

PLC Based Milling Machine Operations

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ABSTRACT

A programmable logic controller, PLC or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory. Milling machines were first invented and developed by Eli Whitney to mass produce interchangeable musket parts. Although crude, these machines assisted man in maintaining accuracy and uniformity while duplicating parts that could not be manufactured with the use of a file. Development and improvements of the milling machine and components continued, which resulted in the manufacturing of heavier arbors and high speed steel and carbide cutters. These components allowed the operator to remove metal faster, and with more accuracy, than previous machines. Variations of milling machines were also developed to perform special milling operations. During this era, computerized machines have been developed to alleviate errors and provide better quality in the finished product.

Keywords: PLC, Milling Machine, VFD Driver, Relay, SMPS, Spindle Motor, R/F Feed.

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I. INTRODUCTION

A programmable logic controller, PLC or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory. Milling machines were first invented and developed by Eli Whitney to mass produce interchangeable musket parts. Although crude, these machines assisted man in maintaining accuracy and uniformity while duplicating parts that could not be manufactured with the use of a file. Development and improvements of the milling machine and components continued, which resulted in the manufacturing of heavier arbors and high speed steel and carbide cutters. These components allowed the operator to remove metal faster, and with more accuracy, than previous machines. Variations of milling machines were also developed to perform special milling operations. During this era, computerized machines have been developed to alleviate errors and provide better quality in the finished product.

Necessity:

- It is used in many machines, in many industries.
- It is designed for multiple arrangements of digital and analog inputs and outputs, extended

temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

- Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory.
- The milling machine is one of the most versatile Metal working machines in a shop.
- It is capable of performing simple operations, such as milling a flat surface or drilling a hole, or more complex operations, such as milling helical gear teeth.

Objective:

- The aim is to design a PLC and Milling Machine operations.
- The system is automatically based on pre-programmed timings.
- A PC interface is provided for easy programming of the hardware.

Theme:

- Basic theme of project is performing milling operations using PLC. Following keywords are on which we are working in our project:
- Milling Machine, PLC, SMPS, VFD drive, Spindle motor, Wind LDR software.

Problem Statement:

Our basic problem definition is the implementation of milling machine operations automatically by using PLC to complete required amount of product with 100% efficiency within minimum period of time.

The purpose of this work is to increase the quantity and quality of the products with the help of PLC as compared to manual milling machine as it is taking maximum time to perform this desired operations.

II. LITERATURE REVIEW

1. Osamu Maeda, Yuzhong Cao, Yusuf Altintas Manufacturing Automation Laboratory, Department of Mechanical Engineering, University of British Columbia, 5 October 2004. "International Journal of Machine Tools & Manufacture 45 Expert spindle design system"

This paper presents a general, integrated model of the spindle bearing and machine tool system, consisting of a rotating shaft, tool holder, angular contact ball bearings, housing, and the machine tool mounting. The model allows virtual cutting of a work material with the numerical model of the spindle during the design stage. The proposed model predicts bearing stiffness, mode shapes, frequency response function (FRF), static and dynamic deflections along the cutter and spindle shaft, as well as contact forces on the bearings with simulated cutting forces before physically building and testing the spindles. The proposed models are verified experimentally by conducting comprehensive tests on an instrumented-industrial spindle. The study shows that the accuracy of predicting the performance of the spindles require integrated modeling of all spindle elements and mounting on the machine tool. The operating conditions of the spindle, such as bearing preload, spindle speeds, cutting conditions and work material properties affect the frequency and amplitude of vibrations during machining.

2. Richa Netto, Aditya Bigari Thadomal Shahani Engineering College, Mumbai University Bandra, Mumbai - 400050 Maharashtra, India September 2013 "International Journal of Computer Applications Programmable Logic Controllers"

The analysis carried out in this technical paper highlights the concepts, working, advantages and practical applications of programmable logic controllers, along with a comparison with other control systems. A PLC aids in automation of a process by monitoring inputs and controlling outputs after making a decision on the basis of its program. It is commonly used for controlling many mechanical movements of heavy machinery and to control the voltage and frequency of power supplies. PLCs offer an array of advantages over other control systems, and have

hence evolved as an important controller in industries these days owing to its large number of applications.

III. PROPOSED SYSTEM**Block diagram description:****Limit Switch:**

A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator the device operates the contacts to make or break an electrical connection.

R/F Feed:

Reverse Forward Feed is used for forwarding and reversing the particular object.

PLC:

A programmable logic controller, PLC, or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many machines, in many industries. PLCs are designed for multiple arrangements of digital and analog inputs and outputs, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

Before the PLC, control, sequencing, and safety interlock logic for manufacturing automobiles was mainly composed of relays, cam timers, drum sequencers, and dedicated closed-loop controllers. Since these could number in the hundreds or even thousands, the process for updating such facilities for the yearly model change-over was very time consuming and expensive, as electricians needed to individually rewire the relays to change their operational characteristics.

Advantages of PLC:

- Flexible
- Faster response time
- Modular design easy to repair and expand
- Handles much more complications

Relay:

A relay is an electrically operated switch, used where it is necessary to control a circuit by a low power signal or where several circuits must be controlled by one signal.

SMPS:

A switched mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like a main power to load.

VFD Drive:

Variable Frequency Drive is a type of motor controller that drives an electric motor by varying the frequency and voltage supplied to the electric motor.

Load:

An electrical load is a portion of a circuit that consumes electric power. It affects the performance of the circuit with respect to output voltage or current such as sensors, voltage sources and amplifiers.

Spindle:

The spindle holds and drives the various cutting tools. It is a shaft, mounted on bearings supported by the column. The spindle is driven by an electric motor through a train of gears, all mounted within the column. The front end of the spindle, which is near the table, has an internal taper machined on it.

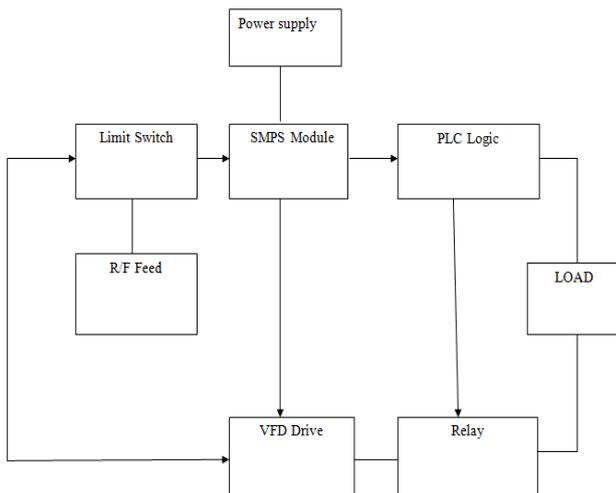


Fig 1. Block diagram of PLC Based Milling Machine

IV. ADVANTAGES AND APPLICATION**Advantages:**

- 1) Very accurate & simple structure.
- 2) Human safety.
- 3) Time consumption.
- 4) More secure.
- 5) Production cost increases.
- 6) Efficiency is 100%.

Applications:

- 1) Easy to produce product, so market value increases.
- 2) Automatic work will be done so man power requirement is less.
- 3) Machine value is greater.

V. CONCLUSION

In this paper, we discussed about Milling Machine operations with the help of PLC. We know that there are many functions can be done with the help of PLC because of using PLC, machine works are very fast and time consuming as compared to manual work. In addition, if giving other some input data as a reference then accuracy of results is also increases and as compared to other methods.

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