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Upgradation of Milling Machine Using Servo Drive

M. Gowri Shankar[1], S. Prasanth[2], R. Venkatesh[3]

[1]Assistant Professor, Department of Electronics & Instrumentation Engineering, Adhiyamaan College of Engineering (Autonomous), Dr. M. G. R. Nagar, Hosur, Tamil Nadu, India

[2-3]Student, Department of Electronics & Instrumentation Engineering, Adhiyamaan College of Engineering (Autonomous), Dr. M. G. R. Nagar, Hosur, Tamil Nadu, India

ABSTRACT

This project is about Servo drive upgradation from Rexroth DKC01.3-FW to Mitsubishi MR-J4-700B4 in H-series cylinder head LA8290 milling machine bay-1 in shop 5. Milling machine is used in the line for milling inlet manifold of Cylinder head. This machine contains Component fixing fixture, Hydraulic power pack, controlled by servo rapid. These elements are in-turn controlled by servo drive of Mitsubishi make, of model: MR-J4. This up gradation is done because of obsolescence of Rexroth DKC01.3 Servo drive. Mitsubishi Servo drive of model: MR-J4-700B4 is more populated in the shop for various machines, this Servo drive is wiser and user friendly than Rexroth DKC01.3, so we have planned to upgrade to model Mitsubishi MR-J4-700B4. This Servo drive is having more advantages than Rexroth DKC01.3, some of the advantages are it is highly reliable, extremely user and maintenance friendly, modularized Input units. It combines high performance to meet complex requirement, versatile communication facility to integrate intelligent device.

Keywords : Milling Machine, Servo Drive

I. INTRODUCTION

A servo drive could be a special electronic amplifier used to power electric servomechanisms. A servo drive monitors the feedback signal from the servomechanism and continually adjusts the servo rapid . A servo drive receives a command and feed back signal from an effect system, amplifies the signal, and transmits current to a servo motor so as to provide motion proportional to the command signal.2-axis and 3-axis servo drives are available for operating two and three servo motors, respectively. These servo drive enable energy-conservative, compact machine at low cost. differing kinds of servo motors including rotary servo motors, linear servo motors, and direct drive servo motors are freely combined as long because the servo motors are compatible with the servo drive.

The servo drives are communicates with the plc using RS232 communication cable. The servo drives control the speed of the servo motors in line with the required speed within the plc programmed memory. MR-J4 servo drive manufactured by the mitsubishi company is used in this project.

Drives used in an automatic system or in milling system are differing types like electrical, hydraulic or pneumatic. Electrical drives These are Direct current or Alternating current servo motors. they're small in size and easy to manage. Hydraulic drives These drives have large power to size ratio and supply

stepless motion with great accuracy. But these are difficult to keep up and are bulky. Generally they employ petroleum based hydraulic oil which can have fire hazards at upper level of working temperatures. Also hydraulic elements need special treatment to shield them against corrosion. Pneumatic drives This drives use air as working medium which is out there in abundant and is fire proof. they're simple in construction and are cheaper. However these drives generate low power, have less positioning accuracy and are noisy.

In this servo drive, usually AC, DC, servo and stepper electrical drives are used. the varied drives employed in milling machines will be classified as Spindle drives to supply the most spindle power for cutting action

II. BLOCK DIAGRAM

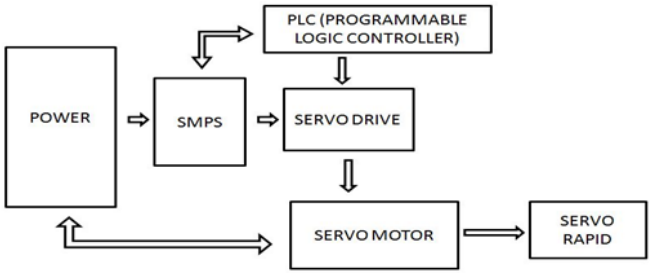

Fig. 1 Block Diagram

III. DESCRIPTION

Milling is the machining process of using rotary cutters to remove material from a H-series cylinder head in inlet manifold for cylinder head by advancing the cutter into the work-piece at a certain direction. The cutter may also be held at an angle relative to the x axis of the tool. Milling covers a wide variety of different operations and machines, on scales from large individual parts , heavy-duty gang milling operations. It is one of the most commonly used processes for milling machining custom parts to precise tolerances. Typical milling operations are:

Plain milling is the milling of a flat surface with the axis of the milling cutter parallel to the machining surface.

End Milling is the milling of a flat surface with the axis of the milling cutter perpendicular to the machining surface Gang milling is a vertical milling operation that utilizes three or more milling cutters grouped together for the milling machin of a complex surface in one pass Straddle milling a group of spacers is mounted in between one side and face side of milling cutters on the spindle motor.

The objectives of the design are i) obtain a complete automated milling machine. ii) Design the control panel considering all the possible constraints using PLC and servo drive. iii) Achieve sequential flow of servo rapid. iv) For easy back up support for maintenance and cost effective.

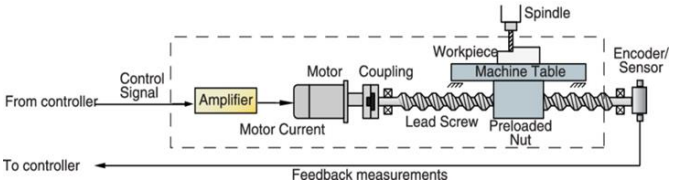

Fig.2 Typical milling machine

From this block diagram it is explained as, three phase supply is given transformers for the required voltage level then it is given to MCB's, contactors and AC line filter for protection, then it is given to power supply module. PSM is connected in series with spindle and servo drive for power maintenance.

MR-J4-B Servo Motors are connected to servo drives for the controlling; feedback is taken from motor to sevo drive for its actual speed and position of the servo rapid, depending upon the inputs given to PLC MITSUBISHI FX5U, Motor speed and position will control according to the inputs given and actual

measurements. Along with this sensors and limit switches signals will also control the milling machine movements.

Major components required for automation are PLC(Programmable logic controller) MITSUBISHI FX5U, Servo Motor Drive MITSUBISHI MR-J4-700B4, Proximity sensors, solenoids, Computer Numeric Control, and Limit switches. Four servomotors are connected to the Servo drives for the axis movements X axis. One spindle motor is connected to the spindle drive for the milling cutter rotation. Power Supply Module (PSM) is required to proper maintaining the power to the servo and spindle drives. PSM is connected in series with the spindle drive and servo drives. Working of Drives and motors is based on the signal obtained from Programmable logic controller. The inputs to PLC are signals from sensors. Push buttons are for start and stop operation. In Milling machin is for the communication of the machine with outside world. HMI has LCD screen which helps to display the ongoing operation and to even give input for different operations. The sequence to run the machine is done in two ways manual mode and auto mode. In manual mode all the movements take place one after the other in an order second method is based on the auto mode given by the operator. One or more movements take place according to the choice of operator which can also be called as conditional flow of movements.

The milling machine controlling is done by using the PLC part programming starts from analysis of the applications, distance has to move from initial homing position to final end point. Along with that depth of cutting, speed of the spindle (milling cutter) and type of the milling head. Final point of control is by checking the completed job. Below is the controlling methodology of the whole system. The following are the steps of controlling process Control panel is designed for the milling process mainly consists of Programmable Logic Controller, Servo drives , Spindle drive, Power Supply Module.

Servo drive, relay boards, SMPS (switched mode power supply), MCB's, Contactors and MPCB's etc. These components are assembled and wired and are further connected to the Milling machine. the connection between the control Panel and milling machine.

The milling machine and the control panel that is to be designed. The proximity sensors and limitswitches are inputs to PLC. The position of different movements whether at home position or at end position is given to programmable logic controller through these sensors. As per the programming done, actuating output signals are given to servo drive feed to servo motors and Spindle motors, which results in the movement of the x axis in the direction given by the operator. Here the servo drives are operating on constant v/f ratio. So here Power Supply Module controlling the power given to the drives intern controls the speed of the motors. i.e., on actuation of axis drives. Here X axis is for movement of vertical direction, for the rotation of the work-piece on the work table and Spindle drive for controlling the speed of the milling cutter according to the depth of the cutting. The interfacing between the PLC makes it easy to operate the machine in required directions manual mode or in auto mode.

IV. CIRCUIT DIAGRAM

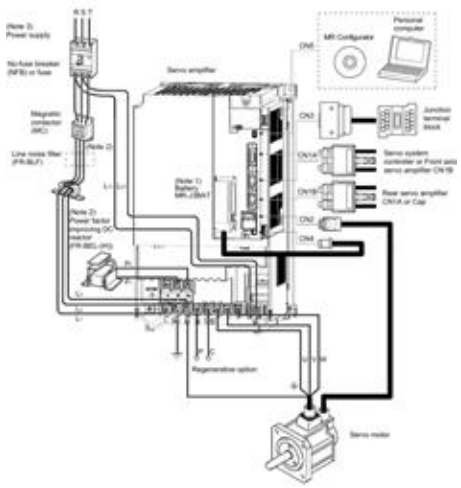

Fig 3. Circuit Diagram

Using this servo drive the run time of the servo rapid can be reduced and high reliability of the machine can be ensured.

V. RESULTS

Fig 4. Result

By using the MITSUBISHI MR-J4-700B4 servo drive.used to reduce power consumption and we can connect number of servo drive than Rexroth servo drive. We can also implement the reliability of the machine.

VI. CONCLUSION

Our project is about servo drive upgradation from REXROTH DKC01.3-100-7-FW to MITSUBISHI MR-J4-700B4 in LA8290 milling Machine. This project is taken because of obsolescence REXROTH DKC01.3-100-7-FW, So we have gone for replacing MITSUBISHI MR-J4-700B4. These have various advantage of REXROTH DKC01.3 Over MR-J4-700B4. Some of advantages are isolated power supply, CPU Module, Input Module, Output Module. Individual modules can be diagnosed and replace. By this project we are Aspiring MTTR (Mean Time To Repair) From 12hours to 1hour. MTBF (Mean Time Between Failure) from 36 hours to 480 hours and reliable machine.

VII. FUTURE WORKS

In future manual work done in machin can be reduce by fully automated control assembly line and increase the production rate of machine.

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