



Overview of the Performance Enhancement of the Automatic Gear Finishing Machine

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ABSTRACT: Gearing is one of the most critical components in mechanical power transmission systems. The transfer of power between gears takes place at the contact between the mating teeth. During operation, meshed gears' teeth flanks are submitted to high contact pressures and due to the repeated stresses, damage on the teeth flanks, in addition to tooth breakage at the root of the tooth are one of the most frequent causes of gear failure. This happens because of poor finishing and deburring process.

The gear finishing machine is the main gear processing equipment, which is used to manufacture large volumes and high efficiency production of spur and helical gears. Now question comes when there is need to manufacture variable transmission ratio of gears, at that time we need frequently to produce and replace the driving change gears, which bring inconvenience for the industry. And here we are introducing automatic gear finishing machine using PLC.

KEYWORDS: gear finishing, deburring, PLC

I. INTRODUCTION

Recently every manufacturing industry is very much conscious about improvement in equipment performance and in this techno part computerized Numerical Control Technology is playing most important role. It is not economic for industry to install in machine at a time they have old machine so that retrofitting is useful. Retrofitting refers to the addition of new technology or features to older systems this definition gives an almost all information about the word retrofitting. When we say that retrofitting related to some component that mean we try to upgrade that component and improve their efficacy through a present technology. Rebuilding and remanufacturing typically include a CNC retrofit. The anticipated benefits include a lower cost investment than purchasing a new machine and an improvement in uptime and availability. But there are often other unanticipated benefits to retrofitting including lower energy costs, higher performance and a new level of manufacturing data accessibility.

II. EXISTING SYSTEM

The transmission machine is nothing but the basic hobbing machine as shown above. Generally the induction motor is used in the conventional operation. The conventional method to control the system is mechanical in this system and hence it is not so accurate.

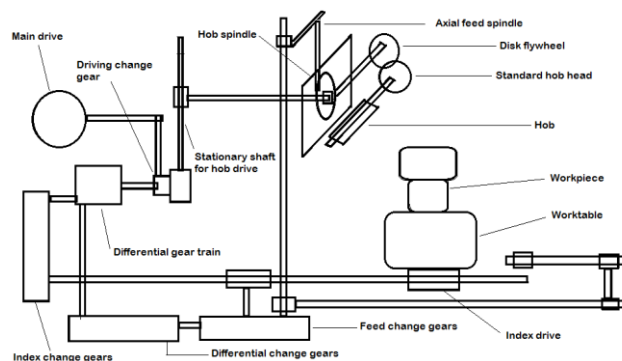


Fig.1: Basics of transmission principle

III. PROPOSED SYSTEM

Authors have proposed the system with software and hardware interface for the operations to be performed during the process of manufacturing the gears.

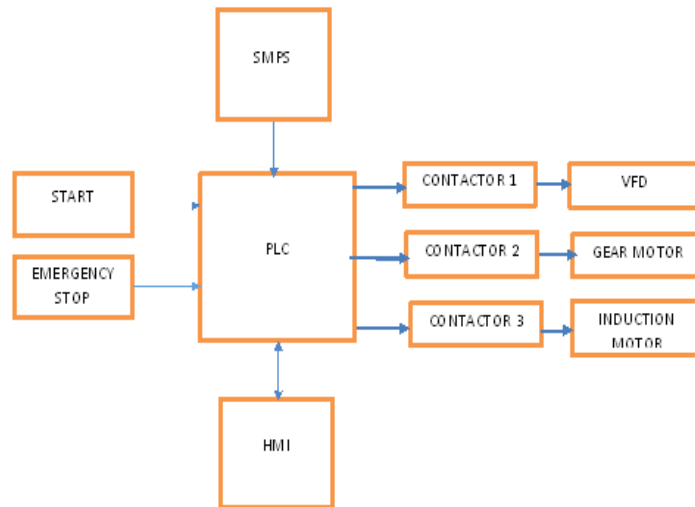


Fig.2: Proposed System for the gear hobbing

The above system shows the complete operation with the control from the PLC unit. Generally the system can be divided in to two parts like hardware and the software structure. The servomotors can be used to control the motion. These are mainly used to control the hob and depth. The PLC and the programming software are needed to control the servomotor operations. The program must be adequate to perform the operations as expected. The major parts of the system are as follows:

a) HMI:

The human machine interface is one of the important part of the system. It is useful for real time data acquisition, display and providing the commands to control the operation.

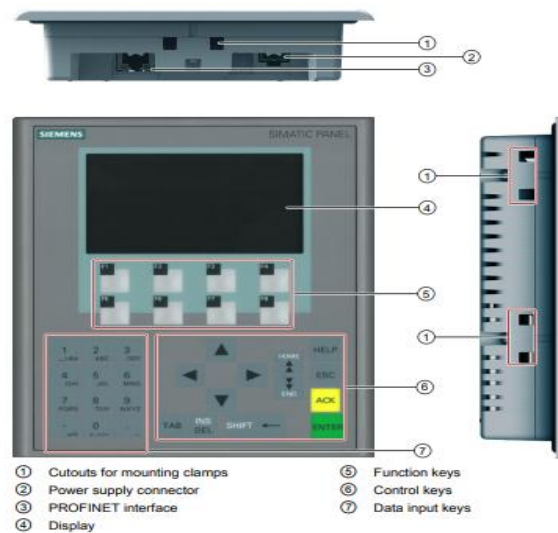


Fig.3: Human machine interface for the proposed system.

b) PLC

The heart of the control system in the proposed system is PLC. It controls the operations very accurately. The can sense, control, store, process the data for performing the operation.



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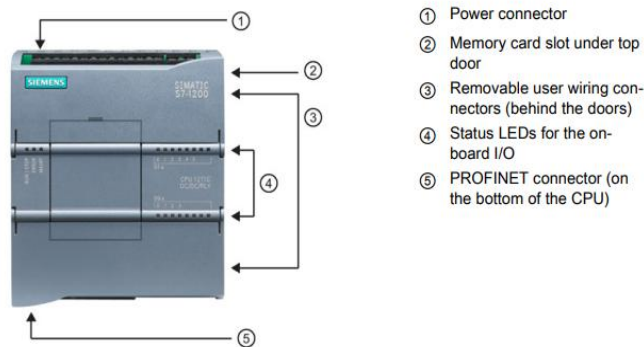


Fig 4: S7-1200 PLC

c) VFD (Variable Frequency Drive):

A 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. Other names for a VFD are variable speed drive, adjustable speed drive, adjustable frequency drive, AC drive, Microdrive, and inverter.

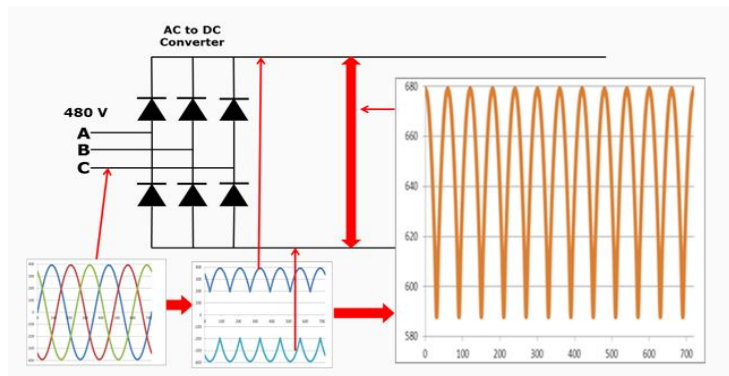


Fig 4: working principle of VFD

d) Gear motor:

A gear motor is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications, and are probably used in many devices in your home.

Gear motors are commonly used in devices such as can openers, garage door openers, washing machine time control knobs, and even electric alarm clocks. Common commercial applications of a gear motor include hospital beds, commercial jacks, and cranes. Regardless of what type of gear motor you're dealing with, they all work in the same manner.



Fig 5: Gear motor

e) Induction motor:

A motor with only armature windings is called an induction motor. An induction motor is the most modest electrical machine from constructional point of view, in the majority of the cases. Induction motor works on the principle of induction where electro-magnetic field is induced into the rotor when rotating magnetic field of stator cuts the stationary rotor. Induction machines are by far the most common type of motor used in industrial, commercial or residential settings. It is a three phase AC motor.

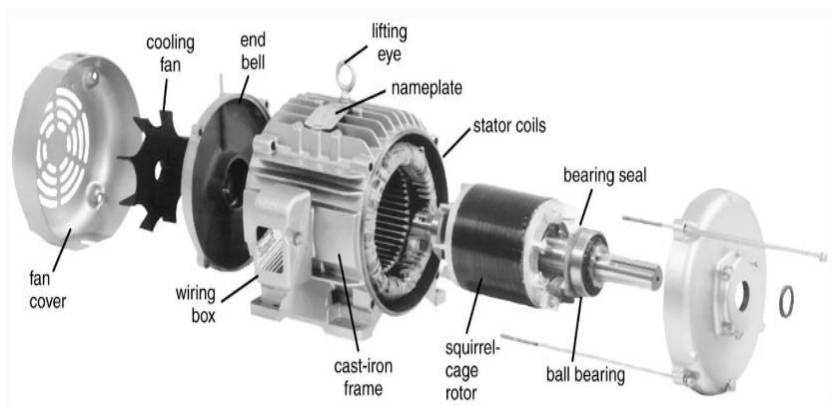


Fig 6: induction motor

IV. EXPERIMENTAL SETUP AND WORKING

Smart gear finishing machine starts working when we push start button. Then we select manual or automatic operation by using touch panel on HMI that is Human machine interface. Machine starts working as we put job on table where brushing of the gear starts with use of motors in vertical and horizontal axis. Job is in continuous rotation with the help of servo motor so all tooth of gear can be processed. PLC controller is used for automation purpose so that manual operations are less.



Fig 7: Smart gear finishing machine by Expert integrated solutions Ltd

V. PRINCIPLE OF GEAR FINISHING MACHINE IN INDUSTRY

The gear finishing machine was originally a standard mechanical transmission machine. Machine includes hob spindle, disk regulator, commonplace hob head, work table, modification gears, hydraulic driving and cooling system, electrical system and so on. It drives by one main motor, with all motions of the machine, like rotation of the hob and work table achieved by exploitation mechanical modification gears and corresponding index ratios.



Fig 8: Super gear produced by gear finishing machine

VI. CONCLUSION

The control is going to play a vital role in improvement of the system performance. Authors have presented the overview of the implementation of the gear hobbing process with the accurate control by PLC and numerical control. The system not only useful for the performance improvement but also improves upon the several factors like the life span, efficiency, accuracy and ease of operation.

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