

A Review on Design and Development of Pick and Place Robotic Arm

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Abstract : Modeling of pneumatic robotic arm for automation in two machines, for material handling purpose. Automation is to be done between two machines namely extrusion and belt grinding machine. This is made as per forward and inverse kinematics of robot arm motion. It is necessary to calculate the load carried by arm during its work time. It is commanded to design the pneumatic arm to pick and place the cylindrical object like steel bars. There are so many types of robotic arms works on various power source like pneumatic system, hydraulic system, Servo motor and includes many of basic mechanisms which are costlier for designing a pneumatic arm it requires number of cylinder and pistons and its motion is achieved by using compressed air supply. Robots are invented in industry to do repetitive tasks, to reduce labor cost and to achieve required quality control of process. For pick and place operation the basic requirements of basic arms are high speed and reliability and the robot gripping element should be cheapest and of simple design. The basic operation starts with simple task as gripping, lifting, moving, placing and releasing in single robotic arm system

Keywords: Forward and Inverse Kinematics, Gripping, Modeling, Pick and Place Arm, Pneumatic System

I. Introduction

According to International Standards Organization (ISO) the robot is defined as, "An industrial robot is an automatic, servo controlled, freely programmable, multipurpose manipulator, with several areas for the handling of work pieces, tools or special devices. Variable programmed operations make the execution of multiplicity of tasks possible. "Robot is mechanical device that performs automated tasks and movements have per predefined program yet set of instructions with human supervision. Miserable wretch we are designing robotic arm that is completely functional by pneumatic principle and thus are in designing, manufacturing and machining. When compares to electronic robot this pneumatic robots with simultaneous and sequential pneumatic circuits capable are of programming performing the same task automatically with assistance of even the unskilled worker which in turn reducing the running cost of the machine.

The end effectors of robotic hand can be designed to perform any desired task such have welding, gripping, spinning etc., depending one tea application. For example, robot arms in automotive assembly line perform has variety of tasks such have welding and parts rotation and investment during assembly. In some circumstances, closed emulation of tea human handball is desired, have in robots designed to conduct bomb disarmament and disposal.

Major company steps in robot arm design are kinematics design, dynamics design, thermal design and stiffness design. Structural analysis of models is done in all industries. It might be difficult to the worker whose pick and best something that can place (square) itself so affect mobile robots widely used are in many field of applications such have service (office), military task, hospitals, acidic environment and agriculture (farming).

II. Literature Review

M.Ciancietti, A.Arienti, B.M.Follador, B.Mazzalai, P.dario they get inspired by the Octopus to and make an interesting model in robotics due to its high dexterity, variable stiffness and very complex behavior. In this experiment they study the key features and patterns of movement of Octopus arm and this features and patterns and patterns of movement are that is elongation, shortening, bending and reaching etc. used for guide the movement of actuator. They conclude that the concept proposed for the mechanism at the base of the robotic arm inspired to the Octopus muscular hydrostat where successfully implemented on mock-ups and the corresponding models have been modified and validate.

Ravikumar Mourya, Amit Shelke, Saurabh Satpuite, Sushant Kakade, Monoj Botre have main objective of their project are to design and implement a four DOF pick and place robotic arm. They conclude that the CAD tools like Creo1.0 and Auto CAD are used to model the desire manipulator. To determine the end effectors position and orientation, theoretical analysis of inverse kinematics are carried out. Ansys software is used for FE Analysis.

Prof. S.N.Teli, Akshay Bhalerao, Sagar Ingole, Mahesh Jagadale. This project aims to design and fabricate the pneumatic arm for pick and place of cylindrical objects. They conclude that arm is controlled by manually flow control and direction control valve. Arm rotation and movement is done by pneumatic cylinder using helical slot mechanism. Total arm weight is 25 kg. The model is expected to lift at least 10 kg weight.

S.Premkumar, K.Surya Varman, R.Ballamurgan, Experimental aim is to collaborate the gripper mechanism and vacuum sucker mechanism working in single pick and place robotic arm. These robot can perform tasks like gripping, sucking, lifting, placing, releasing, in a single robotic arm. It will reduced the cycle time, Ideal time, cost of operation, space consumption. It is user friendly and effectively used in glass handling system.

S.C.Gutierrez, R.Zotovic, M.D.Navarra, M.D.Meseguer. Their purpose of work is to manufacture a light weight robot arm with a low cost budget. They conclude that to avoid negative influence on the total weight of the arm, the plastic material reinforced with fiber is used and vacuum infusion man process is used for manufacturing. Local reinforced elements must be included during construction of arm shell. The mast light gear reducer, harmonic drive types are used but because of lack of alignment causes disassembly of gear package to avoid these flexible couplings are required.

Gabrielle J.M. Tuithaf, Just L.Harder. Current robots are not safe for interaction with humans, especially for children therefore safe four DOF robot arm is develop. Firstly, the joint stiffness of arm is brought to zero then the arm is supplied with pneumatic artificial muscles and their stiffness can be adjusted by open loop stiffness control.

M.Pellicciari, G.Berselli, F.Leali, A. Verganana. This paper shows the method for reducing the total energy consumption of pick and placed robotic arm. Firstly, electro mechanical models of both series and parallel manipulators are derived and then by means of constant time scaling, the energy optimal trajectories are calculated. It is seen that blowing down an operation as much as possible is not always beneficial. Energy consumption of given operation as a function of the task execution time. Future work includes improvement of the motor model, development of online programming algorithms.

Mohd Ashiq Kamaril, Yusuff, Reza Ezucin Samin, Babul Salam, Kader Ibrahim, paper presents the development of wireless mobile robot arm. Wireless PS2 controller is used to control the pick and place operation. The development of this robot is based on Arduina Mega Platform. Analysis of speed, distance, load lifted by arm is done to know its performance. This robot expected to overcome the problem such as placing or picking object that is away from the user, pick and place hazardous object fast and easily.

H. Hagenah, W. Bohm, T. Breitsprecher, M. Merklein, S. Wartzack. This paper will show how modern materials as cellular titanium & nano crystalline aluminium can be used to build advanced light weight robot arms. This paper will cover the definition of the product specification, the setting of a basic design and the optimization of this by means of topology optimization. This optimization requires an intelligent modeling to be able to investigate different initial setting and boundary conditions. Different innovative light weight construction materials and the corresponding manufacturing technologies are developing and analyzed.

Mohd Aliff, Shujiro Dohta, Tetsuya Akagi, flexible Hui Li the aim of study is to develop the and light weight actuator and applied into has flexible hose robot arm. In this paper, the Slavic Master's degree height flexible control and the trajectory control of the robot arm are proposed. This robot arm has 3DOF i.e. bending, expanding and contracting and will be applied into has device for human wrist rehabilitation. In this paper the analytical model of year has flexible hose robot arm is proposed for Slavic Master's degree height control in trajectory control.

III. Figures

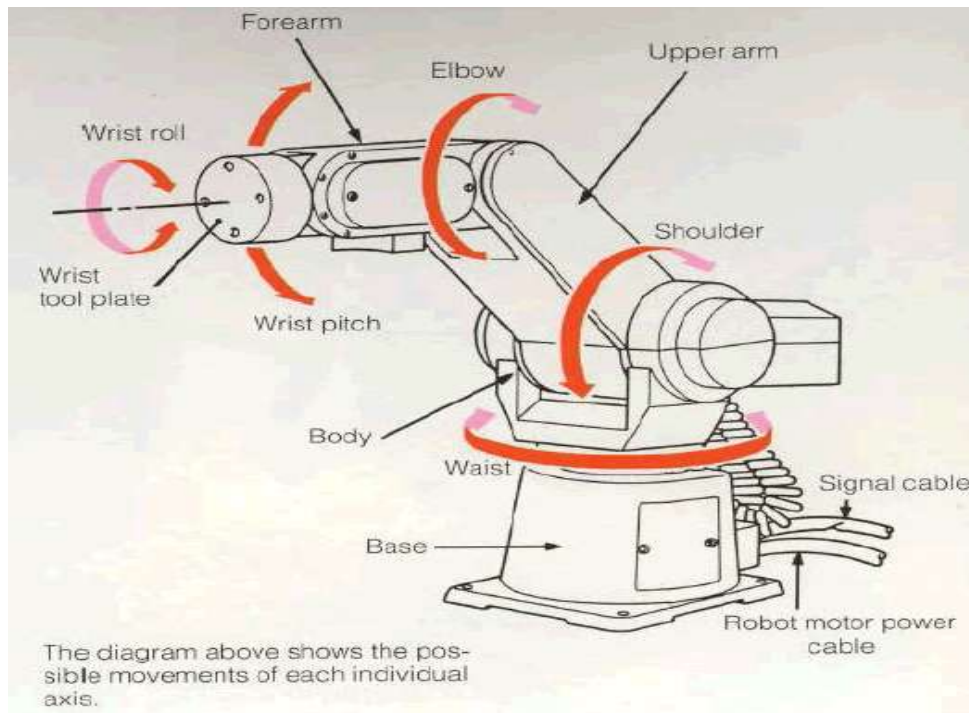
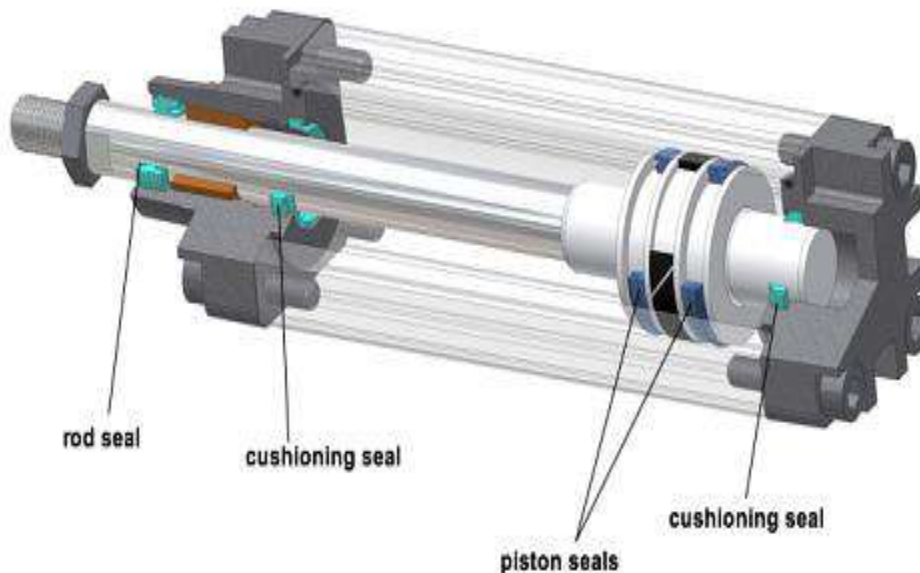


Fig.1 Nomenclature of Robotic Arm

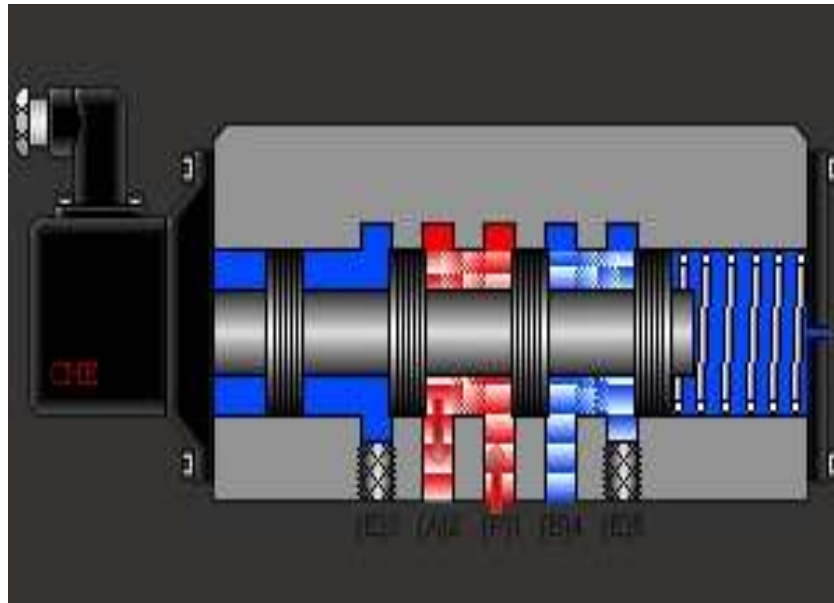
IV. Components of Pneumatic arm

4.1 Pneumatic Cylinder:



Double acting cylinder is considered to be has hand actuator in any pneumatic systems. Double acting cylinders are expensive more than acting cylinders single; purpose double acting cylinders are superior to the single important measure acting cylinders by any other. Are double acting cylinders faster and stronger. In industrial applications, single acting cylinders also used are possible yew, when speed and purpose forces importing are double acting cylinder are employed. Applications include opening and closing doors, taking things off conveyor belts and putting things one to conveyor belts.

4.2 Direction Control Valve:



In 5/2 way direction (management) control valve, from the name itself has 5 ports equally speed and 2 flow positions. It can be used to isolate and simultaneously bypass has passage way for the fluid which for example should retract golden extend has acting cylinder double. There variety of ways to are gaunt this actuated valve. In solenoid valve is commonly used, has rise can be manually golden twist pinch to actuate the valve, the year golden internal external hydraulic golden pneumatic pilot to move the shaft inside, sometimes with has return spring one the other end so it will go original back to its positions when press is gone, yet has combination of any of above mention.

4.3 GRIPPER:

Pneumatic grippers

- Controlled by pneumatic solenoid valves, pressure cylinders

The diagram illustrates the internal mechanism of a pneumatic gripper. It shows a rack and pinion system where linear motion from a piston is converted into rotating motion. Labels include 'Linear Motion', '(rack)', 'Rotating Motion (pinion)', 'pushes piston', and 'pneumatic supply'. On the right, two views of the gripper show the jaws opening and closing, with blue arrows indicating the direction of movement.

Gripper is a device which involves parallel or angular motion of surface. It is provided with the jaws to pick and place the objects. The air is provided to produce the grasping force. Gripper is capable of lifting very small object as well as large objects like engine blocks of vehicles.

V. Conclusion

Pick and place robotic arm can reduce the human efforts by automatic handling of material, an automatic, servo controlled, freely programmable, multipurpose manipulator, with several areas for the handling of work pieces, tools or special devices. By using modern materials as cellular titanium & nano crystalline aluminium, a light weight robotic arm can be manufacture.

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