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Stress Analysis of Supporting Plate Used in Pneumatic Robot for Drilling Blockage in Borewell

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ABSTRACT

The advancement in the field of automation along with the mechanical design has a great impact on the society. The objective of the project is to design and analysis of "Pneumatic Robot for Drilling Blockage in Borewell".The analysis of plate for load taking capacity as equivalent stress,total deformation and safety factor. The light weight servo motors were implemented for the machine operations. A long range digital camera was placed to find the stone position. This machine is a human controlled computerized machine system.The complicated manual process makes 70% of the motor damage. The project design is based on studying different type of stone and their specification and driller material to drill the stones in borewell pipe with drilling parameter with calculations and contain designing and fabrication of pneumatic robot.Our robot design constitutes a best ergonomic design and performs safest operation. And use for the drilling a stone inside the bore well which can help us to free the bore well and use it again for water supply.

Keywords: Ansys, Supporting Plate, Computerized control, Digital camera, Pneumatic cylinder, Robot design.

I INTRODUCTION

In the present era, robotic technologies combined with rapid advances in electronics, controls, vision and other forms of sensing, and computing have been widely recognized for their potential applications in almost all areas. Now a days it's quite often we see unused bore wells left open after the use. When we are working on the bore well that time some stones block the bore well and we are not able to remove this manually and in this condition 0we need to close this bore well for permanently. Also invest the extra money in new bore well. This is a time consuming and costly process. To overcome these hurdles, we have designed a pneumatic bore-well robot with advanced equipment and devices. A robot is an intelligent, re-programmable and multifunctional manipulator designed to work in inaccessible environment to do variety of tasks which are laborious, threatened and risky. The robots with flexible structure are needed so that they can adapt themselves according to the pipeline parameters. The robots are simplest, energy saving and best suited for use on prepared surfaces. These

locomotion systems have main chasis connected to links and joints. The entire system is manually controlled by the user. The CCTV camera is used for continuous monitoring and records each and every action of the drilling and display can be observed on monitor. The fully computerized control unit controls the camera and acquires the images that have been captured with the help of CCTV camera. With the help of this, the stone position can be inferred.The video signals received are analyzed by the user and in turn send the suitable commands to the robot.

II PROTOTYPE

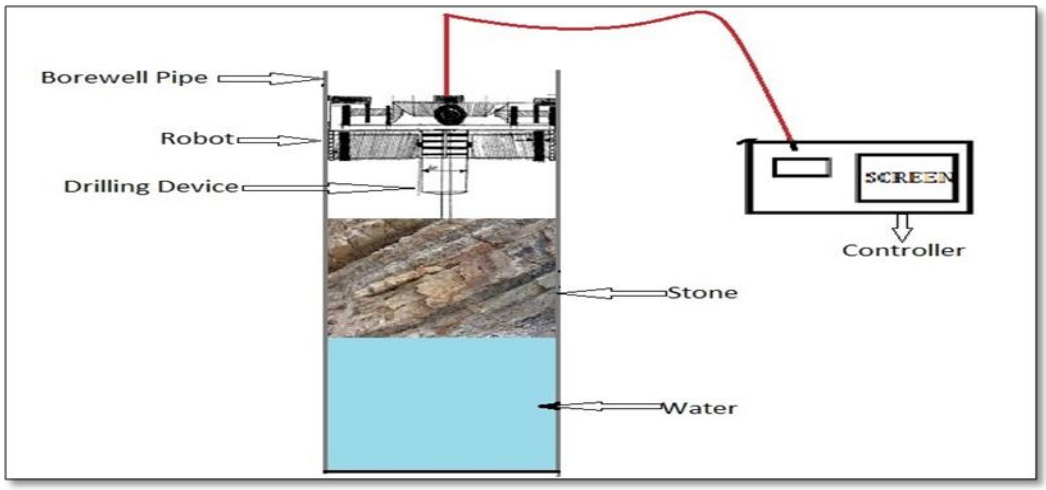

Fig.2.1: PROTOTYPE

III CATIA MODEL

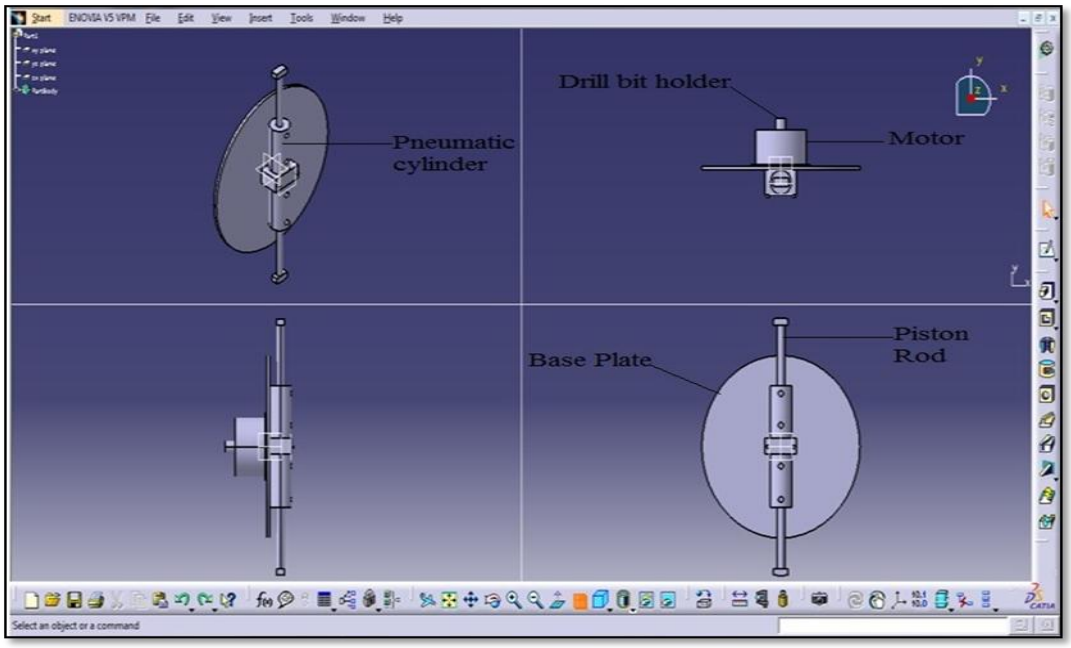

Fig.3.1: Catia Model of pneumatic robot

3.1 Design of Plate:-

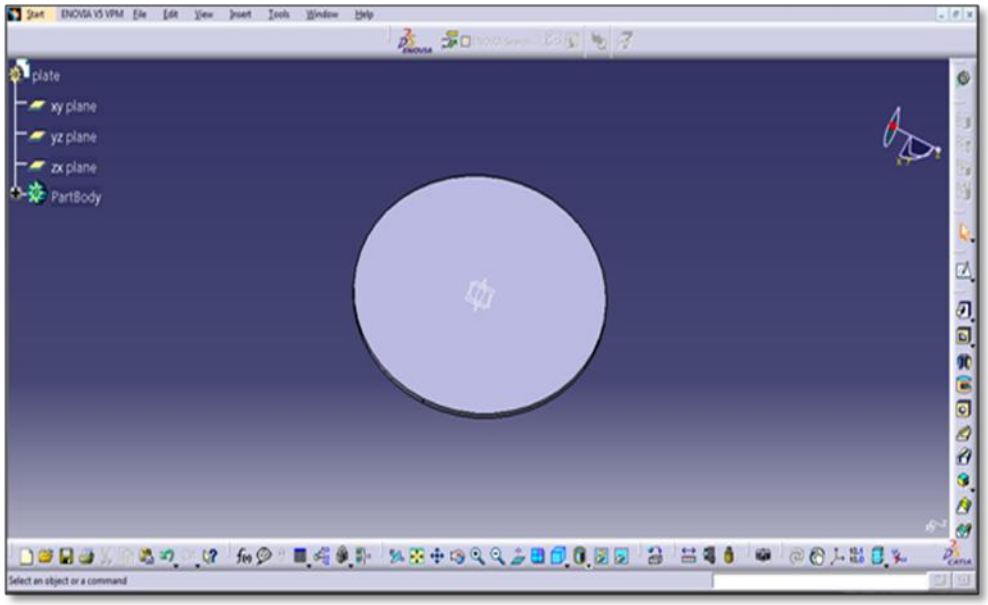

Fig.3.2: Design of Plate

IV ANALYSIS OF PLATE

Meshing of plate

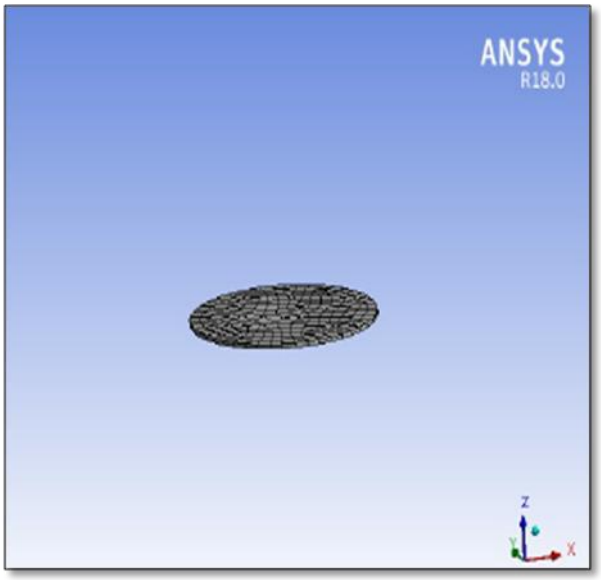

Fig.4.1: Meshing Plate

1. Static structural analysis

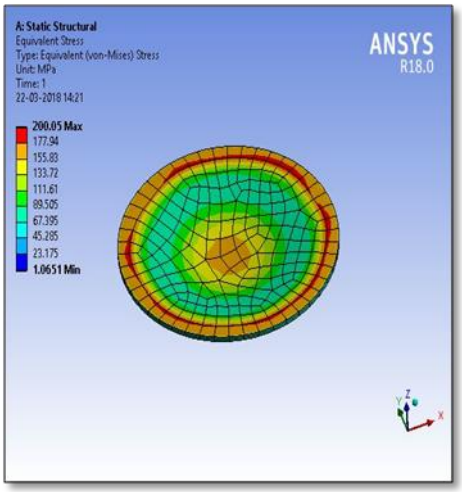

Fig.4.2 (a): Equivalent Stress

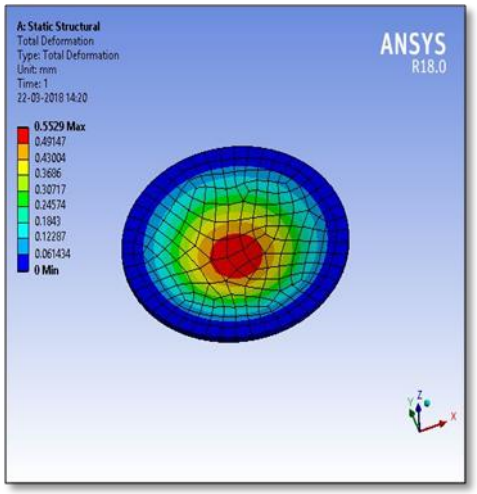

Fig.4.2 (b): Total deformation

2. Solution for safety factor

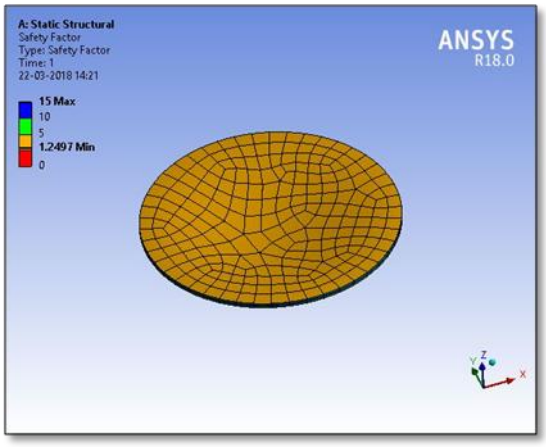

Fig.4.3: safety factor

3. RESULTS:

Table 4.4: Results table

Sr. No.	**DETAILS**	**VALUES**
1	Max Deformation	0.5529 mm
2	Max Stress	200.05 Mpa
3	Factor of Safety	1.24

Factor of safety (F.O.S.) = 250 / 200.05 = 1.24

The deformation obtained from the results is 0.5529 mm which is negligible at such force.According the analysis results, the thickness of the plate was decided to be 3 mm.

V CALCULATION

- **Equivalent stress:-**

Applying Force on Plate:-7500 N

$$\text{Equivalent stress} = \frac{\text{Force}}{\text{Area}}$$

$$= \frac{\text{Force}}{2\pi r^2 + 2\pi rh}$$

=204 Mpa

- **Factor of safety:-**

$$\text{Factor of safety} = \frac{\text{Ultimate stress}}{\text{Allowable stress}}$$

$$= \frac{250}{204} = 1.225$$

- **Forces to break the stone =**

$$a = \frac{A}{V} = \frac{NAo}{\frac{\pi}{4}D^2H} = \frac{200 \times 39.2}{\frac{\pi}{4} \times 10^2 \times \frac{H}{10}} = \frac{998.2}{H} J/cm^2$$

Taking,

1) H=2cm, a=499.10 J/cm^2.
2) H=3cm, a=332.73 J/cm^2.
3) H=4cm, a=249.55 J/cm^2.

Where:

a = Impact penetrate-specific work (IPSW), J/cm3;

A= Total impact work of, J;

V= Rock volume to be broken after, cm3;

N= Total impact times,

A_0= Work of single impact, A_0 = 39.2 J;

D= Actual hole diameter after drilling, d = 1 cm (bit diameter = 10 mm);

H= Net depth, mm.

VI FUTURE DEVELOPMENTS

The Robot can be equipped with necessary cleaning device like brush so that it can be used to clean underground tank.The cost of robot is high. But comparing to current re-boring operation, cost is less.By connecting smoke sensor to the robot we can get the information related concentration of smoke or gases in respective field like mines and dangerous zones.

VII CONCLUSION

It is concluded that from the report anlysis of the plate, structural steel having compressive yeild strength is less than maximum yeild strength .Plate taking sustainable load according to result of ansys.This project is used to reduce human efforts for clearing blockage operations in the bore well. It performs operations in very less time as compared to traditional methods. Thus, it has been designed keeping the entire obstacle in mind that may arise during the operation.It can do the pipeline inspection which is beyond of human reach.

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