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Analysis of agro kart – an agricultural accessory

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ABSTRACT: Agriculture is the backbone of our country and it is the cause for food and survival. There are lot of methods and techniques adopted by the people for agriculture. But in the present state the population is growing at a very faster pace. This state could not be sustained with the primitive agricultural practices. The first and foremost work in any agricultural activity is ploughing. But due to the advent of modern technology, the elements of engineering are applied in this proposal. Normally a two wheeler is used by a farmer to migrate from one place to another. But by slightly modifying the back swing arm of the two-wheeler, it can perform ploughing activity. This ploughing auxiliary is neither a mini tractor nor a farming equipment but an external accessory that can be fixed to any two wheeler. It has a high reduction gearbox which draws it's input from the rear wheel of the bike. The speed of the bike is converted into useable torque. This Kart is a flexible attachment and can be removed at any cause. The different components of this attachment are structurally analyzed and studied for its linear, non-linear and dynamic characteristics using Analysis and Simulation software. The end results are correlated for optimization, so that ploughing is made with ease[1].

KEYWORDS: Agriculture, Data Mining, Machine Learning, Predictive analysis, Social Networking Spam, Spam detection.

I.INTRODUCTION

In the recent advancement of technology, the cost of tractors and self-propelled agro-vehicles are high and this not affordable by medium and low class farmers[1]. Two wheelers have become abundant even in villages, so in this experimentation the static ploughing attachment is energized with the help of two wheeler, such that the speed rotations of the bike is converted to useful torque for ploughing activity. The traditional hand tools like country plough, weeder, spade are less efficient and requires more driving labor power [2],[3].

COMPONENTS

FRAME
A frame or chassis the main supporting structure to which the other components are attached. Frame resembles the skeleton of the body and it is made by using Grey cast iron which reduces the maximum stresses at the holes on the body[4] .
WHEEL
The tyre or wheel for automobiles and bicycles, provide traction between the vehicle and the road also providing a flexible cushion that absorbs shock.
The materials of pneumatic tyres are synthetic rubber, natural rubber, fabric and wire, along with carbon black and other chemical compounds. High traction wheels are used in this proposal.
BALL BEARING
A ball bearing is a rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads
SWING ARM
A swing fork or pivoted fork, is the main component of the rear suspension and It is used to hold the rear axle firmly, while pivoting vertically, to allow the suspension to absorb bumps in the road. The tip is made by H.S.S steel for preventing failure by bending[4].

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PROCESSES/METHODS:

WELDING

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint.

TURNING

Turning is a engineering machining process in which a cutting tool, typically a non-rotary tool bit, describes a helical tool path by moving more or less linearly while the work piece rotates.

GAS CUTTING

Oxy-fuel cutting (commonly called oxyacetylene cutting), Pure oxygen, instead of air, is used to increase the flame temperature to allow localized melting of the work piece material (e.g. steel) in a room environment. A common propane/air flame burns at about 2,000 °C (3,630 °F), a propane/oxygen flame burns at about 2,500 °C (4,530 °F), and an acetylene/oxygen flame burns at about 3,500 °C (6,330 °F).

FRAME DESIGN:

The pictorial view of the frame is designed by using 3D modeling CATIA software.

Fig -1

CALCULATIONS:

SPECIFICATIONS OF TWO WHEELER

Two wheeler diameter =0.596m

Final gear ratio =0.875

Final drive reduction =2.38

Maximum speed of two wheeler N1 =9000rpm

Top speed of two wheeler =110kmph

Kmph converted into m/min=(110*1000)/60

=1833.33m/min

Wheel speed = engine speed/ (π×wheel diameter)

=1833.33/ (π×.596)

N2 =979.14rpm

Considering reduction gear box

Gear ratio of two wheeler = primary reductions × final gear ratio × final reductions

$=Y_1 \times .875 \times 2.38$

$i = 2.0825Y_1$

i =N1/N2

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$2.085Y_1$ = 9000/979.14
Primary reduction Y_1= 4.41

Third gear ratio
Assume speed = 80 kmph
=1333.33m/min
Wheel rpm in third gear = 1333.33/(π×.596)
=712.10 rpm
Gear ratio =primary reduction × third gear ratio × final reduction
=4.41× Y_2 × 2.38
i=10.495Y_2
10.495 Y_2 =9000/712.1
Y_2 =1.204

Second gear ratio
Assume speed = 50kmph
=833.33 m/min
Speed in rpm =833.33/(π×.596)
=445.06rpm
Gear ratio (10.495Y_3) = 9000/445.06
Y_3 =1.926

First gear ratio

Assume speed = 30kmph
Speed in m/min = 500m/min
Speed in rpm =267.038rpm
10.495Y_4=9000/267.038
Y_4=3.21

Gear ratio's

First gear ratio= 3.21
Second gear ratio=1.926
Third gear ratio=1.204
Fourth gear ratio =0.875

Torque of two wheeler= 12.8 Nm
Torque exerted on shaft = toque of two wheeler × gear ratio × transmission efficiency

Transmission efficiency= 90%
Gear ratio = primary reduction × first gear ratio × final drive reduction × first sprocket reduction × final sprocket reduction

Torque on first gear

=12.8×4.41×3.21×2.38×1.11×3.58×.9
=1542.33Nm

Force developed in first gear

Torque = Force * radius of rear wheel
1542.33 = F * .645
F = 4782.41 N

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Speed developed in first gear

V = π D N
Where N = speed in rpm
V = velocity in m/s
D = diameter in m
Assume primary reduction = 4.41
4.41 = 9000 / output rpm
Primary output rpm = 2040.81 rpm

First gear speed

i = 3.21
3.21 = N primary / N_{fi} = 2040.81 / N_{fi} (first speed)
N first = 635.76 rpm
Then final reduction I = 2.38
2.38 = 635.76 / N_f (final speed)
N_f = 267.13 rpm
Then 267.13 / 1.11 = 240.65 rpm
240.65 / 3.58 = 67.22

Therefore final speed of our vehicle = 67.22 rpm

V = π * D* N
= π * .645 * 67.22 = 136.20 m / min
= 136.20 * 60 / 1000 = 8.172 kmph

Similarly, the results of Torque developed, speed developed and driving force developed during respective gears are tabulated in the following table.

TABLE-1

S.NO.	FIRST GEAR	SECOND GEAR	THIRD GEAR	FOURTH GEAR
TORQUE(N-m)	1542.33	925	578.49	420.41
SPEED (kmph)	8.172	13.62	21.78	29.98
DRIVINGFORCE (N)	4782.41	2868	1793.76	1303.58

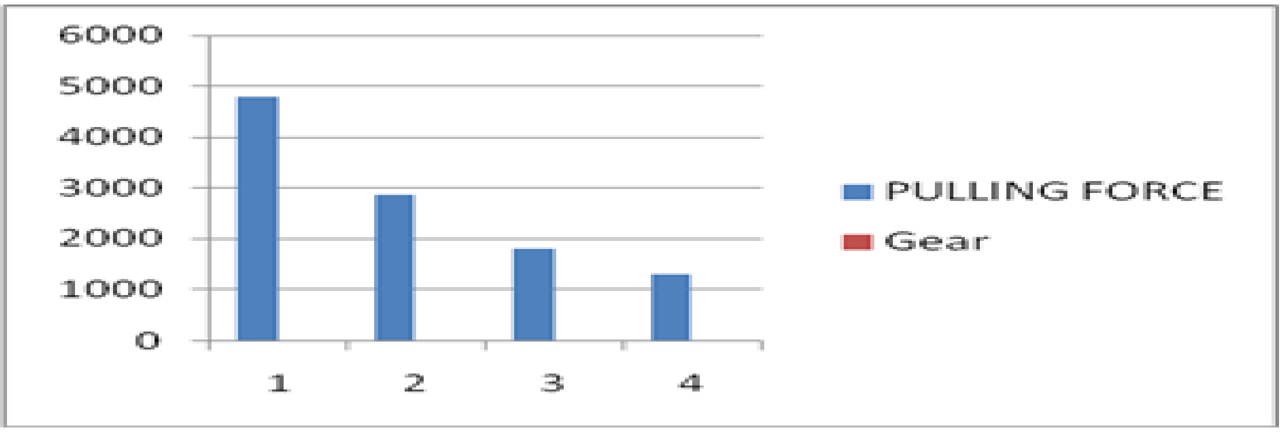

Fig:2

The above shown graph depicts the relationship between the pulling force and gear ratio of the reduction gear box. The pulling force decreases periodically on increase of the gear ratio.

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This fig.3 bar graph shows that on increase of gear ratio of the gear box correspondingly the speed of rotation also increases.

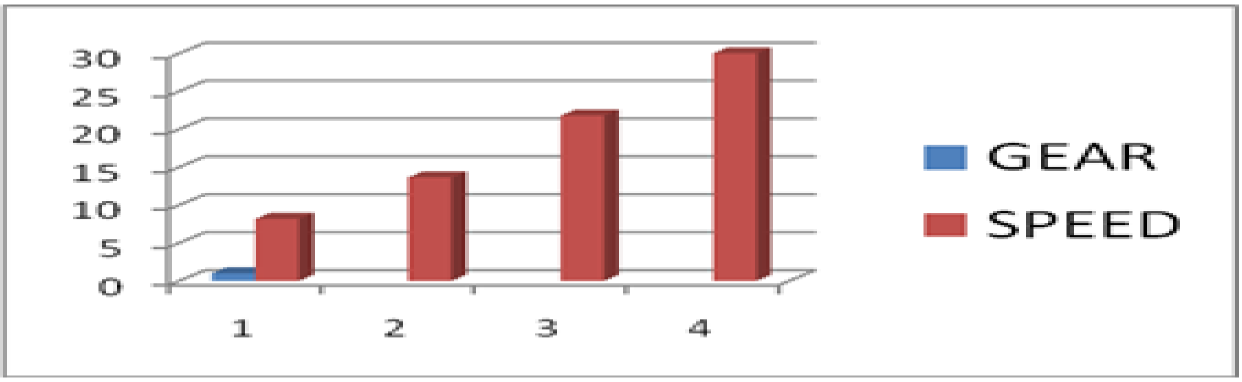

Fig:3

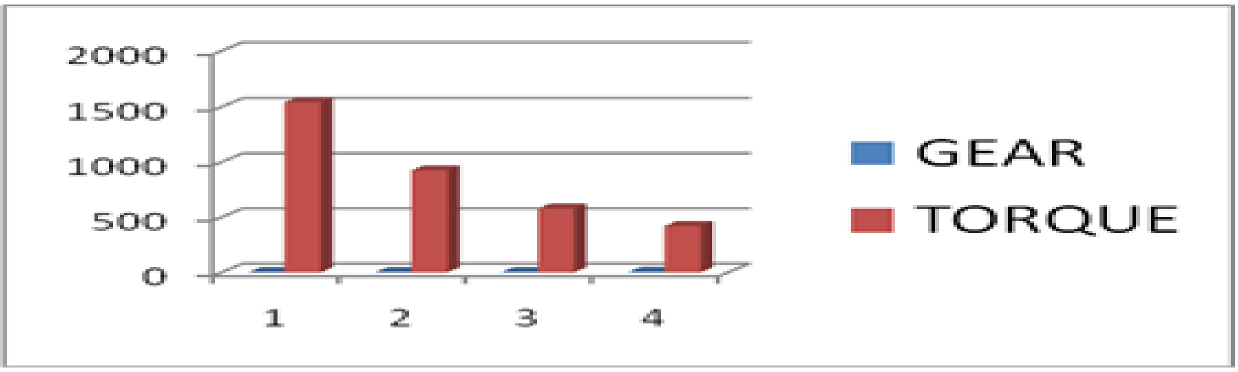

Fig:4

The above graph infers that the gear ratio and the torque produced are inversely proportional to each other.

STRUCTURAL ANALYSIS:

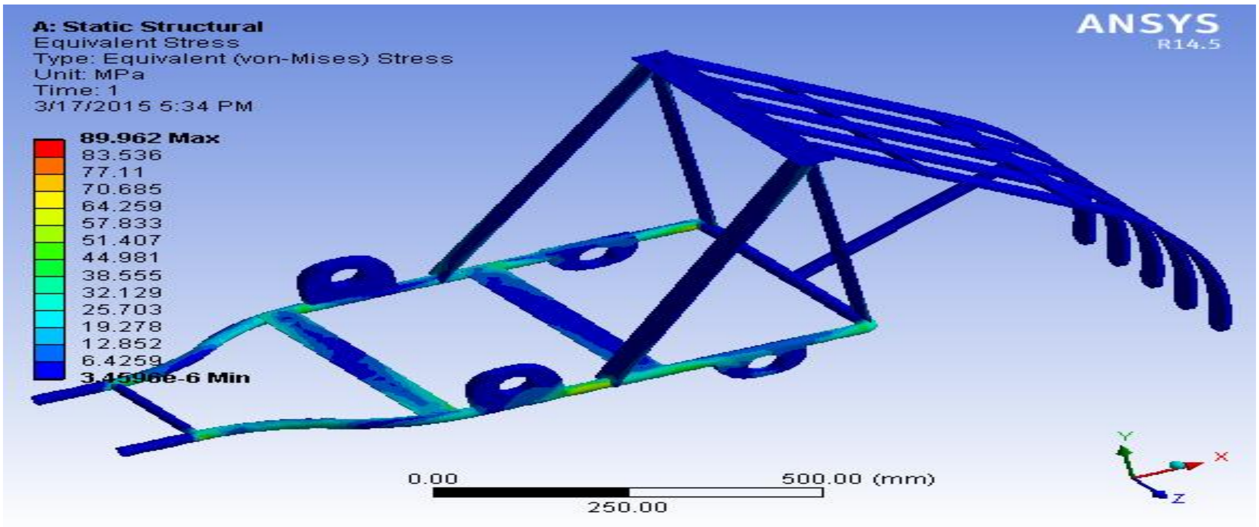

Fig: 5

When 5000N of load is applied on the frame and impact analysis is applied on the side of the frame and the resultant is that the equivalent stresses are under safe limit.

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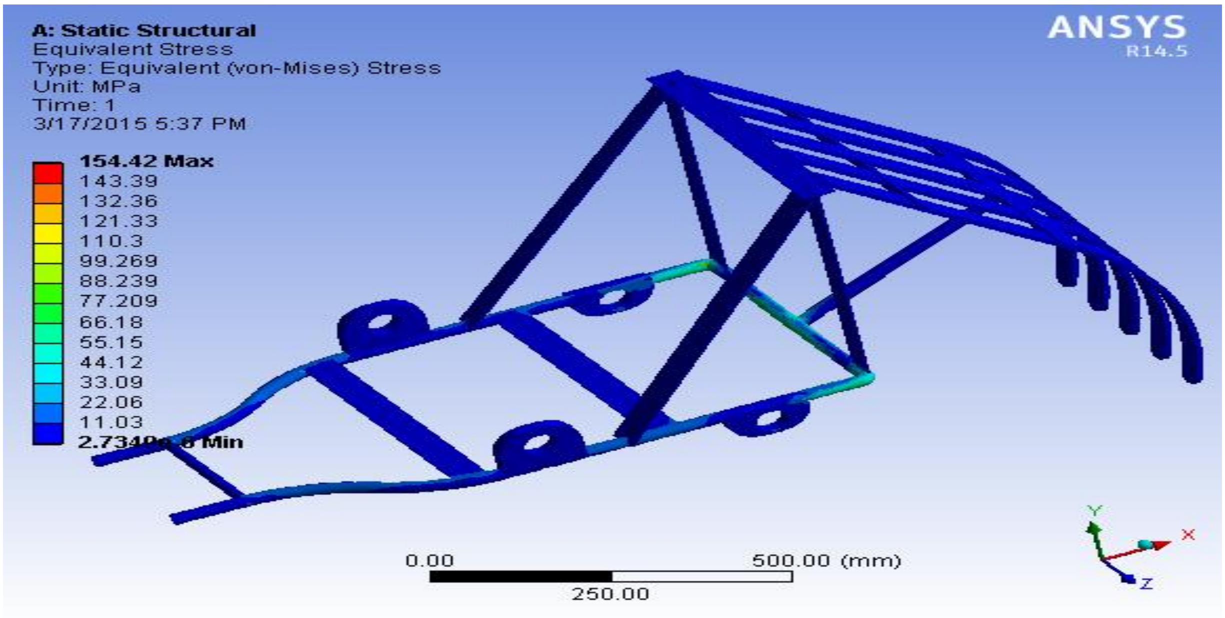

Fig: 6

The rear impact structural analysis is performed on the frame under the condition that parametric variable is von mises stress. The stresses are under FOS limit.

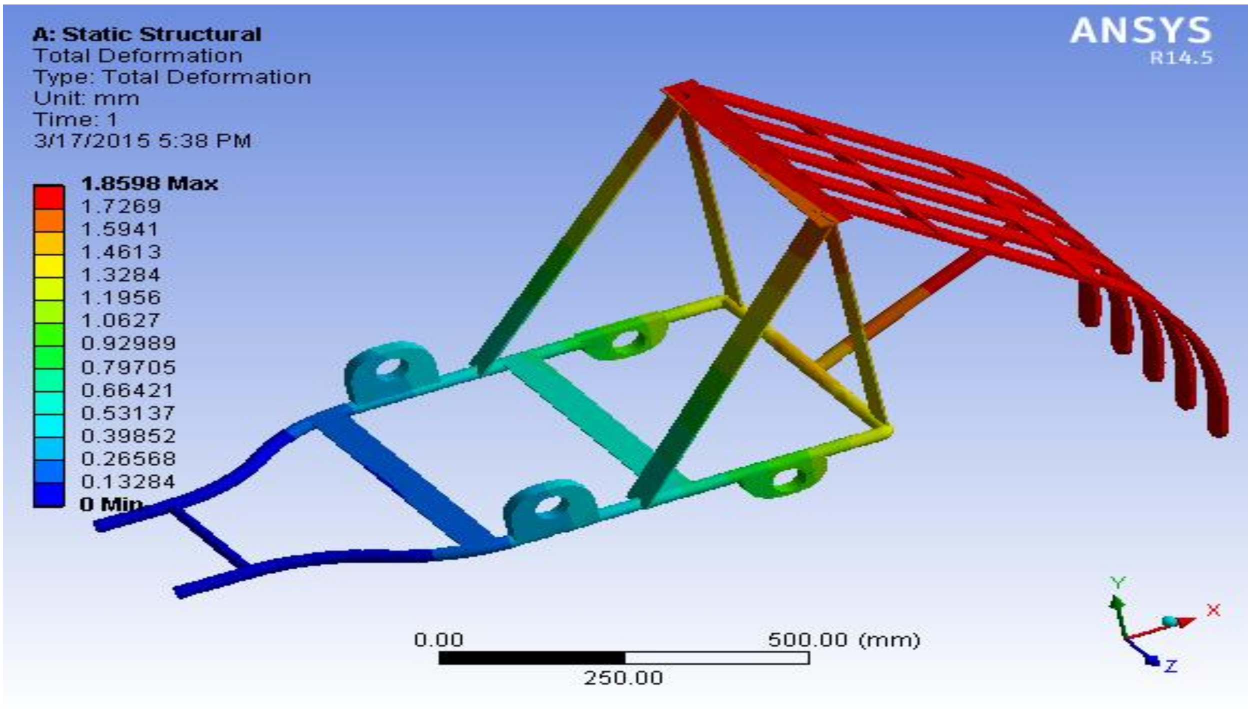

Fig:7

The rear impact deformation analysis is executed using analysis software and inferred that the deformation is balanced at all parts of the frame and the maximum deflection is obtained at the ploughing arm.

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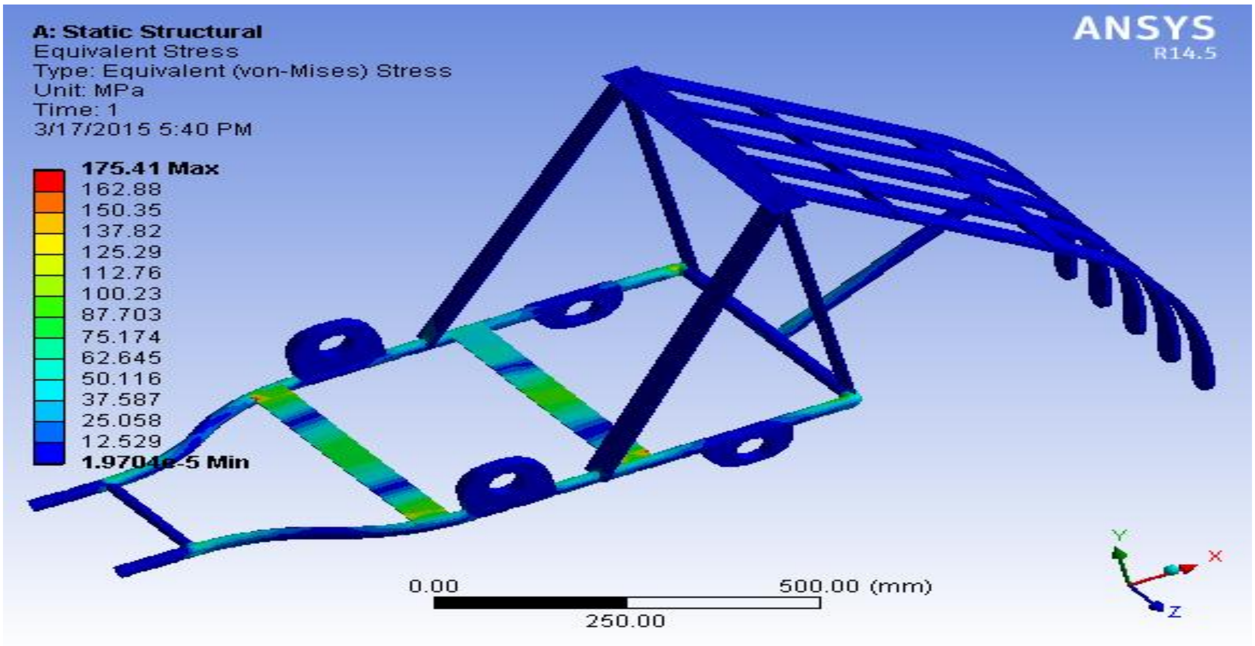

Fig:8

In the above shown result the stress analysis is conducted considering self weight of 300kg and stresses are under the limit of safety.

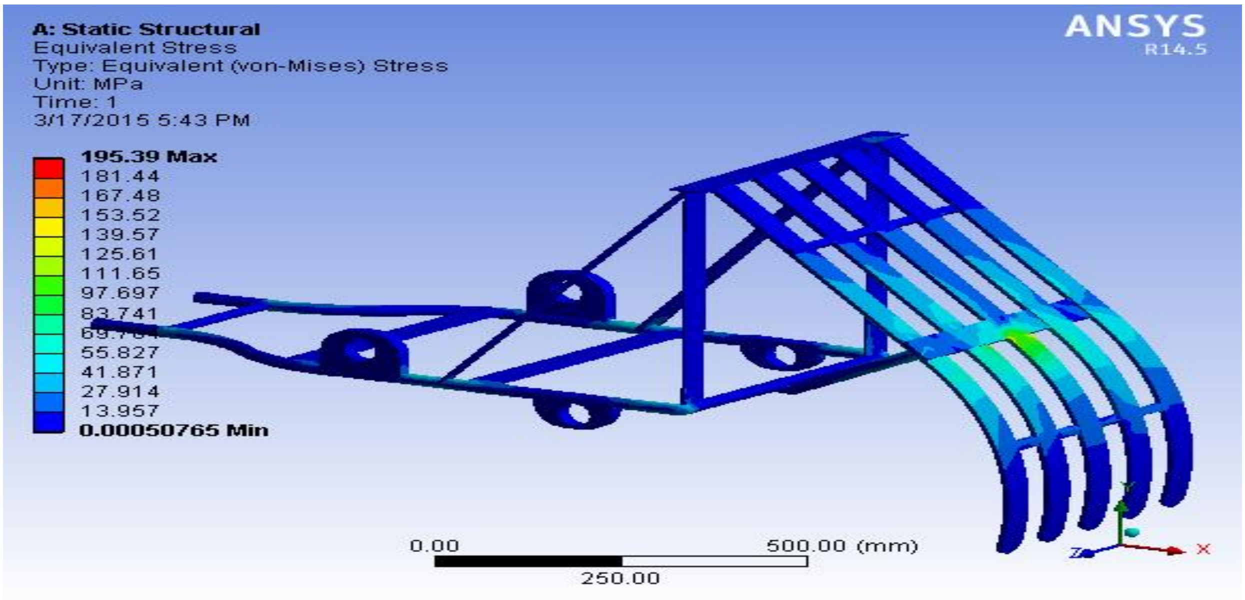

Fig: 9

In this static structural analysis 1000N of load is applied on the ploughing arm and the equivalent stresses are very less behind the safety limit.

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VI.RESULTS AND DISCUSSION

- The design model of the proposal is obtained using 3D modelling software.
- The various gear ratio's and the corresponding gear speeds are obtained and the numerical relation shows that gear ratio is inversely proportional to pulling force and torque, also the gear ratio is directly proportional to the shaft speed.
- The structural analysis is conducted on three stages namely with side impact, rear impact and ploughing arm, correspondingly the parametric conditions like equivalent stress, total deformation and total torque are also included in this analysis and hence inferred that the structural design is safe.
- The massive final drive torque coupled with high traction tires enables this kart to perform all the basic agricultural activities like plowing and weeding with utmost ease. Moreover the maintenance free detachable petrol engine with high fuel efficiency has further improved the sleeves of this proposal and hence the cost barriers in the agricultural field would be reduced by fabrication of this proposal.

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