

Design Analysis and Fabrication of Multi-Purpose Shovel

T. Mohan¹, P. Gajendran², S. Sheik Barkath³, S. Gopalakrishnan⁴
^{1,2,3,4}M.Kumarasamy College of Engineering, Thalavapalayam, Tamil Nadu, India.

ABSTRACT

The present innovation is to create a shovel which works on different soil conditions and to increase the overall yield, can also reducing the time consumption directly. Generally, the agricultural shovel is used for making weed control, water irrigation and bund forming purposes. The standardized size of spade will not be suitable for every farmer and every land condition due to packing of soil, uneven height and other parameters. So, the normal shovel failed to have the flexible features and not suitable for all the farmers requirements to work efficiently. Therefore, there is a need to introduce a shovel for changing the spade metal head or blade angle easily to carry out the work in the effective manner and also the wooden handle should be replaced with a correct substitute.

KEYWORDS

Different Angle, Design and Simulation.

Introduction

The present invention provides an adjustable shovel for easily changing the shovel blade angles depending on the soil condition and the farmer's height. The adjustable shovel comprises of a metal head, shovel handle, movable portion, threaded part in which the movable portion travels to achieve the angle what we need to have, at that time of working. By using these parts we made this multipurpose shovel and we can have the following angles in the shovel, 180 degree, 90 degree, 35 degree.

Design of Experiments

Based on the feedback given by the farmers and also by analyzing the different land conditions in different regions we understood the exact problem of the farmer in their agricultural field and then only we invented the following design.

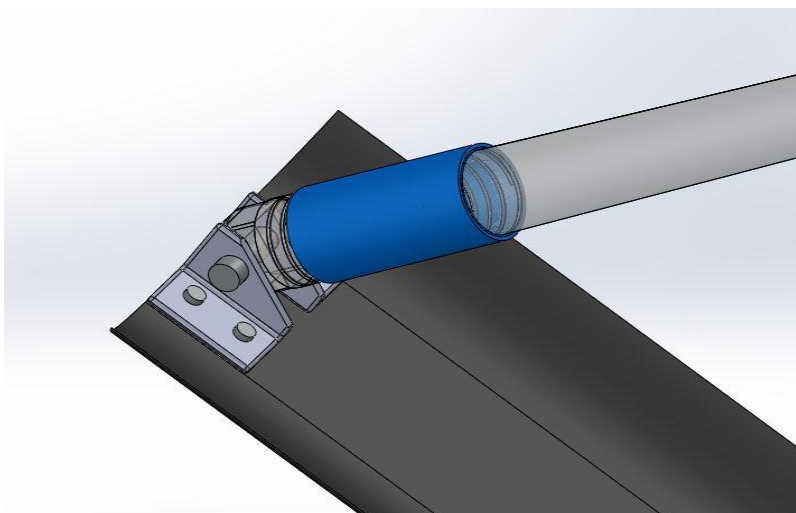


Fig. 1.Top View

The above diagram shows the top view of the design. In that the highlighted part is called angle holder which is used to hold the angle. The angle holder moves in the threaded portion over the handle, whenever we required to change the angle, we can loose the angle holder and can fix the angle by moving the handle forward and backward, then the angle holder can be tightened to achieve the required angle.

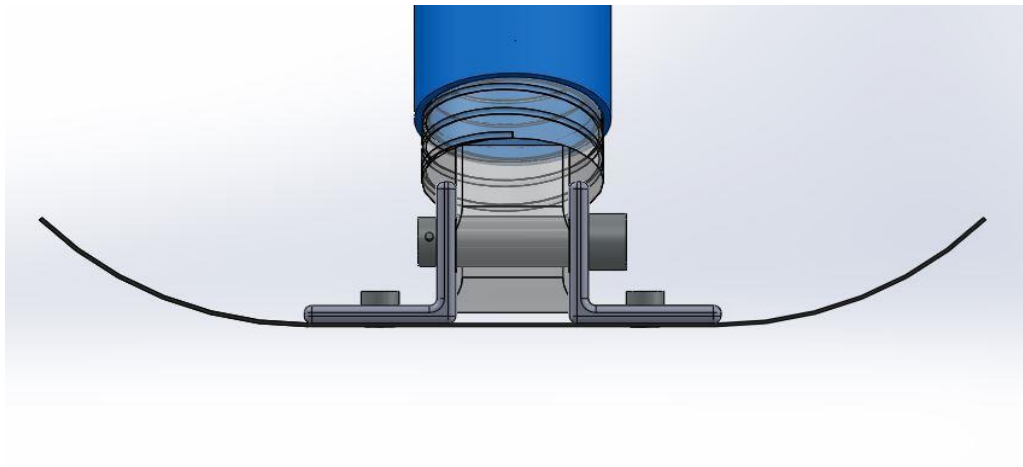


Fig. 2.Front View

The above diagram shows the front view of the design. In this view we can clearly observe the threaded portion of the handle which is connected to the angle maker by using bolt and nut. The angle maker is connected with metal head by using rivet joint.

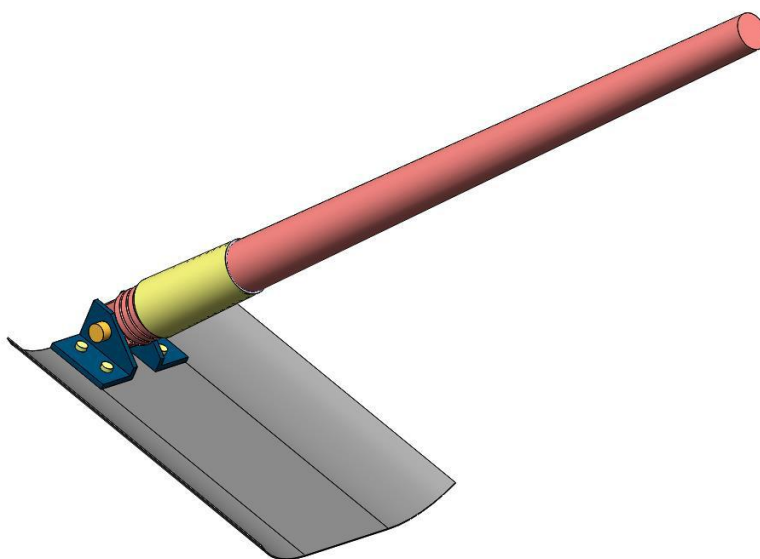


Fig. 3.Overview

Objective

The objective of the present invention is to provide a simple design shovel along with rotatable features for the agricultural application and to provide a light weight rotatable shovel in low cost.

Another objective of the present invention is to provide a tool for reducing the effort of the farmers in the working time and increase the life time of shovel by introducing the composite materials.

The present invention is to introduce a common shovel for all kind of soil conditions and it can resist the vibration also and finally we can have a compact and hand adjustable shovel for all the farmers.

Fabricated Shovel



Fig. 4.35 Deg



Fig. 5.90 deg



Fig. 6.180 Deg



Fig. 7. Threaded part with Angle Holder and Maker

Simulation

Model name: Assem1
Study name: Static 1(-Default-)
Plot type: Static nodal stress Stress1
Deformation scale: 21.6236

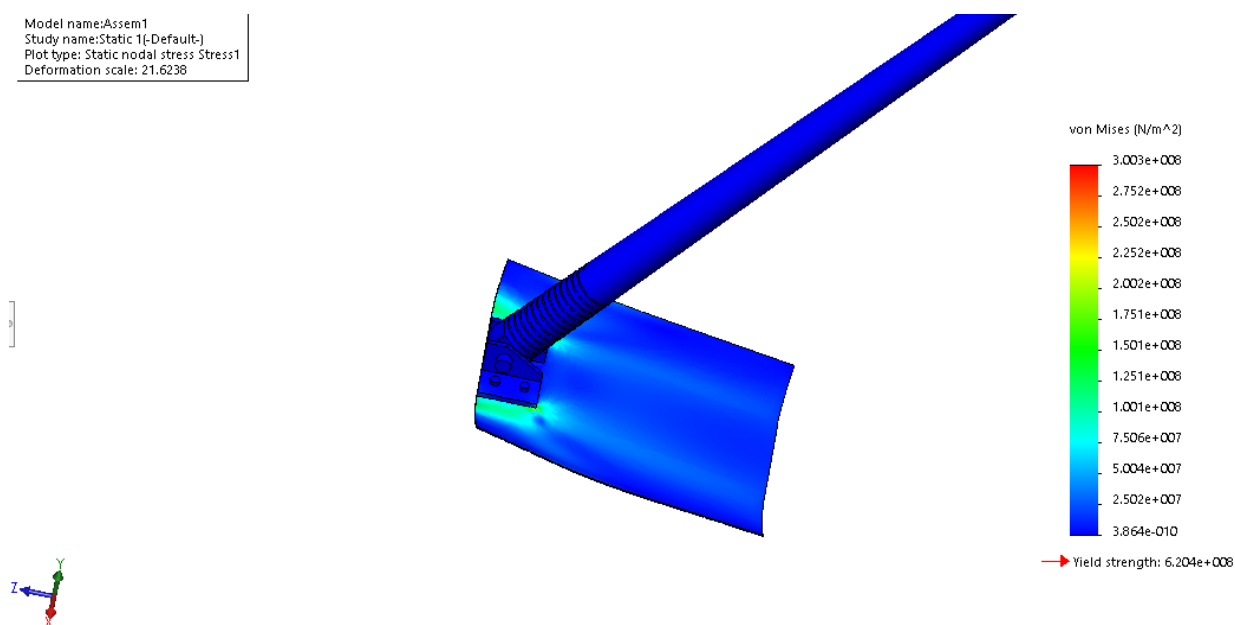


Fig. 8. Stress Analysis for 50 N at 35 deg

In this analysis we are analyzing the multipurpose shovel with the help of solid works software in that, we fixed the shovel handle and have given the load of 50 N on the metal head.

The above analyzed result is Von Mises Stress (N/m²) and in this the maximum yield strength of the material is 6.204e+008 N/m².

And we got the stress value for 50 N load applied on the shovel is just 3.864e-010 N/m² only.

Hence, the total shovel is in good condition while applying the load and we can see the range of stresses acted on the

above diagram, in that the value obtained for stress is $3.864e+010 \text{ N/m}^2$ that means the minimum stress is acted on the shovel.

Model name:Assem1
Study name:Static 11-Default-
Plot type: Static nodal stress Stress1
Deformation scale: 10.8007

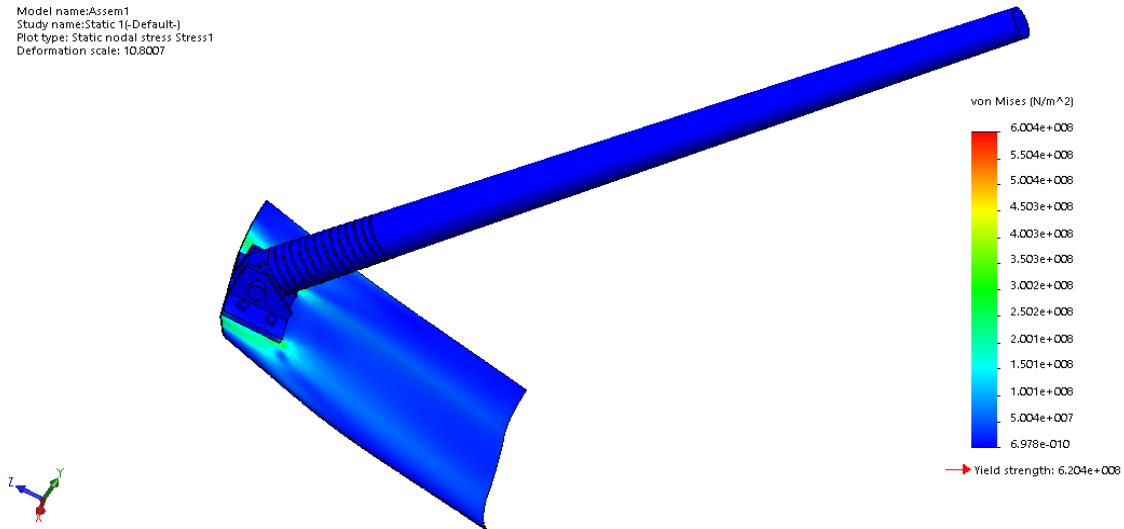


Fig. 9. Stress Analysis for 100 N at 35 deg

In this analysis we are analyzing the multipurpose shovel by giving the load condition as 100 N which is acted on the metal head.

The above analyzed result is also Von Mises Stress (N/m²) and in this the maximum yield strength of the material is $6.204e+008 \text{ N/m}^2$.

And we got the stress value for 100 N load applied on the shovel is just $6.9782e-010 \text{ N/m}^2$ only.

Hence, the total shovel is in good condition while applying the load and we can see the range of stresses acted on the above diagram, in that the obtained stress value is $6.9782e-010 \text{ N/m}^2$ that means the minimum stress is acted on the shovel.

So, we can come to know that, the multipurpose shovel can be used under 100N load with no problem.

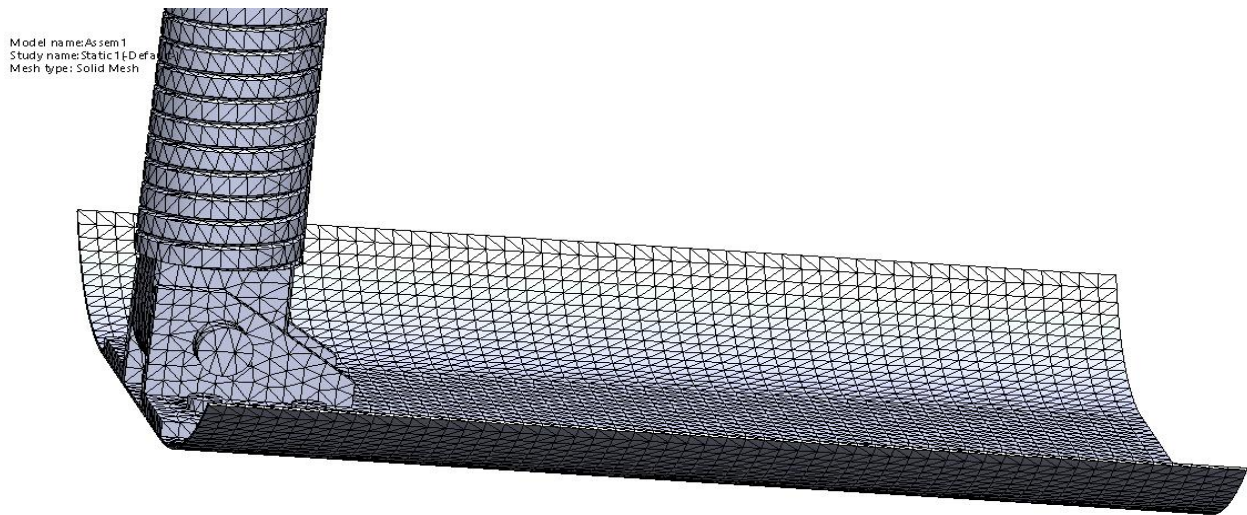


Fig. 10.After Meshing

Meshing is the process of subdividing the model into small pieces. Finite element analysis programs look at the model as a network of interconnected elements. The software automatically creates a mixed mesh of shell, beam and solid elements.

Then the applied load is equally distributed on all the surfaces of the solid element and finally we can get the accurate result.

While doing the meshing process it takes five to eight minutes to complete and it is done to make the problem solvable using finite elements.

After the meshing process we can break the domain into pieces and each piece are representing an element and finally we can have the meshed solid element.

Material Properties

Name	Alloy Steel
Model type	Linear Elastic Isotropic
Load	50 N
Default failure criterion	Max von Mises Stress
Yield strength	6.20422e+008 N/m²
Tensile strength	7.23826e+008 N/m²
Elastic modulus	2.1e+011 N/m²
Poisson's ratio	0.28
Mass density	7700 kg/m³
Shear modulus	7.9e+010 N/m²
Thermal expansion coefficient	1.3e-005 /Kelvin

Conclusion

The various embodiments of the present invention provide a Multipurpose shovel for easily changing the spade angle based on the farmer requirement and soil condition.

According to an embodiment of the present invention, the composite handle is provided for maintaining the proper strength and weight of the shovel within the limit.

By doing so, we can have the inclination in the shovel what we want to have during our working time. The above-mentioned features are not present in the existing spade.

Finally, we have a complete spade for all kinds of soil condition, three angles to work in the agricultural land when needed and also handle length can also be adjusted according to the farmers height.

Hence, the farmers can use it very effectively and efficiently for their agricultural work and also, we have a huge market opportunity for this product.

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