Stress and Strain Analysis of Al Robot ARM

R. Ashok Kumar[1] S.ArunKumar[2] K.Vinothkumar[3]
[1,2,3]Assistant Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]R.M.K College of Engineering and Technology, Chennai

Abstract— The aim of the paper is to design and analysis of inspection robot which used to inspect the weld joints, cracks, and tiny holes in hazardous waste storage tank. The wastes extract from nuclear reactor is collected and stored in storage tank and at certain period it will dispose. So, the tank is monitoring by human beings at regular intervals. The waste is very hazardous to human health. It may affect human beings, so my project is to place robot instead of human beings. Robot is going to design by modeling software and various analyses to be done. Finally the idea is to be given for their future project.

Key words: Vawt, Magnate, Magnetic Levitation, Wind Turbine, Blade hub

I. INTRODUCTION

The science and technology of robotics originated with the spirit of developing mechanical systems which would carry out tasks normally ascribed to human beings. It is quite natural that the main thrust was towards using open-loop serial chains as robot. Such manipulators have the advantage of sweeping workspaces and dexterous maneuverability like the human arm, but their load carrying capacity is rather poor due to cantilever structure. Consequently, the links tends to bend at high load on the one hand, while on the other, to satisfy the strength requirements the links become bulky which leads to Vibration at high speed. Though possessing a large workspace, their precision positioning capability is poor. Hence for applications where high load carrying capacity, good dynamic performance and precise positioning are of paramount importance, it is desirable to have an alternative to conventional serial manipulators. For possible solutions one can look into the biological world and observe that

- The bodies of load carrying animals are more stably supported on multiple in parallel legs compared to the biped human.
- Human beings also use both the arms in co-operation to handle heavy loads.
- For precise work like writing three fingers actuated in parallel are used.

In general, it can be accepted that robot manipulators having the end effector connected to the ground via several chains having actuation in parallel will have greater rigidity and superior positioning capability. Thus makes the attractive for certain applications and the last two decades have witnessed considerable research interest in this direction.

Industrial robots play a central role in factory automation. However, there has been little effort as to the application of application of robots in machining work such as grinding, cutting, milling, drilling etc. This kind of work requires robot manipulators to have high stiffness, rigidity and accuracy.

A. *Types of Robotic Arms:*

There are many different types of robotic arms. The joints and movements of each arm create a different work Envelope. The number of axis is directly related to the maneuverability of a robotic arm.

II. REVOLUTE COORDINATE ROBOT ARM

The revolute coordinate robot arm is very similar to the human arm and it is capable of many of the same motions as a human arm. But the design of the kind of robot is a little bit different from human arm due to the complexity of the human shoulder joint. The shoulder of the revolute robot rotates by spinning the arm at its base. The movement of the shoulder is done by flexing the upper arm member back and forth while the elbow joint moves the forearm up and down. This kind of robot is very flexible and looks somewhat like a human arm.

A. *Polar Coordinate Robot Arm:*

The polar coordinate robot arm is very flexible and can grasp different kinds of objects around the robot. The robot rotates by a turntable base and the elbow joint is the second degree of freedom and moves the forearm up and down. This robot achieves the third degree of freedom by changing the reach of the forearm. The inner forearm has the job of bringing the gripper close or away from the robot.

B. *Cylindrical Coordinate Robot Arm:*

The cylindrical coordinate robot arm has the shape of a robotic forklift. The area which this arm works in is the shape of a thick cylinder. The rotation of the shoulder is done by revolving the base like the polar coordinate system. The forearm of this robot can grasp objects of different heights by moving the forearm up and down the column. The forearm also has a three dimensional work envelope.

C. *Cartesian coordinate Robot Arm:*

The Cartesian coordinate robot arm consists of a carrier belt like track that makes the arm go back and forth. The work envelope of this robot arm is shaped like a box. The forearm of the robot moves up and down along the column and contains an inner arm that can reach both close and far.

III. SPECIFICATION OF STORAGE TANK

Diameter of the storage tank: 12m
Length of the storage tank : 16m

A. *CAD Software:*

AUTODESK INVENTOR is a commercial CAD/CAM package that is widely used in industry for CAD/CAM applications. It is one of the new generations of system that not only offer a full 3-D solid modeller, n in contrast to purely 2-D and surface modellers, but also parametric functionality and full associability. This means that explicit relationships can be established between design variables and changes can be made at any point in the modelling process and the whole model is updated.

B. Assembly Modeling:

1) Enjoy robust, fast assembly modeling performance.
2) Create simplified representations ‘on-the-fly’.
3) Share lightweight, yet fully accurate model representations using the unique Shrink wrap tool.
4) Use Assembly Sense to embed fit, form, and function knowledge to create assemblies quickly and correctly.

C. Assembly View of the Robot:

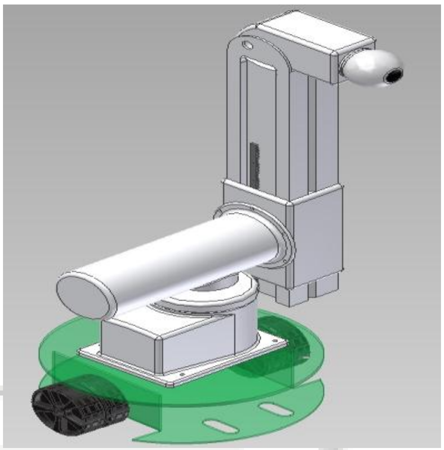

Fig. 1: Assembly View

D. Mechanisms of Robot :

The entire mechanism of the robot as follows

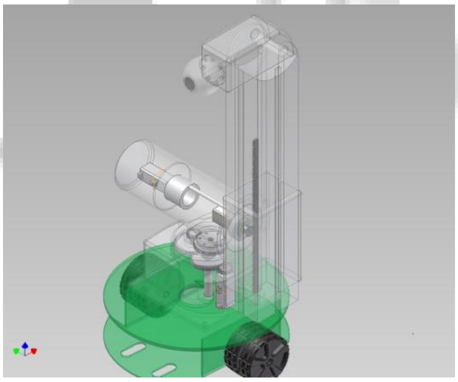

Fig. 2: Mechanism

E. Analysis Part:

1) Base Part Analysis:

The stress strain analysis has been done on the base part of the robot for the pay load.

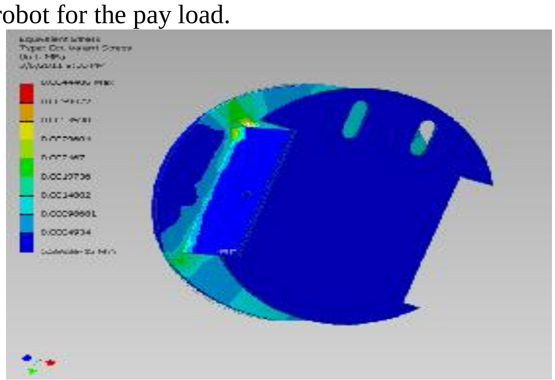

Fig. 3: Base Part Analysis

2) Arm Part Analysis:

The stress strain analysis has been done on the arm part of the robot for the torque.

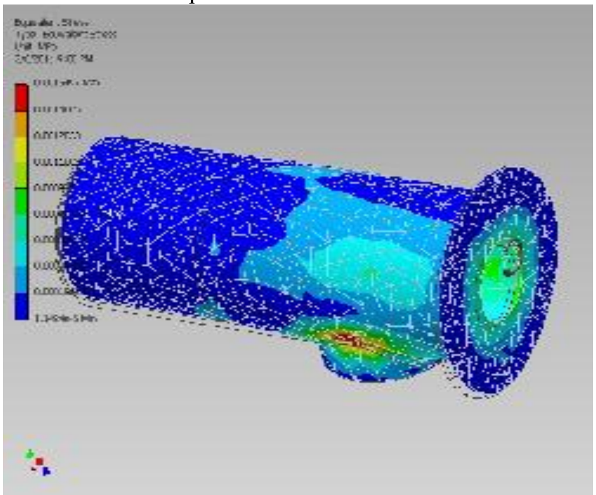

Fig. 4: Arm Part Analysis

3) Slider Part Analysis:

The stress strain analysis has been done on the slider part of the robot for the pay load.

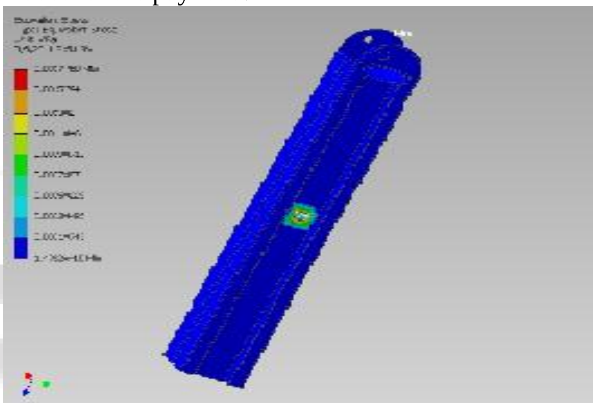

Fig. 5: Slider Part Analysis

IV. CONCLUSION

Thus the model of robot is been design based on coordinate systems, joints and mechanisms and it taken for analysis. Analysis is to be done in second phase and based on analysis the changes required in inspection robot will be modified.

The robot is not to be fabricated only model is to be design. The model should undergo various approval processes and in future.

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