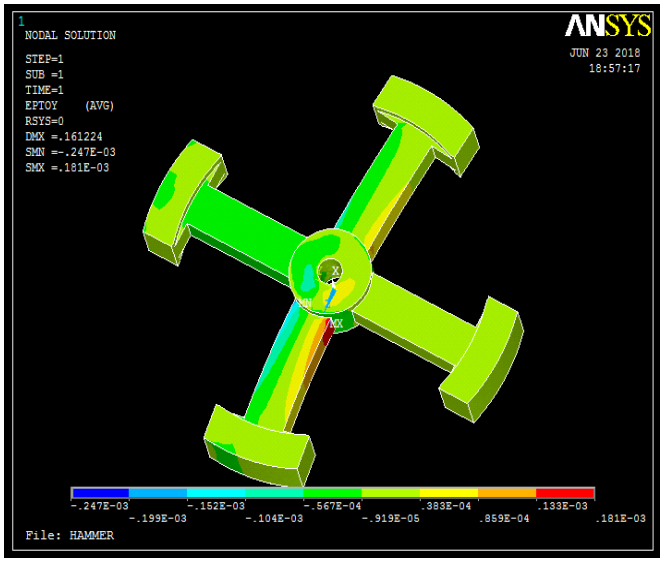

Fig.17.

VII. CONCLUSION

Sledge processing appears to fit well with business tasks in upgrading the utilization of material and the diminishment of waste. In this model number of various tasks should be possible in one machine with great effectiveness. In any case, it was watched that there is as yet a need to alter suppositions among of organizations and material mill operators to make this sort of collaboration known and to get it executed. In above figures, the uprooting of the total parts is fit and understood utilizing Ansys and dislodging happened in the mallet is 0.1612mm, which is less. This is demonstrating to us that obviously every segment in gathering is having minor removal. Stress is at the settling area (Minimum Stress which is adequate), push esteem is 41.3MPa. The most extreme strain esteem is 0.181E-03MPa, this arrangement comprehe-nding with the assistance of Ansys programming. With the goal that the most extreme relocation is less .so we can finish up our plan parameters are around amend. The last outcome positive way .There is no issue in the plans of the machine. Last get together is composed and it is managed without disappointment. Additive treatment for the material can exhibit rather genuine ecological issues if done in the backwoods without reasonable field activities; ought to be produced.

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