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"DESIGN AND ANALYSIS OF RIGID TYPE CULTIVATOR BY USING ANSYS SOFTWARE"

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ABSTRACT

In this paper the FEM analysis of 11-Tyne cultivator is presented. Cultivator is important agricultural equipment used for soil preparation. The main objective of this analysis is to find out the failure in the tyne due to different loading condition at different speed in medium black soil. The existing cultivators which are manufactured by local manufacturers get failed at different points after approximately one session of uses. A CAD model of tyne was developed using CATIA ver 5.0 –modeling software and then by using ANSYS software FEM analysis was done to determine the stresses.

KEYWORDS: *Cultivator, FEM, CAD design, Stress, Deformation, Tyne, CATIA, ANSYS*

I. INTRODUCTION

A cultivator is a hardware utilized as a part of optional culturing and in addition essential culturing in a few areas. One feeling of the name alludes to outlines with teeth additionally called shank or scoop that pierce the dirt as they are dragged through it straightly. Cultivators are optional working gear which agriculturists utilize cultivators after land is at first furrowed. Around 80% of Indian rancher utilize rural actualizes like rotavator, cultivator, furrow and so on. In any case, those ranchers confront some issue like breakage of scoop tip in view of material of scoop, soil, root, stone and so on. Thusly, it is essential for the architects and horticultural apparatus makers to foresee misshapening and basic anxiety dispersions on the machine components amid culturing operations, which will enable them to make streamlined hardware by utilizing anticipated learning.

Fig.1

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II. METHODOLOGY

The investigation centered distortion of a s ingle tine of the cultivator. In this way, all segments of the gathered strong model cultivator were not utilized as a part of the FEM investigation. The FEM programming bundle, Ansys Workbech, was used the FEM stretch examination process. The FEM examination was set up in 3D, straight, static and isotropic material model presumptions. At the point when genuine working conditions were assessed, limit conditions were connected to the model appropriately. Most extreme draft force size for each tine was represented by the exploratory examination information. The draft constrain of cultivator was measured as 3500 N that was applied on the surface of the limited offer in the inverse heading of the development f the tine and weight of execute was 135kg. Diverse estimations of vertical compel following up on cultivator tine were obtained by distinctive researchers. Because of the state of the tine and soil condition utilized as a part of this investigation, the vertical compel was taken as 19 % of the deliberate draft.

$$\text{Draft of one tine} = \frac{Total\ draft}{No.of\ tines} =$$

= 3500/11 = 318 N

Vertical force acting on cultivator = 318 x 19 % = 60 N (19 % of draft)

III. MODELING & SIMULATION

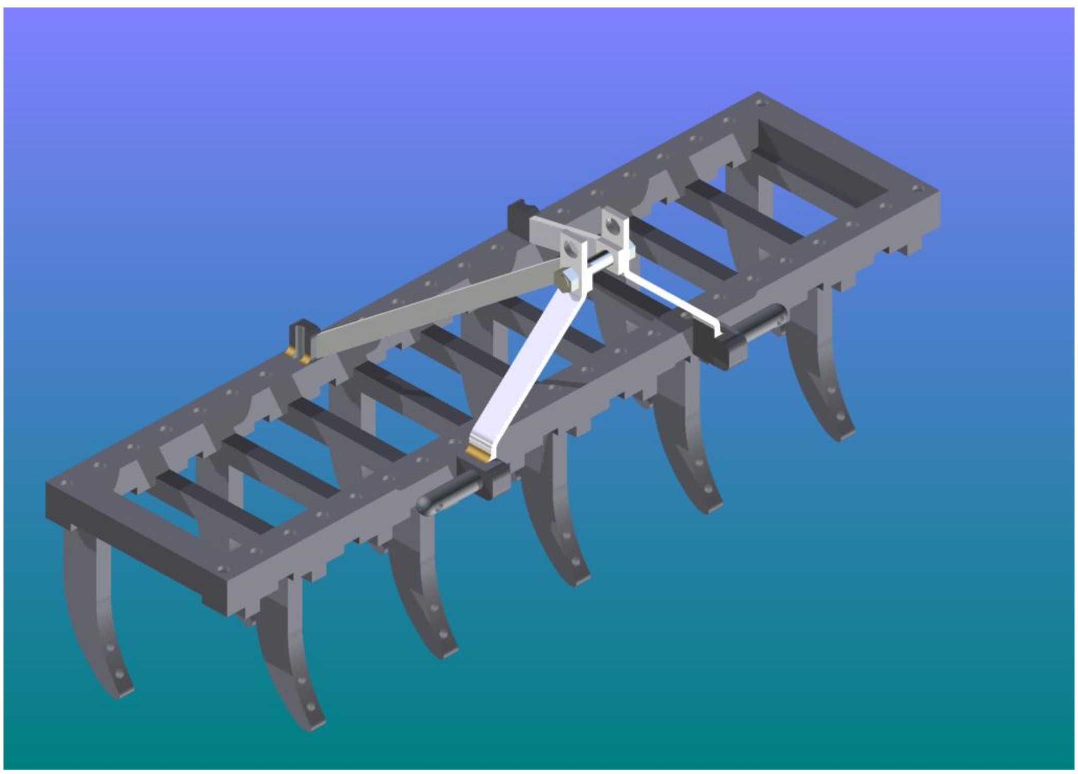

Fig.2 Eleven Tyne

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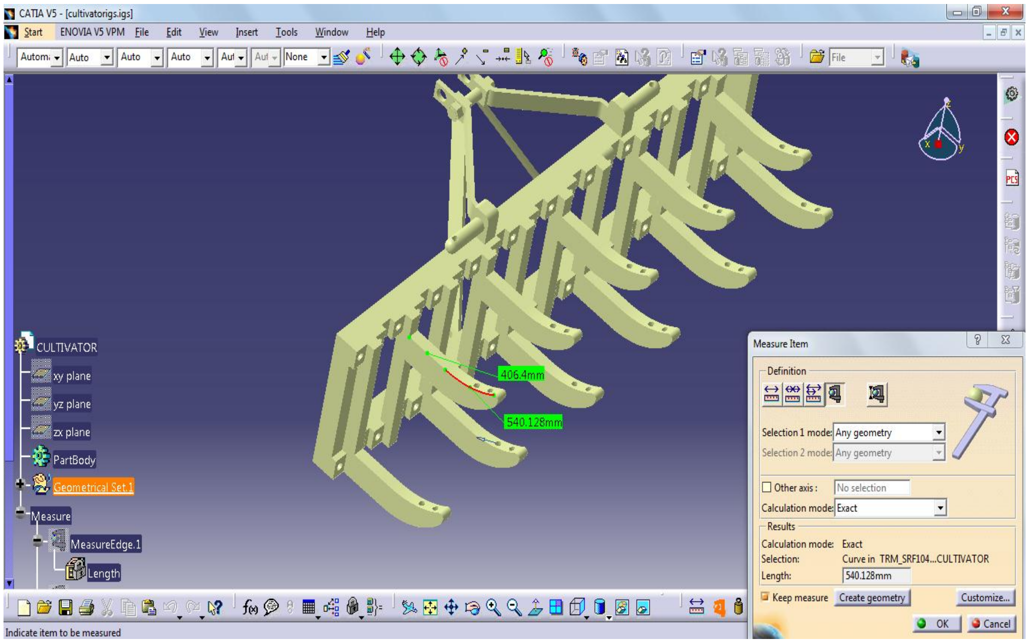

Fig.3 Cultivator 3d dimensional model

Table.1 Our Cultivator Specification

S.No.	Front Tyne (mm)	Rear Tyne (mm)	Frame width (mm)	Length (mm)	Height (mm)	Thickness Tyne (mm)	Spacing Between Tyne (mm)	Unit Mass/ Weight (Kg)
01	946	945	1270	4978	1174	101	823	101.2

IV. SIMULATION

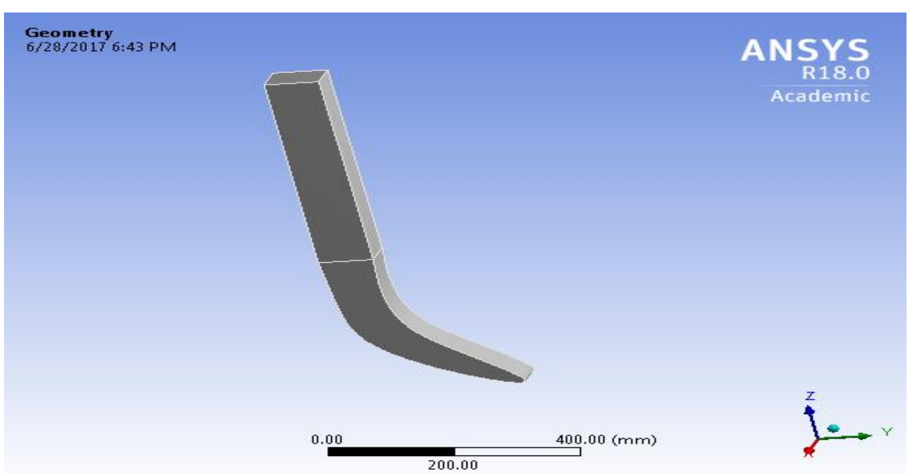

Fig.4 Modeling of Tyne

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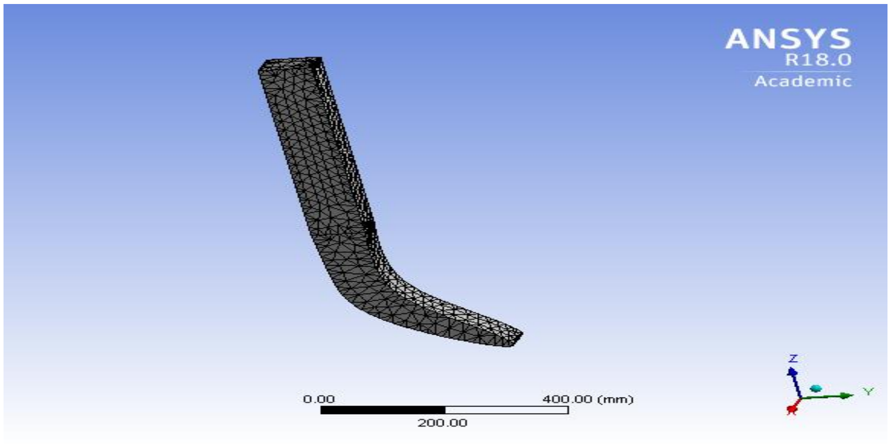

Fig.5 Meshing of Tyne

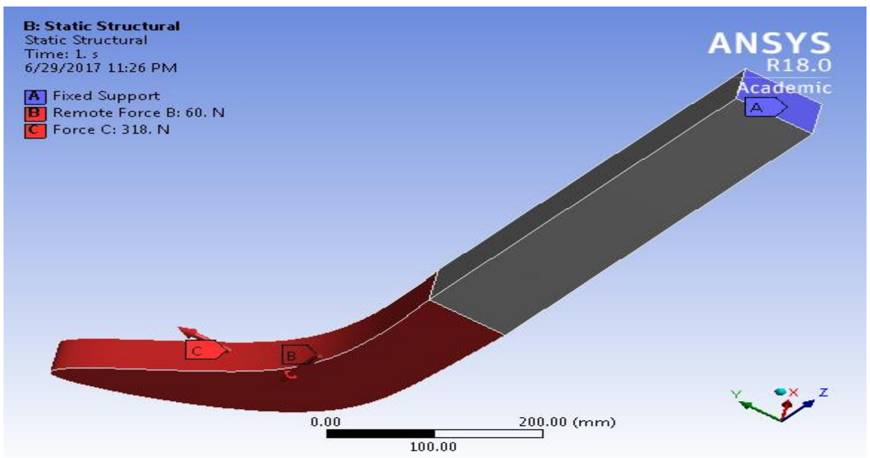

Fig.6 Force apply on Tyne

STRUCTURE STEEL MATERIALS

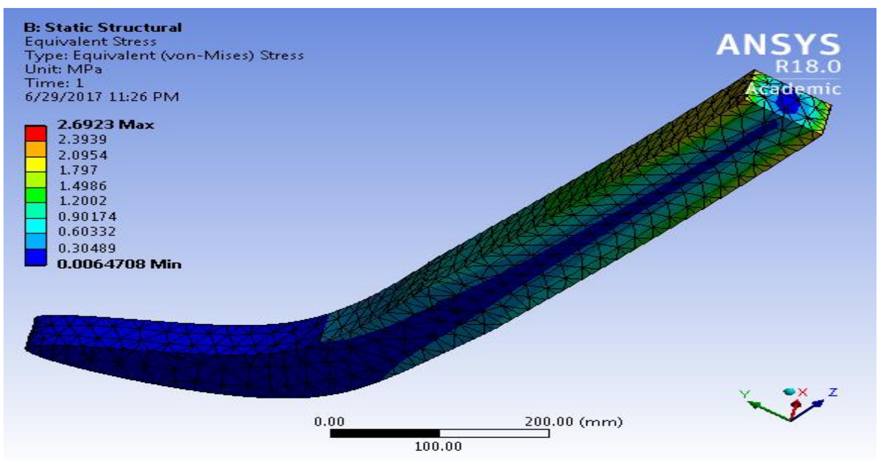

Fig.7 Von – misses stress result in structure steel materials

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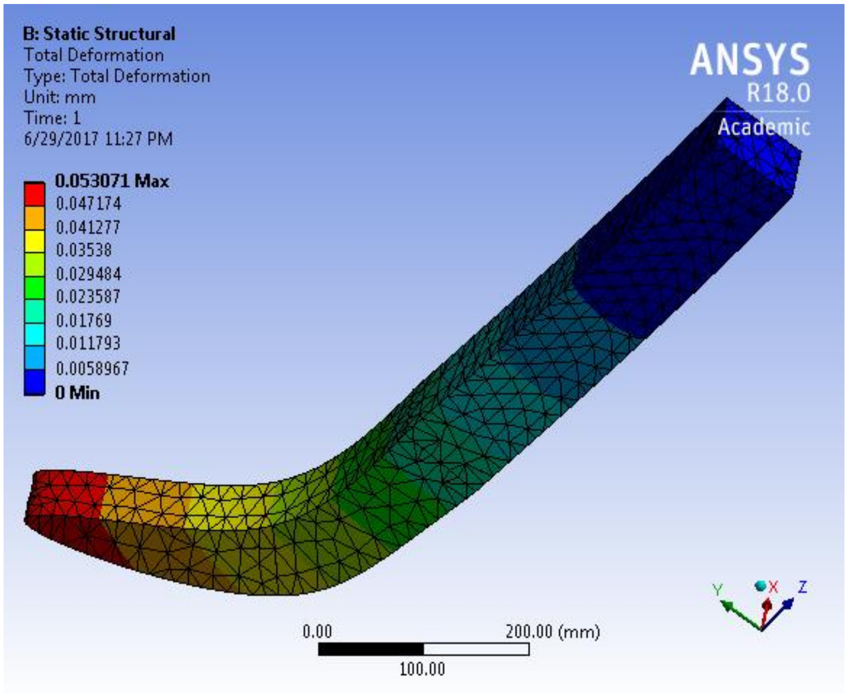

Fig.8 Deformation stress result in structure steel materials

Magnesium Alloy Materials

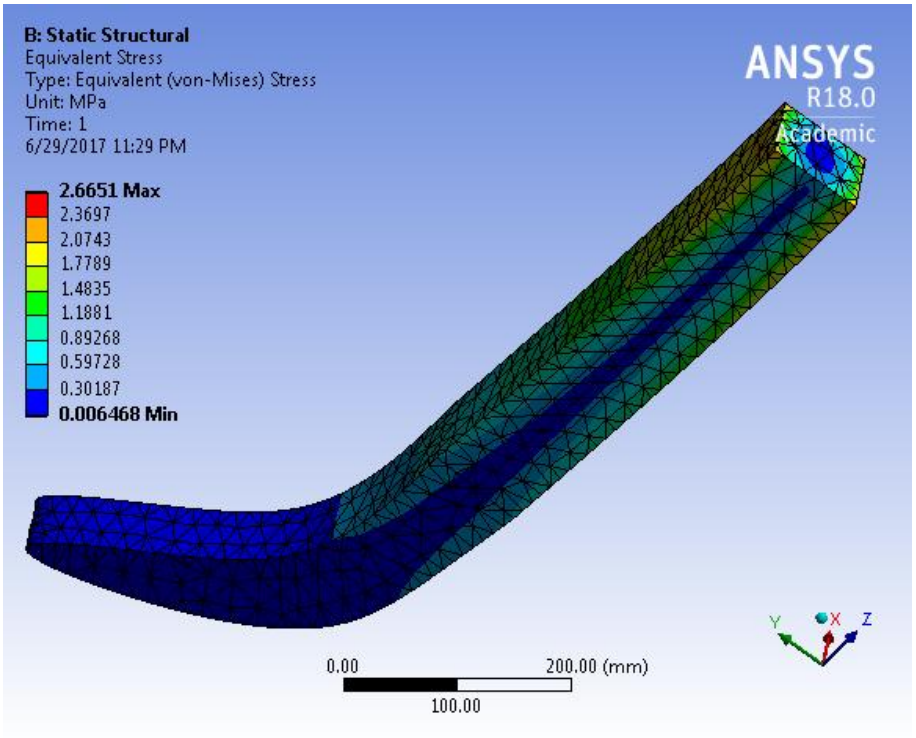

Fig.9 Von – misses stress result in Magnesium Alloy Materials

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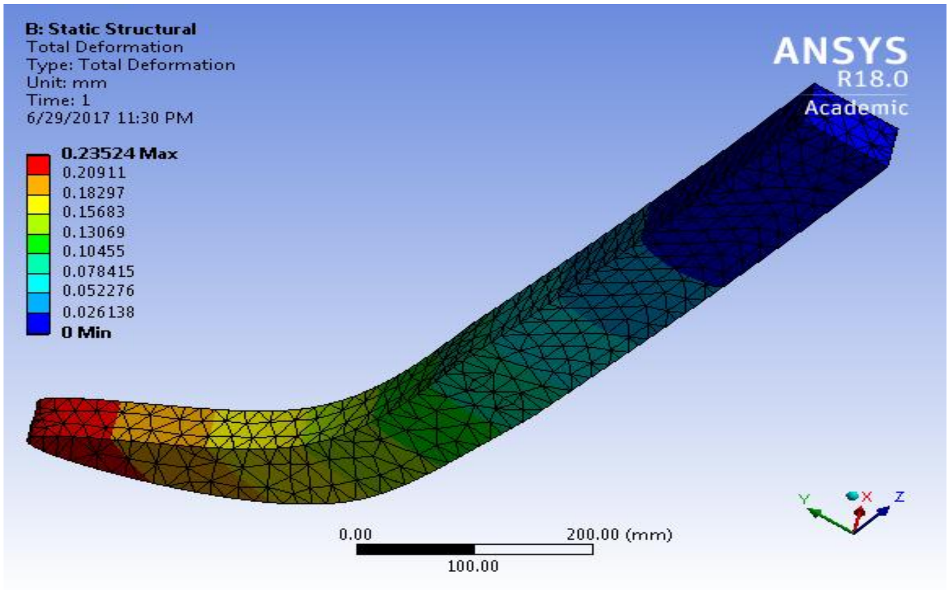

Fig.10 Deformation result in Magnesium Alloy Materials

Epoxy S Glass UD

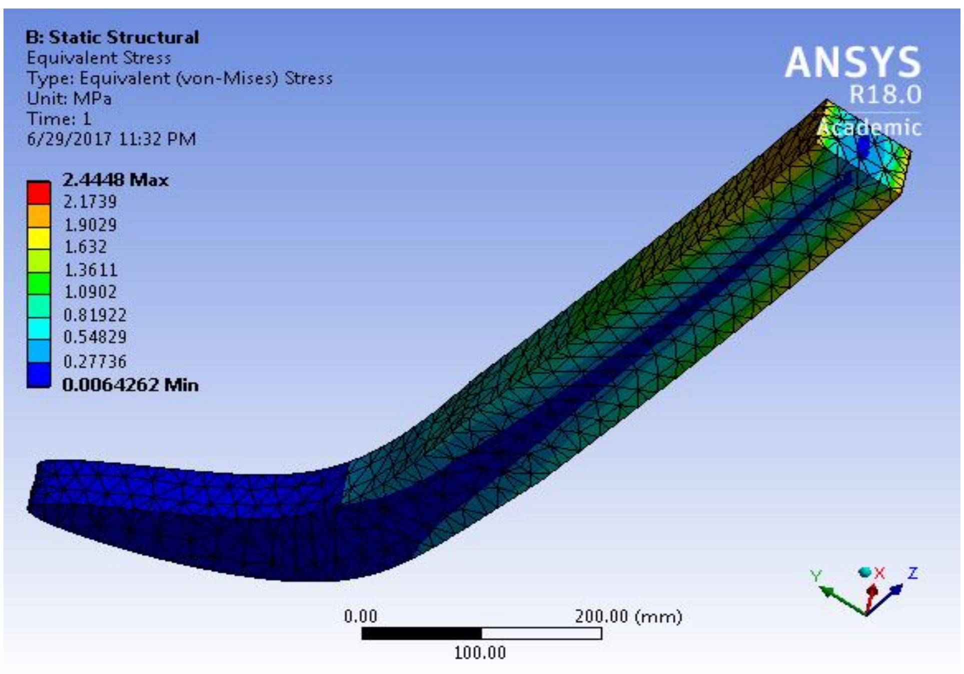

Fig.11 Von – misses stress result in Epoxy S Glass UD Materials

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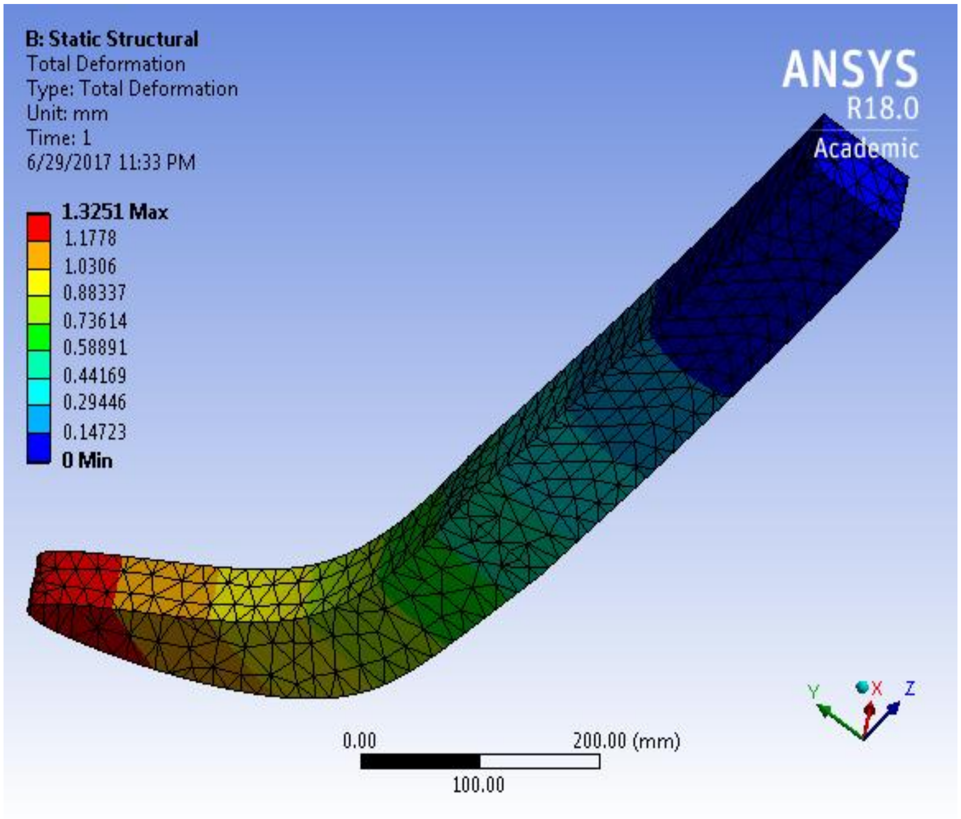

Fig.12 Deformation result in Epoxy S Glass UD Materials

Epoxy Carbon UD

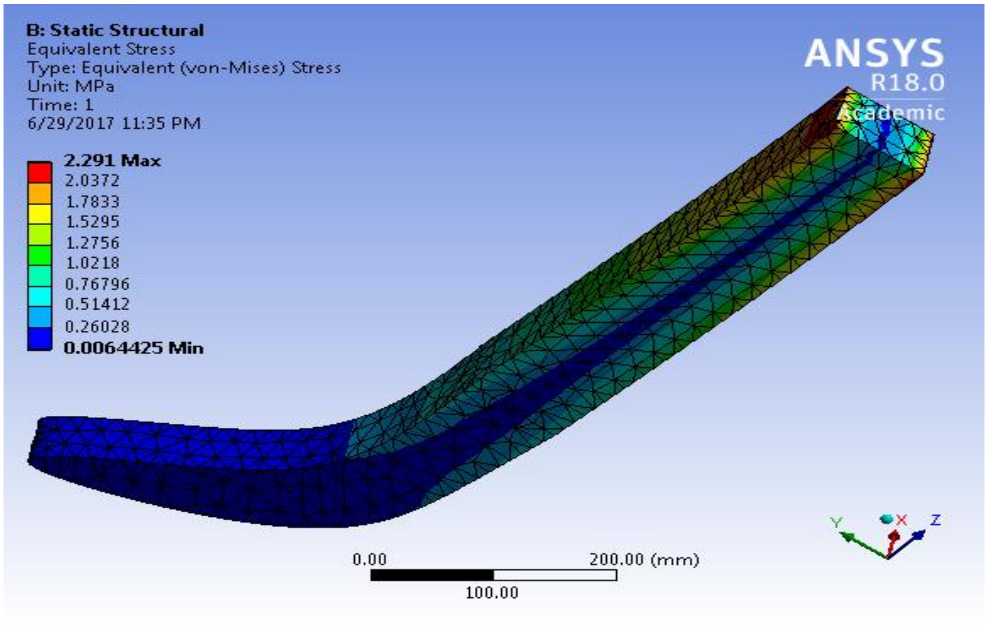

Fig.13 Von – misses stress result in Epoxy Carbon UD Materials

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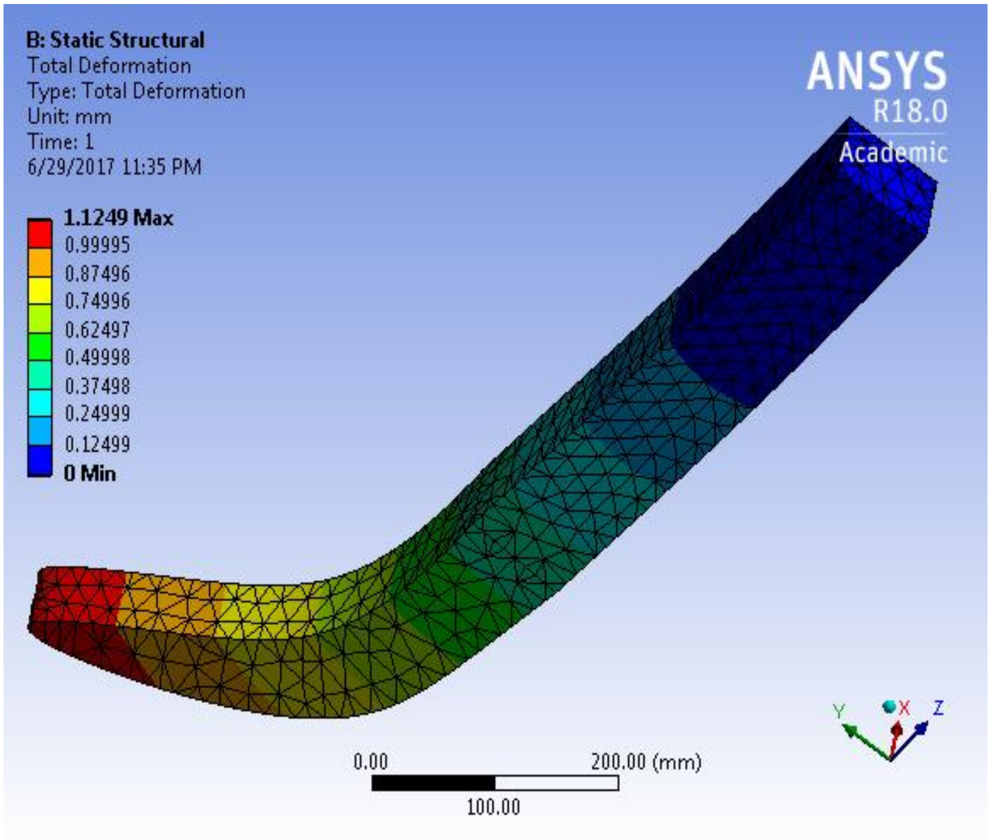

Fig.14 Deformation result in Epoxy Carbon UD Materials

V. RESULT & DISCUSSION

Maximum equivalent stress of 2.6923 MPa and a maximum total deformation of 0.0058967 mm were obtained for Structure steel and maximum equivalent stress of 2.6651 MPa and a maximum total deformation of 0.23524 mm were obtained for Magnesium Alloy materials and maximum equivalent stress of 2.4448 MPa and a maximum total deformation of 1.3251 mm were obtained for Epoxy -S Glass UD materials and maximum equivalent stress of 2.291 MPa and a maximum total deformation of 1.1249 mm were obtained for Epoxy Carbon UD materials.
The stress results compared with the yield point (355 MPa) of the tine's material and found that the maximum stress did not exceeded the yield point, which signified that deformation does not cause failure on the tine. Visual investigations of thetine also confirmed that there was no significant deformation on the tine. The FEM simulation prints and deformation are shown our study . This study was focused onthe deformation and stress distribution of agricultural tillage machinery andtools by means of CAD and FEM applications. For this purpose, a case study was constructed and presented. A cultivator which has 11 tines was used in the case study. According to the study, a number of points can be summarized as follows; Maximum draft force of the cultivator was calculated as 3500 N inthe field experiments. This means that each tine has 318 N maximum draft forces. In the FEM stress analysis, the maximum equivalent stress was 2.6923 MPa, and a total deflection of 0.0058967 mm was obtained on the initial design of the tine. When compared with different materials the yield point of the tine material, the results show that there was no significant deformation occurring on the tine to cause failure.

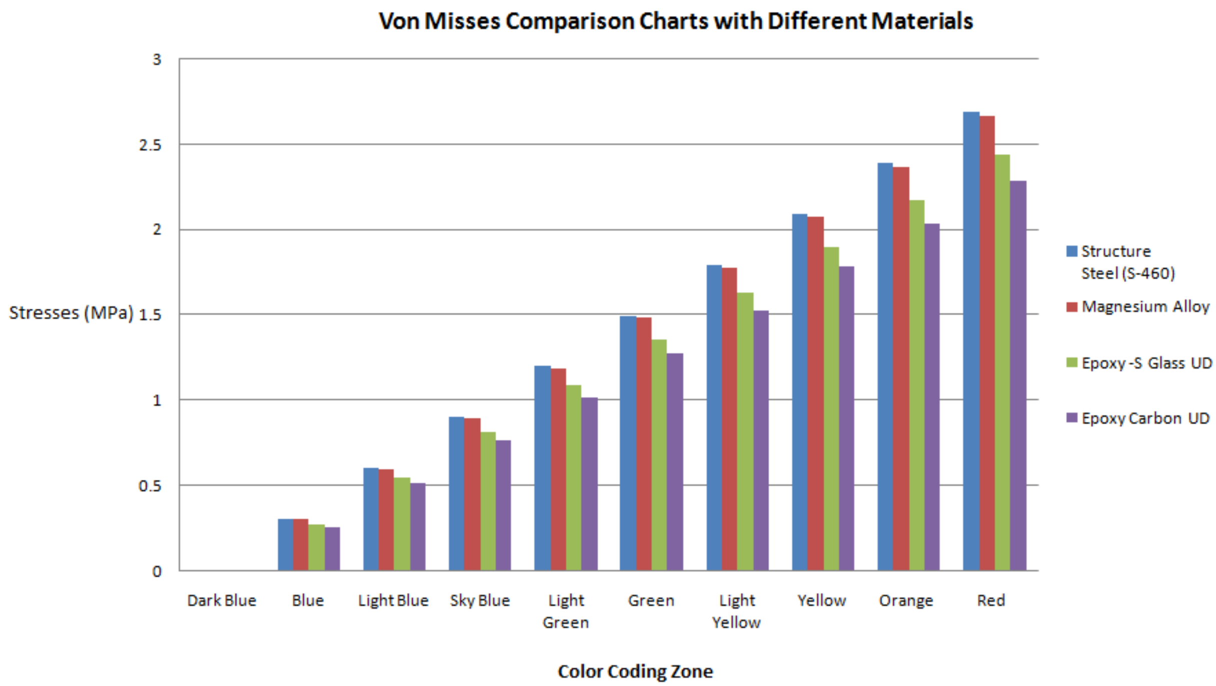

Fig.15 Von-mises comparison chart

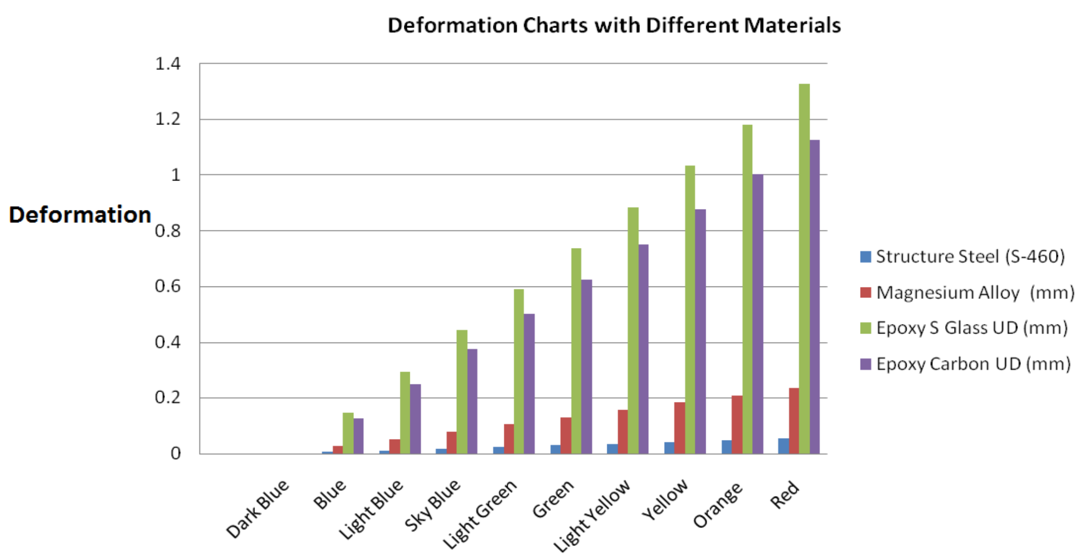

Fig.16 Deformation chart of different materials

VI. CONCLUSION

From the literature review it is concluded that cultivator is important device which is form directly stress due to contact of soil and Tyne of cultivator is the actual member to contact the soil. and Tyne is having a number stress but we conclude shear stress is maximum form as compare to other Stress and we have the better solution to minimize the shear stress to improve life and efficiency of Tyne and our cultivator has optimized weight other than company cultivator .

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