Review on Real Time Control of Feed of Milling Machine for Machining Operations

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Abtract: *Nowadays, Milling machine is very useful in various applications for giving the desired shape to product from raw material in various industries by doing different operations like cutting, turning etc. At present, CNC (Computer Numeric Control) takes the position of conventional Milling machine, which is very costly as compare to conventional machine. Little modification can make the conventional machine into semi-automatic which can work very similar like CNC machine. By doing retrofitting, conventional horizontal milling machine convert into semi-automatic milling machine. In this project, we used variable frequency drive, a microcontroller, actuator which can control the speed of feed of Horizontal Milling Machine and made a semi-automatic. In this we give input in the form of speed with the help of computer or mobile phone through the IOT (Internet of Things) platform.*

Keywords: *CNC, Internet of Things, Retrofitting, Microcontroller, Variable frequency Drive, Milling Machine*

1.1 INTRODUCTION

Milling Machine is used to remove the excess metal from the workpiece and gives the desired shape to the workpiece by controlling the parameters like feed, spindle speed and depth of cut. It is one of the oldest and made a space in every manufacturing industry. It is three axis machine which can operate manually. In milling machine, workpiece is hold at the worktable at any position by fixture and cutter is held at any orientation of spindle i.e vertical or horizontal. But the working principles of milling machine remain the same. Now the context has changed, industries can upgrade themselves for surviving for long period in the around atmosphere. So they can replace conventional machines into modern machines which can ease their work and have more productivity and efficiency. In horizontal milling machine, the cutting force direction is upwards so due to this it tends to lift off the job from the worktable whereas in cutting force direction is downward in down milling, it press the workpiece.

Fig 1. Horizontal Milling Machine

1.2 TABLE TYPES OF MILLING OPERATION

Up Milling	Down Milling
In up milling, cutter rotates against the direction of table feed.	In this process, the direction of cutter is along the table feed
Chip load on teeth increases gradually from zero at the point of engagement to maximum at the point of disengagement.	Chip load on teeth gradually reducing from maximum at the point of engagement to zero at disengagement.
Thin workpiece samples in up milling may get distorted.	Distortion chances of thin workpiece in down milling is less then up milling
Heat generation is high due to buildup edge which can enhance the chances of chip welding	Chances are less but quality of finish surfaces degraded.
In horizontal milling machine, the cutting force direction is upwards so due to this it tends to lift off the job from the worktable.	Cutting force direction is downward in down milling, it press the workpiece .

1.3 WORKING PRINCIPLE OF MILLING MACHINE

The workpiece is held on the worktable of the milling machine. The feed of workpiece is control by the table movement against the rotating cutter. The cutter is mounted on a spindle or arbor and revolves at fixed speed. Spindle can rotate in two direction either forward or reverse, according to what kind of machining required for operation either up milling or down milling. As the workpiece moves, the teeth of cutter remove the metal from the surface of workpiece and the desired shape is obtained.

1.4 RETROFITTING

Retrofitting is defined as the process in which some modifications has been done in the existing machine with the help new technology. By doing retrofitting, we can enhance the life of conventional machine so that their efficiency and accuracy would also increase.

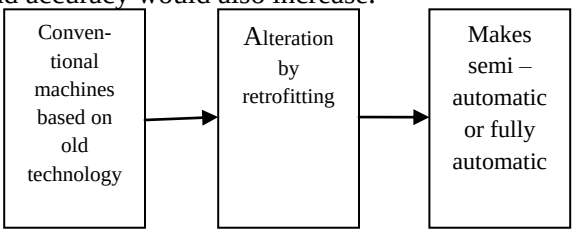

Fig 2. Flow Diagram for retrofitting

1.5 OBJECTIVES OF RETROFITTING OF EXISTING MACHINE

- Accuracy will increase.
- Machining time reduced.
- Operating cost also reduced.
- Productivity increase and more control on machine.
- Both skilled and unskilled operator can operate.
- Machine life will enhanced.
- Can do operation at any motion and speed.
- Cost effective as compare to CNC.

1.6 DIFFERENT COMPONENTS USED FOR UPGRADATION OF MACHINES

(a) VARIABLE FREQUENCY DRIVE

Variable Frequency Drive is electronic device used to handle the dynamic attributes of an electric motor dependent on the demand of the load. VFDs control the fundamental parametes of engine, the frequency and speed to control the optional attributes like motion and torque. To

determine the speed of motor in RPM then follow equation no. 1 given below:

$$N=120*f/P \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where, N=speed in RPM

f=Frequency in Hertz

P= No. of poles of electric motor

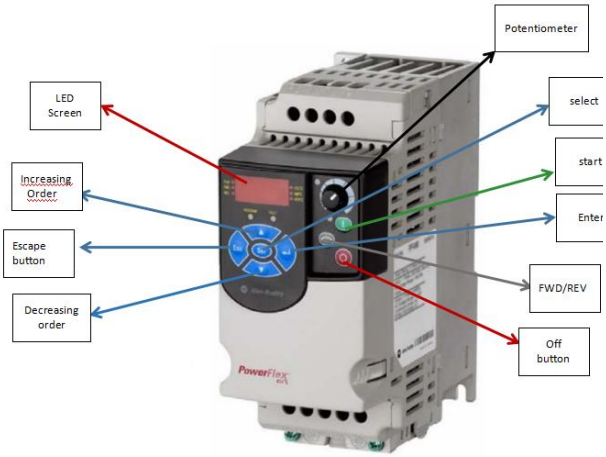

Fig 3.Variable Frequency Drive

(b) ACTUATORS

A variety of actuators such as fluid power actuator, servomotor, stepper motor, may be used to operate the cross-slide system. A suitable actuator will be selected based upon various factors such as torque and resolution requirements as well as ease of interfacing with microcontroller selected for controlling the system.

(c)CONTROLLER, SENSORS AND ACCESSORIES

A microcontroller, digital display, keypad, actuator driver circuits, sensors, couplings etc. will be selected for making the system operational.

(d) IOT (INTERNET OF THINGS) PLATFORM

Internet of Things is now taking place rapidly in every industries so that they can monitor at any time. The aim of IOT is to connect each and everything is in industry to the internet so that they can monitor the data. By IOT you can save and send data to cloud and operate with mobile, laptop or other device which is connected to internet.

Fig 4 Feed control system on milling machine

2. LITERATURE REVIEW

Paper on modification of machines

Parmar et al. 2014 [1], discussed that creating mechanization in regular machine by retrofitting stepper based strategy, the machine fills in as CNC coach for educating, learning of the understudy subject. Additionally Cost of machine is limits surmised multiple times underneath the first CNC mentor. As mechanization new created retrofitted machine is finished by supplanting or expelling the parts from traditional machine, subsequently arrangement cost is high as contrast and standard machine yet creation rate is an excess of high. So it is helpful for large scale manufacturing. The exactness of the activity made in retrofitted machine is additionally high so repeatability and dimensional soundness of fabricated part is accomplished. Finally a few complex employment which isn't fabricated in traditional machine can be fabricated in new created retrofitted machine.

Parkash et al 2014 [2], convert manual machine into semi robotized machine with the assistance of substitution and expansion of certain parts. they built up a semi automatic lathe machine dependent on stepper technique. In this project

they automated 5ft bed long manual lathe machine into semi automatic milling by keeping three portions (mechanical, pressure driven and electronic) in their brain. They replace the ball screw instead of lead screw an additional plate are supplanted and some require parts like engine, additional plate ,lead screw, hydraulic circuit included the arrangement cost expanded in examination of standard machine. this set up is valuable for large scale manufacturing as the creation rate is high.

Veeranjaneyulu and Hari babu 2012 [3] concentrated on the examination and structuring of gear in the gearbox framework when they moved force at various rates. The most part the gear box made by the cast iron and cast steel materials however they fabricated the gear box by aluminum with the goal that the weight will decrease all the pressure and displacement analysed by COSMOS programming which is a part of solid works. the heaviness of the aluminum decreased to three times in regard of combination steel, with the goal that the mechanical effectiveness will increment.

Swami and Kumar 2012 [4], utilized a bed for examination of dynamic burden and static burden. they diminished the heaviness of the bed without trading off its auxiliary characteristics like inflexibility and exactness .they use CATIA programming for 3D displaying with the assistance of HYPERMESH. They investigated it with the assistance of ANSYS programming. by doing this they decreased the heaviness of the bed structure upto 16.1kg which diminished the manufacturing cost of the machine.

Pagar et al. 2016 [5], convert manual lathe machine into semi-automatic control milling machine by replacing and included a few sections. In the improvement and transformation into the semi mechanized control lathe machine,the researchers kept three portions in their psyche which is required ; these were mechanical, hydraulic and electronic. An additional plate utilized for introducing servo motor . In part of mechanical aspect, some unused parts like gears were expelled for introducing servo motor. In electronic possibility they included a servo engine for giving a controller to the viable activity in both the axes Z and X.

Kumara and Mohan Ram 2014 [6], redefined the design of fixture of lathe machine used for brake drum. We all know fixture is used to hold the workpiece and also it locate the work piece and fixture did not guide the tool. there are a few issues like zero gap and button utilized and so on with the goal that it is hard to machine the bore of brake drum. So they design the fixture with pad instead of button and give space/hole so the instrument moved unreservedly inside the brake drum . In structure and assembling of machine apparatus they utilize mild steel having standard ISO 9001. By doing this new installation of machine it is progressively agreeable to run this and it will decrease fatique of operator just as machine bed. The pad thickness further decreased with the goal that balancing is high.

Paper on control speed of motor

Vishv Mohan 2013 [7] this paper shows the results at the point when power transmission and appropriation has been done at lower frequencies then this condition is good for rationing the energy. VFDs help to make power transmission at low recurrence so the energy saved from losing because of transmission and force circulation. There are different advantages of utilizing VFDs like force saving, decrease of wear and of the engine.

Lingawar and Ingale 2013 [8] this research paper proposes another idea for controlling the speed of the three phase induction motor by utilizing variable frequency drive. The feedback gadget is utilized for giving the input to the drive to control the speed of engine. In this project the current DC arrangement of batching loom framework was replaced by AC framework. The starting sequence and load for main motor drive was formulated by variable frequency derive and a reference was produced for speed. The speed of the three phase induction motor was controlled with in cutoff by the reference which was produced with the feedback system. This work helps in the business for decrease in the breakdowns, diminish the expense of support, work cost and furthermore it builds the capacity.

Shrike et al. 2013 [9] in this work the researcher made headway with the use of semiconductor technology with the help of microcontroller for controlling the speed of induction motor easier. The variable frequency adjusted the user expound value of speed of the induction motor. The authentic speed and mentioned speed was equated and the dissimilarities were altered by modifying the ejecting angles of IGBTs (Insulated Gate Bipolar Transistor).

M. Deepa 2015 [10] this paper highlighted that the controlling speed of a three phase induction motor by connecting variable frequency drive. As we know the energy saving is very important factor , so the variable frequency drive was with PWM (Pulse Width Modulation) method for control of motors. It leads to the best performance and high efficiency of the induction motor. In the manufacturing industries where the motor and pumps are used where we modify the system by using V/F method for saving energy. With this we use timers for higher safety and safe guarding measure in opposition to sudden jerk in voltage and current also.

3. CONCLUSIONS

The following conclusions are drawn after reviewing the above mentioned literature:

1. By doing small changes or modification in design we can change the conventional milling machine into semi-automatic milling machine and increase the production rate with high accuracy and repeatability.
2. Setup cost and machining time improve.
3. Retrofitting convert old conventional machine and it also increase the life and efficiency of machine. In case of milling efficiency will increase so that the replacement of the milling machine will reduce.

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