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Automatically Hydraulic Adjustable Rotavator

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***Abstract**: Automatic hydraulic adjustable rotavator is obstacle sensing unit and will take action on it as it will move entire structure to the either side. Rotavator is a specialized mechanical tool used for tillage of soil by series of blade. Now a day, utilization of rotavator has been increased in agricultural application because of simple structure and efficiency. However the use of rotary tiller is strongly restricted to shallow type tillage purpose because of high forces coming on blade, life span of blade is less and which result in higher maintenance cost. When rotavator is pulled through a field, the resulting soil texture will be a function of soil condition and geometry of blade. We will use hydraulic actuator for the shifting moment of frame as we have inbuilt hydraulic pump in tractor.*

***Keywords** – adjustable rotavator, obstacle sensor, frame movement, hydraulic actuator*

Introduction

The soil tilling is an ancient technique applied in farm and rotavator is a tilling machine used in farm for the purpose of soil tilling. Since blade is a crucial part in rotavator and it can manufactured or fabricated in different shapes like L, J and C. In L-shape type two more subtype are a) Left hand L-shaped blade, b) right hand L-shape blade. These shapes are manufactured as per local manufacturer. This study is aimed at design and development of L-shape rotavator blade of alloy steel and plain carbon steel. The life of blade is crucial factor and it depends on forces coming on blade and force and geometry of blade has direct relationship with each other. For the increase in life span of blade forces coming on it should be reduced. For this reason a mathematical model is developed and analysis of new model and previous model is carried out using SolidWorks software applying Finite element analysis method on the basis of deflection and stresses induced in blade after application of force. This result is compared with each other and it is found that new model has less deflection and less stresses induce in a blade.

The rotavator is a tillage tool primarily comprising of L-shaped blades mounted on flanges that are affixed to a shaft that is driven by the tractor power-take-off (PTO) shaft. In comparison to passive tools, the rotavator has a superior soil mixing and pulverization capability. During rotavator tillage operations various factors affect its energy requirements. These factors can include soil conditions, operational conditions and rotavator configuration. Discussing the influence of mechanical cultivation on the physical soil characteristics and the changing law of crop growth has been of widespread concern, and still receives attention from soil and agriculture science workers in order to provide a theoretical basis for cultivation (Kosmas et al., 2001; Hammad and Dawelbeit, 2001; Cameira, Fernando and Pereira, 2002). For pulverizing rate, different pulverizing evaluation indices of various soils are mainly obtained by means of experiments, which did not form a very complete theoretical system and had limited guiding significance to actual operation. Thakur and Godwin found out that the greatest force of rotary tool occurs when the cutting angle is $\pi/18\sim\pi/12$ rad under the condition of quasi-static contact and one-cycle rotating process. This discovery provides an important mechanical basis for the design of the rotary tool

Literature Review

C. Manivelprabhu Associate Professor Kumaraguru College of Technology The rotavator tiller is attached with the tractor for soil bed preparation in agricultural land. The main advantage of rotavator is single stage tillage comparing to existing plough machine. The rotavator blade is a critical part of tiller machine that directly engages in soil bed preparation. The life of the blade is restricted to 50 hours.

Dr. N. Sangeetha Senior Associate Professor Kumaraguru College of Technology Rotavator tiller is mainly used in agriculture for loosening of upper layer soil to create seedbed.

The rotavator has higher soil mixing capacity compared with other plough machine and it has good weed cutting capability and it leads to the water-air, thermal and nutrient of the soil is improved. The rotavator can be easily adjusted for various working depths for soil bed preparation.

Gopal U shinde Shyam Kajale The design optimization of rotary tillage tool by the application of Computer Aided Engineering (CAE)-Techniques on the basis of finite element method and simulation method is done by using CAD-Analysis software for the structural analysis. The different tillage tool parts of rotary tillage tools are geometrically constrained by the preparation of solid model, Meshing and Simulation is done with actual field performance rating parameters along with boundary conditions.

Objectives

Main objective is to build a rotavator which will identify obstacle in its path

To build a device which is helpful for farmer

To make complete mechanical device which will be compact

Project Set Up

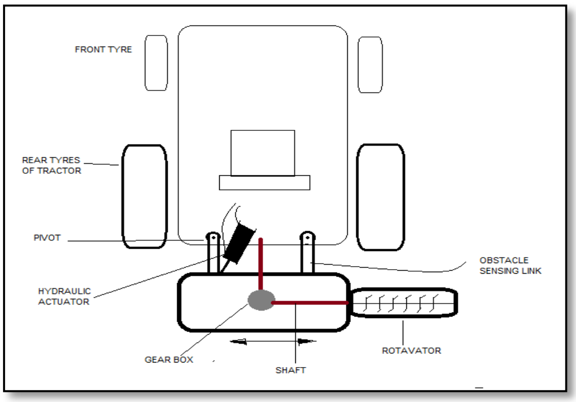

Figure 1 Schematic Representation

Design Parameters

Design Of Rotavator shaft
Design Of Flange
Design Of Rotavator frame
Selection of Gear box
Selection Of Bearings for shaft mounting
Selection Of Universal Joints

5.1Design of Rotavator Shaft

Selection of material For Shaft

We surveyed various materials for the shaft like EN16, EN19 and EN24

. by comparison we have decided to use EN19 material for the shaft because it gives very well combination of toughness and hardness.

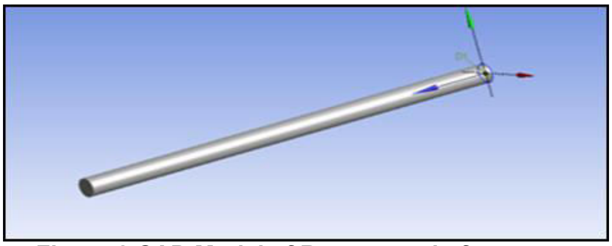

Figure 2 CAD Model of Rotavator shaft

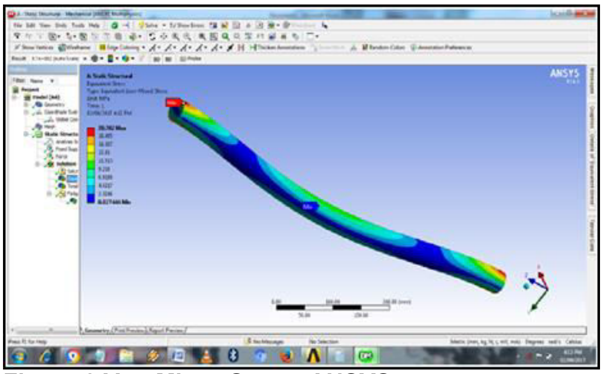

Figure 3 Von Mises Stress ANSYS

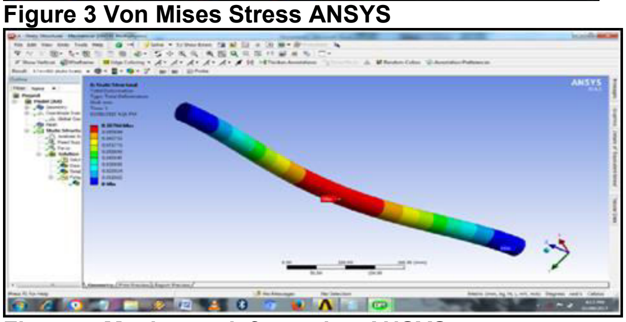

Figure 4 Maximum deformation ANSYS

5.2 Frame Design

Selection of frame type:

Combined ladder cruciform chassis design has been incorporated , The design is based on tubular and rectangular bars, triangulated to provide stiffness against the static and dynamic loads associated. Hence, we decided to choose this type of chassis.

<u>Advantages of combined ladder cruciform:</u>

Provides good strength.

Lightweight.

Required flexibility.

Selection of material:

We surveyed a lot of materials namely AISI 1018, AISI 1020, AISI 4130, etc. It was decided to select AISI 1018 as it satisfied the mechanical requirements and was in the budget.

The analysis of AISI 1018 material has been provided below:

Yield Strength - 365 Mpa
Bending Stiffness - 2790 Nm^2
Bending Strength - 391 Nm

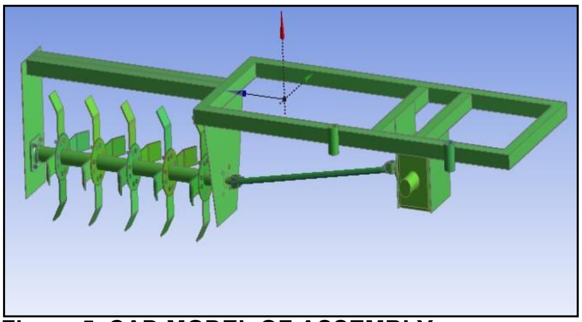

Figure 5 CAD MODEL OF ASSEMBLY

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