Development Of Involute Gear Error Detector

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ABSTRACT

This project work titled" INVOLUTE GEAR PROFILE ERROR DETECTOR BY USING DIAL GAUGE "The aim of the project is to check the error detection by applying the basic principle of involute generation. Usually when the gears have any defects it produces more vibration. In order to rectify the vibration we have planned to design and fabricate the involute gear profile error detector. The main part of the involute gear profile error detector is the base circle disc in which the gear is mounted. The gear is locked by means of locking arrangement which has a shaft and it is coupled to the bearings. The whole locking arrangement is coupled by means of a locking screw arrangement called locking handle which can be able to rotate manually. It consists of the actuating rod which is situated between the baseplate and locking arrangement. The function of the actuating rod to hold the base plate tightly. In this project spur gears are designed. The program is a user friendly one and when executed it is ask the inputs and performs the necessary design calculation and gives necessary output values. It also gives the gear tooth profile with accurate safe dimensions.

1.INTRODUCTION

The involutes gear profile, originally designed by Leonhard Euler, is the most commonly used system for gearing today, with cycloidal gearing still used for some specialties such as clocks. In an involutes gear, the profiles of the teeth are involutes of a circle. (The involute of a circle is the spiraling curve traced by the end of an imaginary taut string unwinding itself from that stationary circle called the base circle.)

Irrespective of whether a gear is spur or helical, in every plane of the involute gears the contact between a pair of gear teeth occurs at a single instantaneous point (see figure at right) where two involutes of the same spiral hand meet. Contact on the other side of the teeth is where both involutes are of the other spiral hand.

Rotation of the gears causes the location of this contact point to move across the respective tooth surfaces. The tangent at any point of the curve is perpendicular to the generating line irrespective of the mounting distance of the gears. Thus the line of the force follows the generating line, and is thus tangent to the two base circles, and is known as the Line of Action (also called Pressure Line or Line of Contact). When this is true, the gears obey the Fundamental Law of Gearing:
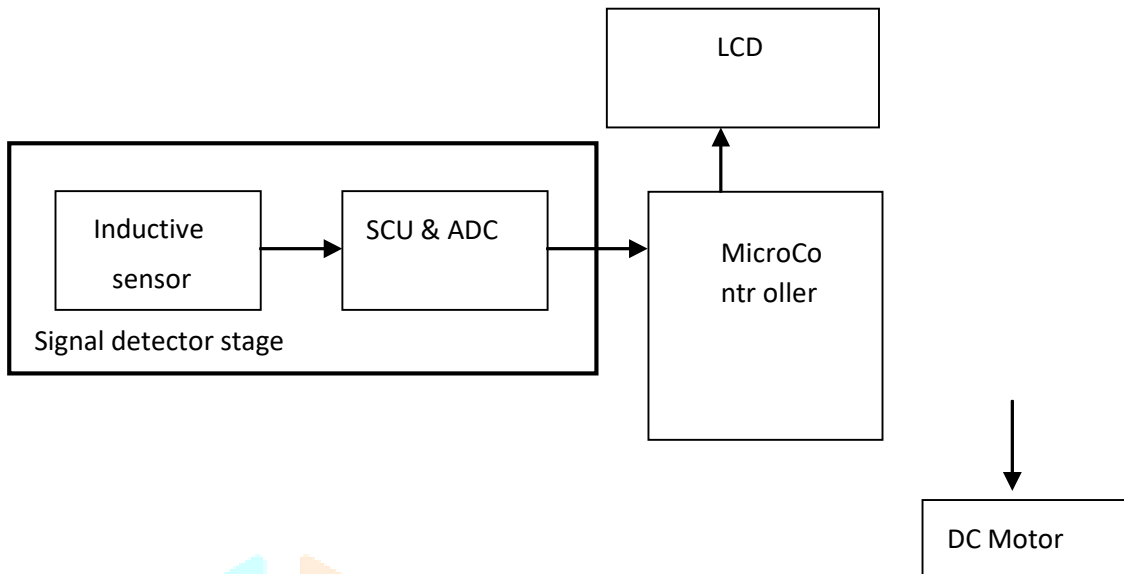
The angular velocity ratio between two gears of a gear set must remain constant throughout the mesh.

This property is required for smooth transmission of power with minimal speed or torque variations as pairs of teeth go into or come out of mesh, but is not required for low-speed gearing.

The Pressure Angle is the acute angle between the line of action and a normal to the line connecting the gear centres. The pressure angle of the gear varies according to the position on the involutes shape, but pairs of gears must have the same pressure angle for the teeth to mesh properly, so specific portions of the involutes must be matched.

While manufacturers can produce any pressure angle, the most common stock gears have a 20° pressure angle, with 14½° and 25° pressure angle gears being much less common. Increasing the pressure angle increases the width of the base of the gear tooth, leading to greater strength and load carrying capacity. Decreasing the pressure angle provides lower backlash, smoother operation and less sensitivity to manufacturing errors.

Only used in limited situations are helical involute gears, where the spirals of the two involutes are of different 'hand' and the Line of Action is the external tangents to the base circles (like a normal belt drive whereas normal gears are like a crossed-belt drive), and the gears rotate in the same direction, and there is sliding at the contact point which gives inefficiency and thus can be used in limited slip differentials. These cannot be spur gears unless they comprise multiple sectors of gears, and are otherwise helical but the meshing gears are of the same helix angle rather than of opposite hand

FUNCTION OF TTHEBLOCKBLOCK DIAGRAM

Figure 1: Block diagram

SIGNAL DETECTING STAGE

The inductive sensor when detect the metal it will send the information to the signal conditioning unit(SCU). The output of sensor is connected with comparator. The comparator is constructed with LM 741 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The non inverting

input terminal is connected to sensor. When the sensor detect metal at that time , the comparator non inverting

input terminal voltage is higher than inverting input. Now the comparator output is in the range of +5V. This voltage is given to base of the transistor Q1. Hence the transistor is conducting. Here the transistor is act as switch so the collector and emitter will be closed. The output is taken from collector terminal. Now the output is zero.

When the sensor detects the metal the 5v is given to 40106 IC which is ADC. The ADC output is become high which is given to microcontroller.

MICRO CONTROLLER AT 89S52

AT89S52 is one of the popular microcontrollers from the Atmel family. This is an 8-bit CMOS microcontroller having 8k Flash memory and 256 bytes of RAM memory. It can be operated at 33MHz maximum operating frequency by using an external oscillator. Like other microcontrollers, it has GPIO pins,

three 16-bit timers, one full-duplex UART communication port, three 16-bit general-purpose timers, on-chip oscillator. Furthermore, it has 40 pins, out of which 32 are GPIO pins. AT89S52 also has an inbuilt Watchdog timer to operate microcontroller low power mode. This microcontroller finds its applications from domestic devices to the industrial level to provide digital control to embedded systems. It is an 8-bit, low power, high performance, CMOS technology based microcontroller with having an operating frequency range between 0 to 33MHz. The chip can work in two power selectable operating modes. This device offers 32 GPIO pins which can be used as digital input-output pins or also same pins can be used for alternate functions.

CIRCUIT DESCRIPTION

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal.

A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and Normally open (NO).

The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So the relay is turned OFF state.

When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

POWER SUPPLY STAGE

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

I. WORKING PRINCIPLE
TRANSFORMER

The potential transformer will step down the power supply voltage (0-230V) to (0-12V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

BRIDGE RECTIFIER

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias

D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a fullwave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

IC VOLTAGE REGULATORS

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts
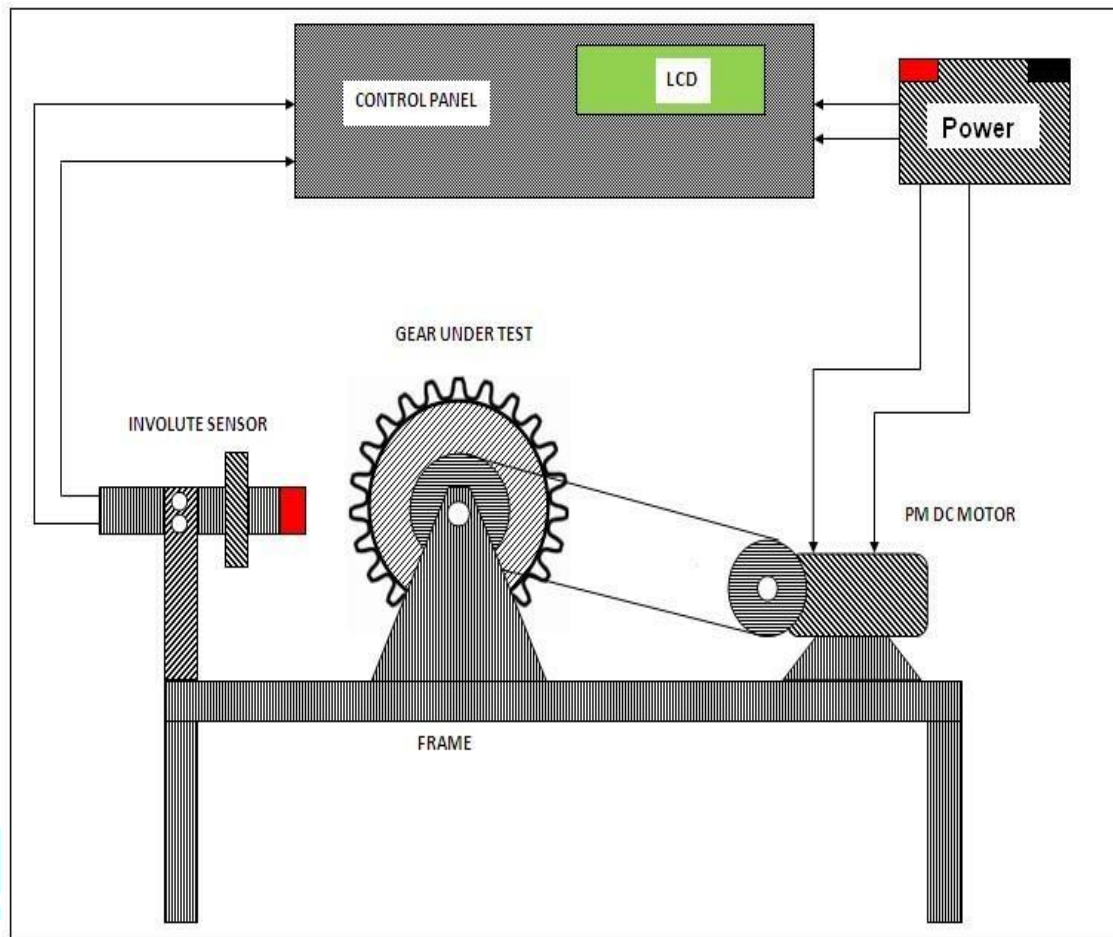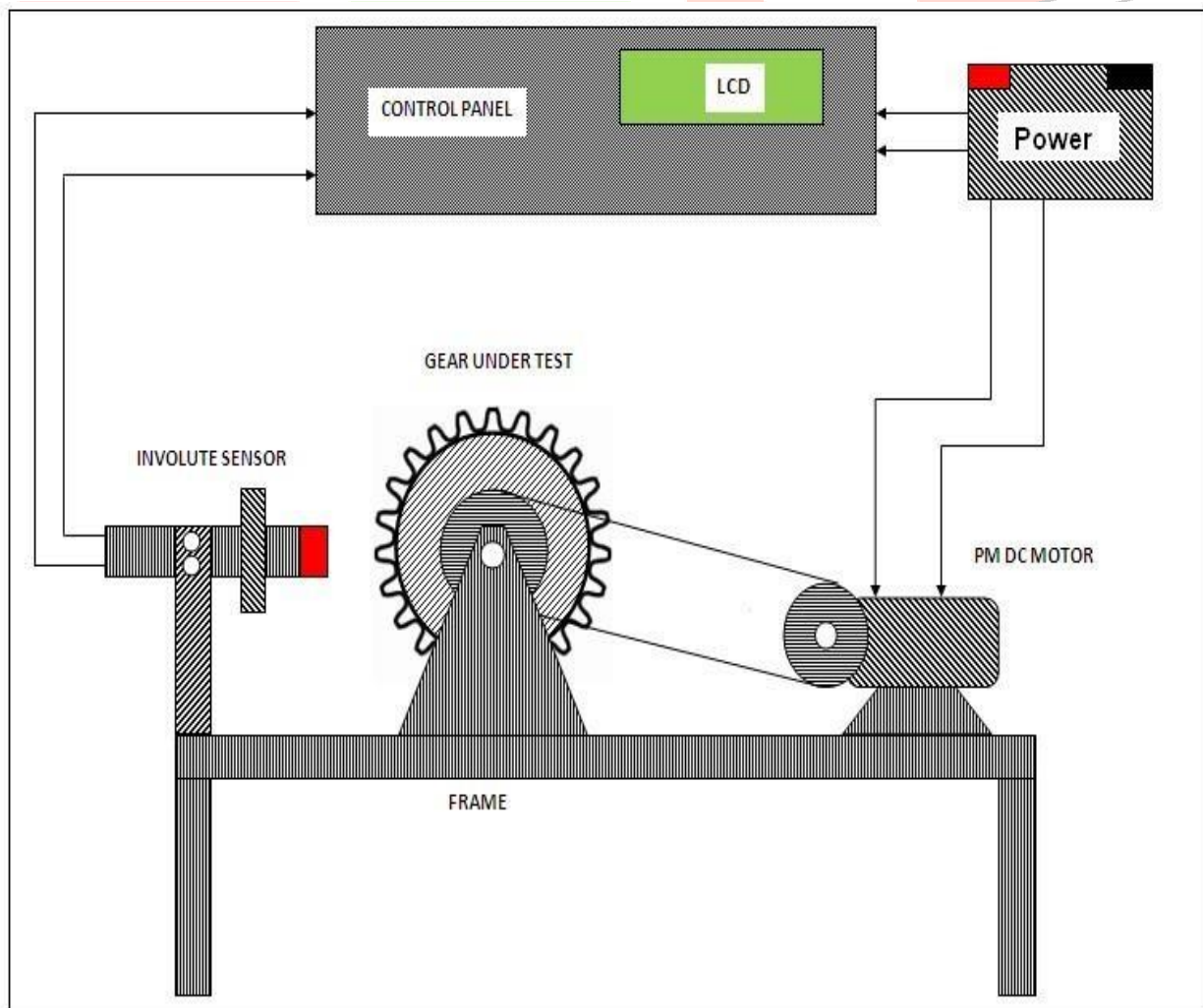
Figure 2: Involute gear profile error detector

CONCLUSION

We feel very happy in fabricating this project, involute profile error checking machine. The project has been properly pre-planned and cost estimated to be completed within the time limits, with less cost to an efficient working condition. Finally we have this project completed successfully at a lower cost using available materials. We gained enough experience in solving technical knows, while the project was under progress. We hereby conclude that it is indeed a great pleasure for us to manufacture this machine which serves especially all small- scale gear manufacturing industries that have so far been deprived of getting the benefit of the conventional involute checkers due to its high cost and complexity. By measuring the involute profile error and making corrective measures, the gear manufacturers can deliver precision gears, which render good power and torque transmission at constant velocities. It is a real boon for all of them who strived to achieve perfection in manufacturing highly precision spur gear at an unimaginable cheaper cost without any compromise for accuracy.

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