Structural Analysis of Earth Auger Bit

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ABSTRACT: Earth Auger as we all know is a vital part in Drilling all Holes in the ground be that a simple hanging bar to one of the most complex rockets. Quite possibly the most important parts of Earth Auger are a Auger bit. So, it is vital to strengthen this important aspect to ready it for any use. Our fundamental objective behind this paper is to study the Earth Auger bit in detail while doing analysis using ANSYS and testing various materials with different moments and by applying load on Auger bit. Our main spotlight will be on deformation and stress analysis using Structural steel , Stainless steel (ss304) and Gray cast Iron Auger bit on ANSYS. The significance of this analysis becomes more important as it reduces various expenses and labor effort.

Key words: Auger Bit, Structural steel , Stainless steel , Gray cast iron Bits , ANSYS.

I. INTRODUCTION

EARTH AUGER

The modified auger is easy to carry and transport one place another. Its designed structure help to reduce the injuries and accidents. Also, its drill bit can drill hole on many types of soils. Material used to make frame able to sustain vibrations and forces acting on it. Our aim to make earth auger more use friendly and to avoid accidents and health disorder related to it.

HISTORY

An earth auger, earth drill, or post-hole auger is a drilling tool or machine used for making holes in the ground. It typically consists of a rotating vertical metal rod or pipe with one or more blades attached at the lower end, that cut or scrape the soil.

Metal augers have been in use since the Middle Ages to drill holes in wood. In the 19th century, the hand-operated earth auger became a common farm and construction tool in the US, and several inventors submitted patents for them. An example is the design of a certain M. Hubby of Maysfield, Texas, consisting of an open hollow cylinder with two blades at the bottom edge.

The first known power earth auger was built in 1943 by John Habluetzel , a farmer in Wamego, Kansas, from parts scavenged from other equipment, including a 7-inch helical blade from a screw separator. It was attached to a tractor and could be operated by the driver from his seat. It dug one 2.5-foot-deep hole every minute. His invention was featured in the Kansas State Board of Agriculture's 35th Biennial Report. He went on to dig holes for other farmers at 10 cents per hole, a side business that he operated well into the 1950s. He donated his invention to the Kansas Museum of History in 1999

There are a number of varieties of the tools known as **earth augers**. If you are looking for a large cutting tool that can remove a lot of earth at one time, then an earth auger is ideal. However, as well as being small hand-held tools, they can also come as very powerful earth-movers, digging holes up to 7 feet deep. There are many different types of earth auger, so you should know as much as you can about these different types of earth auger, and what will be best for you.

II. TYPES OF AUGER BITS

WOOD BORING AUGER BITS:

This is the one of the most common type of auger bit and is used for drilling through thick pieces of wood for construction of channels for pipelines or electric cables. A wood boring auger can be defined as a spiral-shaped drill bit that is specifically designed for boring clean, deep holes into the wood. This is the standard type of auger bit which is used in DIY, and can be used simultaneously with hand drills, power drills and drill presses, etc. Stubby wood augers are also used in confined spaces where it is very difficult or just not possible to fit a regular bit. Although being not much popular than some other wood-working bits in home, augers are most often used by construction workers, where drilling to a much greater depth is more frequently required

III. LITERATURE REVIEW

Prof. R.V. Adakane,Sumedh Shastri, Shekhar Kola, Kartik Giri 12 Dec (2020) Design and Development of Earth Auger. The Work aims at design and development of earth auger which would be modification to overcome all the shortcomings of the existing earth auger. The work will

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be useful to provide a solution for low cost and comparatively safe auger which can be completely used by one person. This work will provide farmers with a cheap and safe alternative to use for plantation or other purposes. This work will help understand the shortcomings of manual and power operated earth augers and provide possible solutions. Hence, this work will reduce the chances of auger related injuries and also increase the stability and usability of the same.

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Prof.R.V.Adakane, Shekhar Khola, Sumedh Shashtri, Kartik Giri (2021) REDESIGN AND MODIFICATION OF EXISTING EARTH AUGER

The Work aims Redesign and development of earth auger which would be modification to overcome all the shortcomings of the existing earth auger. The work will be useful to provide a solution for low cost and comparatively safe auger which can be completely used by one person. This work will provide farmers with a cheap and safe alternative to use for plantation or other purposes. This work will help understand the shortcomings of manual and power operated earth augers and provide possible solutions. Hence, this work will reduce the chances of auger related injuries and also increase the stability and usability of the same. This work will help farmers to use earth auger comfortably and work will be done smoothy and efficiently

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Olivier Gagnon and Michel Allard (2005) Portable Earth-auger Earth-auger System for Permafrost Studies

This technical note presents a light drill specially designed for coring in permafrost. The drill was improved over several years at universities´ Laval's Centre d'e´tudes nordiques. More efficient than theconventional CRREL coring kit t, the equipment allows total-length recovery of cores 10 cm in diameternearly without alteration, and works in most kinds of frozen soils. Drilling is possible to 7 m using atwo to three-person operating crew.

Published online in Wiley InterScience (www.interscience.wiley.com).

Du Chang-long, Liu Song-yong (2009) Study on design of operating mechanism of auger auger

To raise the cutting efficiency and percentage of lumps for the auger mining machine, two cutting models (the axial cutting and the radial cutting) were proposed according to the mining technique of the auger mining machine. Picks installed on different positions of the operating mechanism were optimized. The operating mechanism was developed according to the optimized result. For comparison, trials were carried out with the existing operating mechanism of the same model of auger mining machine. The results indicate that the production efficiency and the advance speed of the new operating mechanism are increased, and the axial resistance is reduced in the same conditions as the existing operating mechanism. And the drilled hole is flatness, there are no obvious cross-sections on the wall of the hole, which indicates that the stability of the new operating mechanism is good, and taking full advantage of coal collapsing during cutting with picks. Simultaneously, the percentage of lumps of the new operating mechanism is increased, while wear on the picks is uniform. China University of Mining and Technology, Xuzhou 221116, China Procedia Earth and Planetary Science 1 (2009) 1406–1410.

CATIA (Computer Aided Three-dimensional Interactive Application) is a multi-platform CAD/CAM/CAE commercial software suite developed by the French company Assault Systems. Written in the C++ programming language, CATIA is the cornerstone of the Assault Systems product lifecycle management software suite. CATIA competes in the CAD/CAM/CAE market with Siemens NX, Pro/E, Autodesk Inventor, and Solid Edge as well as many others.

IV. RESULTS AND DISCUSSION

Static structural analysis for structural steel

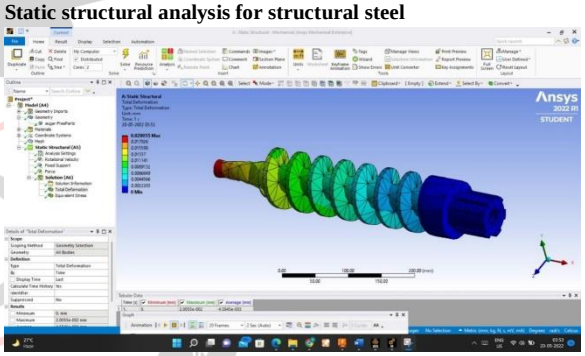

Fig 1 deformation of structural steel

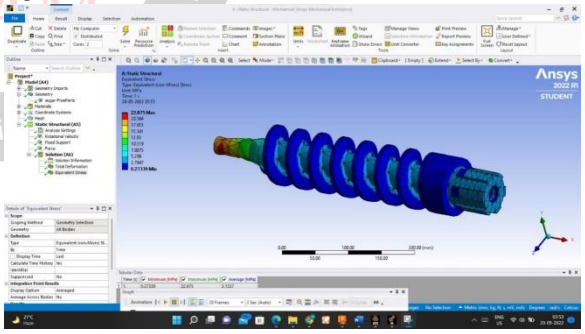

Fig 2. stresses developed in augar of structural steel

Static structural analysis for stainless steel

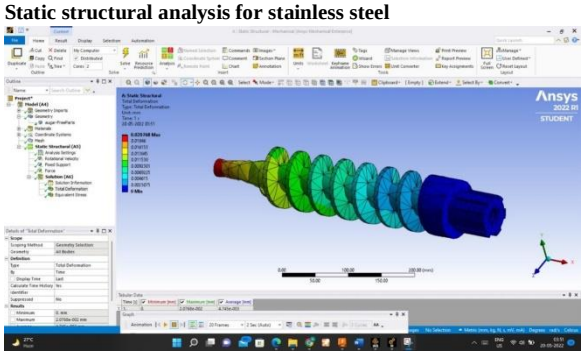

Fig 3 deformation of stainless steel

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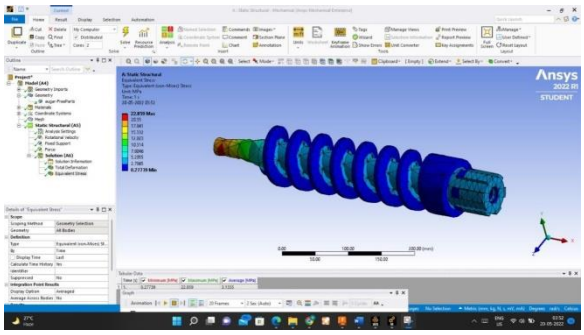


Fig 4 stresses developed in augar of stainless steel

Static structural analysis for grey cast iron

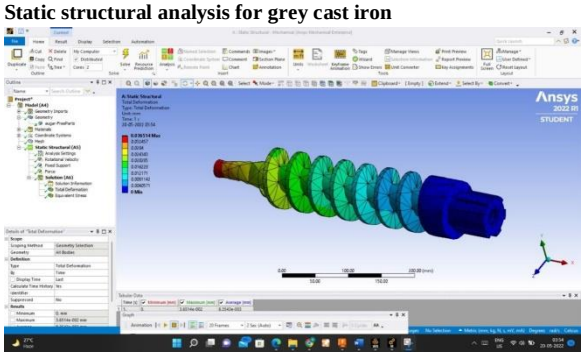


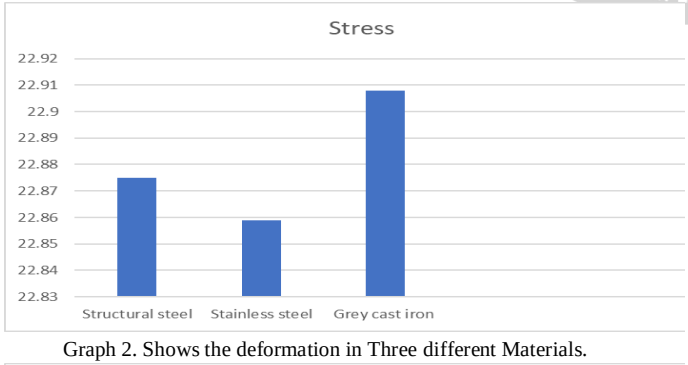
Fig 5 deformation of grey cast iron

Fig 6 stresses developed in augar of grey cast iron

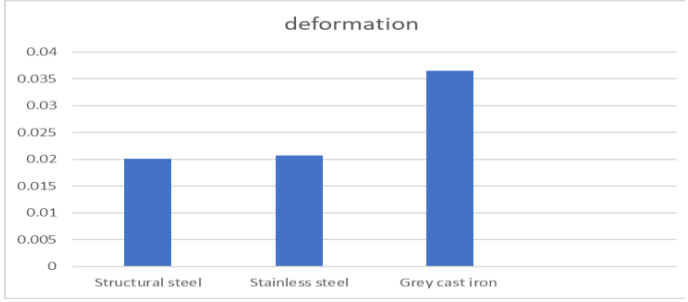
Table 1: Shows Stress and Deformation

Material	Load(N)	Stress(Mpa)	Deformation(mm)
Structural steel	10000	22.875	0.02005
Stainless steel (SS 304)	10000	22.859	0.02076
Grey cast iron	10000	22.908	0.0365

Graph 1. shows Stress produced in three different material.



Graph 2. Shows the deformation in Three different Materials.



V. CONCLUSIONS

An earth auger is a drilling tool or machine used for making holes in the ground. It typically consists of a rotating vertical metal rod or pipe with one or more blades attached at the lower end, that cut or scrapes the soil.

In the above paper we came to know about the Earth Auger machine, its working, parts and many more aspects. Then we have discussed various Applications of Earth augers , Selection of earth augers based on specifications and also the various materials used for auger bits.

Later we decuss about catia , histroy of catia , design procedure steps in catia. Later we did the Finite Element Analysis of the Auger bit. Our analysis was done on the ANSYS software. In the present paper, .And the catia design is transfered to the Ansys software where the simulation is carried. At the first place we tried to analyze the stress in the static as well as the deformation in Structural Steel by applying load.

At the Next place we tried to analyze the stress in the static as well as the deformation in Stainless steel (SS 304) as well as Gray cast iron by applying load. We have simulated the auger with three different material and we found that structural steel is giving us the high strength and less deformation as compare to other two materials. Since the difference is very very low any material can be survived.

VI. REFERENCES

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