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DESIGN, MODELLING & ANALYSIS OF TWO BOTTOM REVERSIBLE PLOUGH

Ms.Sneha S.Wasu[1], Dr.A.R.Sahu[2], Prof. R.D.Thakare[3], Prof.U.D.Gulhane[4]

[1] M-tech, 4th sem CAD/CAM, B.D.C.E., Sewagram, Wardha, India. [2] Asst. Prof. Dept. of Mechanical Engineering, B.D.C.O.E., Wardha, [3]Department of Mechanical Engineering, B.D.C.O.E, Wardha, India, [4]Department of Mechanical Engineering, B.D.C.O.E., Wardha, India.

[1] sneha.wasu86@gmail.com, [2]anilrsahu@yahoo.com, [3]rdthakre@rediffmail.com, [4]udgulhane@rediffmail.com

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ABSTRACT-

In last few decades we all witnessed the development in each and every field. In the field of agricultural also we had seen remarkable development, big farmers are now a day's using cultivator, harvester, tractor, advance machine tools and advance farm equipments, but in the country like India where more than 80% of farmers are small and marginal and they are still doing farming by traditional method only they are also in need of improved agricultural tools that may be hand driven or bullock driven. In this paper the design, modelling and analysis Of two bottom reversible plough is important agricultural equipment used for soil preparation. The main objective of this analysis is to increase the life of share plate . The existing cultivator which is manufactured by local small scale manufacturer gets failed at different points after approximately one session of uses. To analyze this shear plate mechanism using FEM, firstly a proper CAD model has been developed using Pro/E cad software. Then by using ANSYs software FEM analysis have been done to determine the stresses. [12]

Keyword: Two bottom plough, Proe Model , Design Analysis.

I. INTRODUCTION:-

Development is the need of today's world. Wherever you see there is development throughout from the world of aerospace to the things of daily use, no matter what ever small they may be. In the field of agricultural also we had seen remarkable development, big farmers are now a day's using harvester, tractor, advance machine tools and advance farm equipments, but in the country like India where more than 80% of farmers are small and marginal and they are still doing farming by traditional method only, they are also in need of improved agricultural tools that may be hand driven or bullock driven. The tools which they are required mostly manufactured in small scale industries or by local artisans like carpenter and blacksmiths. The present technique of manufacturing of agricultural tools by all these people is like design by evolution. The design is evaluate long span of time. The leisurely pace of technological change reduced the risk of making major errors. The circumstances rarely demanded analytical capabilities of the designer. Also this technique is unsuitable for mass production, difficult to modify, incapability to tap new technologies. The jobs made are not perfect, inefficient, health hazardous and very poor in quality in comparison to the parts made in big industry.

So for the improvement of their production rate, quality and raising the standard of living, modern engineering inputs like Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Rapid Prototyping

(RP), Rapid Manufacturing (RP), Rapid Tooling (RT), Concurrent Engineering (CE), and Quality Function Deployment (QFD) etc. are the need of today. The Modern Technologies and computer capacity has brought a revolution in the entire manufacturing system which comprises of product design, manufacturing, and management also this technologies enable us in modelling analysis, processing and other related digital applications into entire PLM (product lifecycle management) from product conception, through development, to marketing. And computer, in fact, to great extent, has been responsible for linking together all the areas of manufacturing into a single link which is called computer Integrated Manufacturing (CIM). Therefore modern technology and computer capacity could also play a very vital role in development of improved agriculture tools and implements. This project focused on implementation of this technology in the improvement of tilting mechanism of three furrow reversible ploughs.

II. Modelling

Modeling is a process of generating three dimensional objects of the real world for the purpose of designing, analyzing, drafting and manufacturing. Modeling creates a data base in the computer which represents the object generated. This object database is used to display the object, to prepare drawings of the object with different views, to prepare data for analysis and design.

1. Geometric Modeling

Geometric modeling involves the use of a CAD system to develop a mathematical description of the geometry of an object. The mathematical description, called a geometric model, is contained in computer memory. This permits the user of the CAD system to display an image of the model on a graphics terminal and to perform certain operations on the model. These operations include creating new geometric models from basic building blocks available in the system, moving the images around on the screen, zooming in on certain features of the image, and so forth. These capabilities permit the designer to construct a model of a new product (or Its components) or to modify an existing model.

2.Wire Frame Modeling

It uses interconnecting lines (straight line segments) to depict the object as illustrated in Figure. Wire-frame models of complicated geometries can become somewhat confusing because all of the lines depicting the shape of the object are usually shown, even the lines representing the other side of the object.

Solid Modeling

It is a more recent development in geometric modeling. In solid modeling, an object is modeled in solid three dimensions, providing the user with a vision of the object very much like it would be seen in real life

III.Introduction to PRO/E:

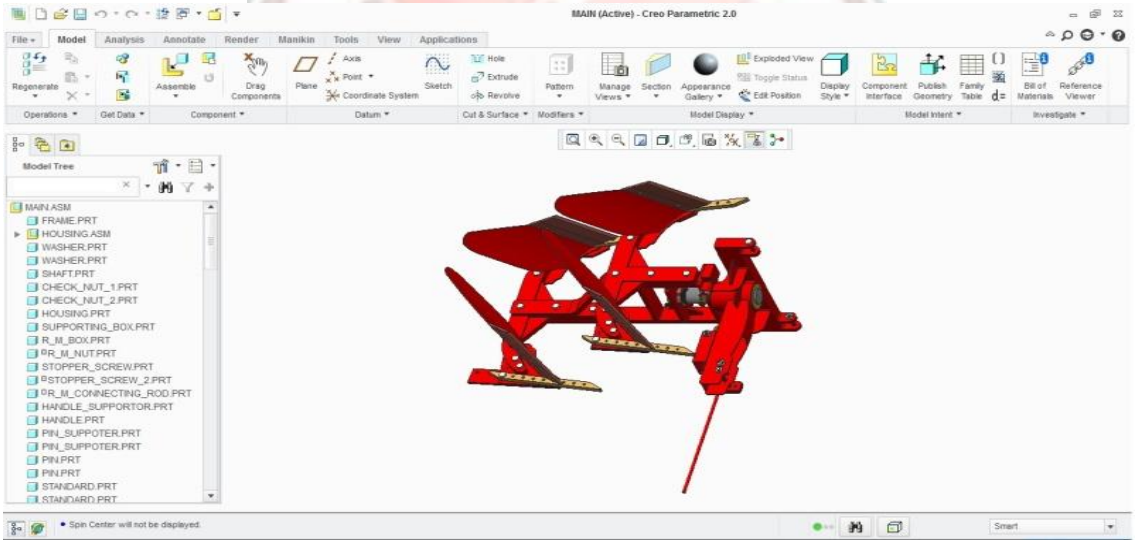
Pro/ENGINEER (commonly referred to as **Pro/E**) is a 3D CAD parametric feature solid modeling software created by Parametric Technology Corporation (PTC). And it provides solid modeling, assembly modeling and drafting functionality for mechanical engineers.

Pro/ENGINEER is an integrated 3D CAD/CAM/CAE solution for mechanical engineering and design which was created by Dr. Samuel P. Geisberg in the mid-1980. It pioneered the CAD industry by introducing the concept of *Parametric, Feature-based Solid Modeling*. Models are driven parameters and intelligent features, rather than simple dimensional values.

Pro/ENGINEER outputs consist of solid model data for tooling and rapid prototyping, CNC modeled accurately with fully associative engineering drawings, and revision control information.

4.2.1 Important Features of PRO-E software:

- Make design changes faster and easier.
- Real-time, dynamic editing and disruption-free design will help users overcome the traditional barriers to flexible and easy design modification.
- Enhanced direct surface editing is also up to 70% faster.
- Accelerate time to productivity by up to 10X.
- User Experience enhancements such as graphical browsing, incisive enhancements, streamlined tasks and faster performance improve design efficiency and reduce time-to-market.
- Create simplified sub-assemblies (envelope definitions) 78% faster
- Create sheet metal parts 30% faster, place forms 82% faster
- New trajectory rib feature helps create parts up to 80% faster.
- Analysis of weld element models is up to 10X faster**.**



<u>Force c alculations (Coarse soil)</u>

D = (2.80 + 0.013 x s2)x WDxWx 10

(Reference-Draft and fuel requirement Measurement using tractor on-board data acquisition system)

D= Draft ,(KN)

S=Operation Speed ,(Km/Hr)

WD= Operation depth, (m)

W= Implement Width of mouldboard

plough,(m)

S=3-4 km/hr

W=0.62 -0.65 m

WD =0.18 -0.25 m

Draft =(2.80 +0.013x42)x0.25x0.65x10

Draft = 4.88 KN = 4.88 x1000 = 4888 N

Draft = 498. Kg

Stress Calculation

Resultant Stress (σt)= Direct stress (σ0) + Bending Stress (σb)

Direct Stress (σ0)= Force (P) / Area (A)

Bending Stress (σb) = Bending Moment (M) / Section Modulus (Z)

σmax = σ0 + σb

σmin = σ0 - σb

stress=7 mpa

ANALYSIS

The design and analysis has been carried out with the help of 3D modeling software and FEA technique using standard FEM tool. PRO-E (4.0) is used for the modeling assembly of cultivator tyne and Inventor has been used for the analysis of model. In the boundary condition, cultivator tyne is fixed at top means to the structure of the cultivator.

There are a number of steps in the solution procedure using finite element methods. All finite element packages require going through these steps in one form or another.

1) Specifying Geometry : First the geometry of the structure to be analyzed is defined. This can be done either by entering the geometric information in the finite element package through the keyboard or mouse, or by importing the model from a solid modeller like Pro/ENGINEER, NX-4. For the cultivator modeling and cultivator tyne modeling is done by using Pro/ENGINEER software. First all the parts modeling done & then assembled. Assembled file of cultivator tyne is saved in IGES format.

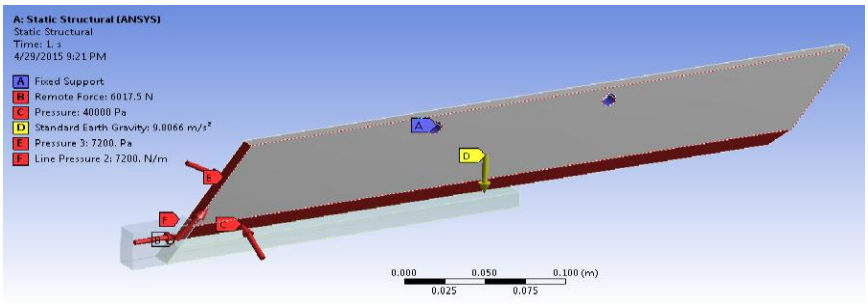
2) Specify Element Type and Material Properties: The material properties are defined. In an elastic analysis of an isotropic solid these consist of the Young's modulus and the Poisson's ratio of the material.

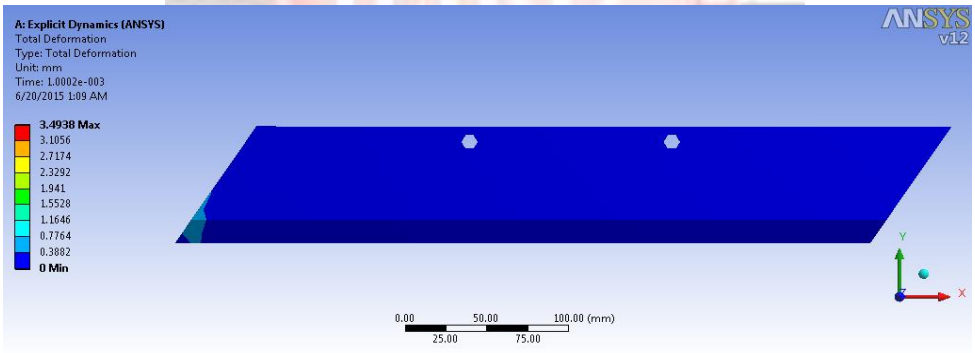
3) Mesh the Object: Then, the structure is broken (or meshed) into small elements. This involves defining the types of elements into which the structure will be broken, as well as specifying how the structure will be subdivided into

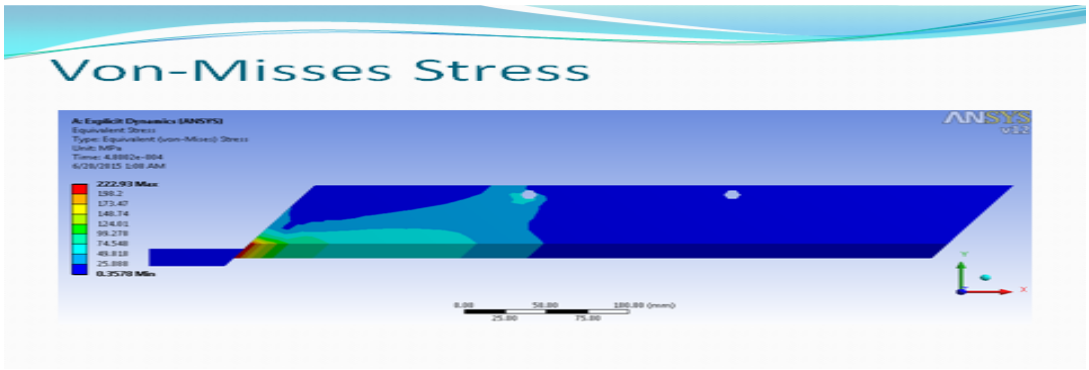
elements (how it will be meshed). This subdivision into elements can either be input by the user or, with some finite element programs (or add-ons) can be chosen automatically by the computer based on the geometry of the structure(this is called auto meshing).

4) Apply Boundary Conditions and External Loads: This is followed by specifying the boundary conditions (e.g.location of supports) and the external loads are specified. For cultivator tyne it is fixed at the top where it is attach to the structure of the cultivator.

5) Processing or solution: The analysis is made on the previously input parameters. The modified algebraic equations are solved to find the nodal values of the primary variable.The five steps mentioned above have to be carried out before any meaningful information can be obtained regardless of the size and complexity of the problem to be solved. However,the specific commands and procedures that must







VII. CONCLUSION

From all above literature review , it has been found that there are different forces act on a mould board plough ,therefore Modeling and analysis of this plough is necessary ,for that proe model of existing plough is needed and analysis of the existing plough is also required. After applying different force on the existing model, the replacement of sheare plate is nessesary. That point is the failure plough point . The existing share plates material should have to change.

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