

PID CONTROL AND ELECTRICAL PARAMETER DATA LOGGING FOR DC MOTOR



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ABSTRACT

DC motor are widely used in various industrial application which includes conveyors, rolling mills, lathe machines, centrifugal pump, lifts, etc. Due to expensive use of motion control system in industry, there has been growing research on PID controller. One of the speed of DC motor. There are various method for controlling the speed of DC motor such as terminal voltage, armature voltage and flux control method which involves large amount of losses due to use of rheostat. The aim of this paper is to show how DC motor speed controlled by using PID controller and also to display the electrical parameters of DC such as voltage, current, power, speed by programming Arduino on the LCD screen. Here, Buck boost converter is used to provide appropriate voltage for DC motor either by stepping up or stepping down voltage. The actual values of current, voltage and speed is sensed through an current sensor, voltage divider circuit and digital encoder respectively.

Keywords: PID controller, armature control

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I. INTRODUCTION

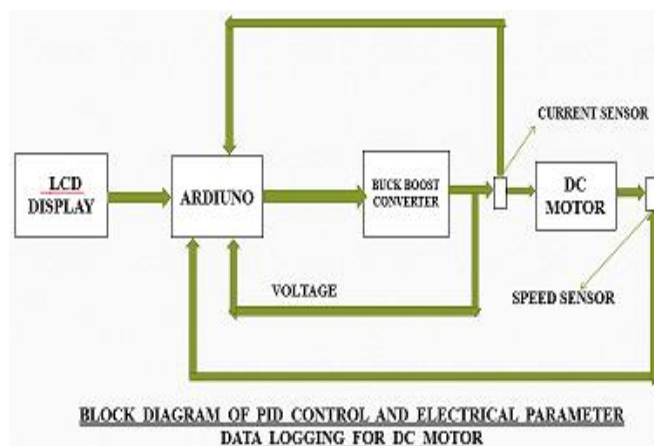
Modern industries, robotics and various activities uses DC motor for various applications. Torque availability and speed regulation are priorities in most motor applications. The use of PID controller is a simple process which can be implement practically. The PID controller have been extensively use in control processes. By programming Arduino we can get values of motor voltage, current, power and speed of DC motor and Arduino can control DC motor speed. Loading of DC motor can be done by strain gauge method. Buck boost converter is used to provide necessary voltage to DC motor. Also we are interfacing LCD for data logging as well as display. Proper sensors and electronic equipment are used for sensing voltage, current and also speed.

PID controller is used in the project setup so as to minimize the error and also change in parameter. Speed of DC motor can be controlled by PID controlling.

II. DESIGN OUTLINE

The design is divided into Arduino, buck boost converter, DC motor and feedback system.

Given diagram



A Arduino

Arduino is used for building electronic and electrical projects as it is an open source platform. It consists of physical programmable circuit board and IDE (Integrated Development Environment). Arduino can operate on voltage 5V. Micro-controller used in an Arduino is Microchip ATmega328P. It allows to program and execute the command by considering inputs.

B Buck boost converter

Buck boost converter is a type of DC to DC converter. Its voltage can be greater than or less than input voltage. Instead of transformer using inductor it is equivalent to converter called as fly back converter. Buck boost converter can operate in two modes. In the first mode switch will remain ON and diode will be OFF. In the second mode switch will remain OFF and diode will be ON.

C. DC motor

DC motor converts electrical energy into mechanical energy. The speed of DC motor is controlled by using PID controller. 24 volt, 100 watt DC motor is used.

D. LCD display

LCD display is used to display data on the screen. It contains liquid crystals that can be visible when current passes through them. It is like a flat panel display. LCD plays important part in Arduino based embedded system. In LCD there are 5*10 pixels so to display one letter 50 pixels should be together. we are going to use 16*2 LCD in which we display current, voltage, speed and power.

E. Potential Divider circuit

Voltage divider circuit is used to measure voltage greater than 5 volts. Voltage divider can act as step down transformer hence by using voltmeter we can measure high voltage. For that high voltage is applied across divider and we get lower voltage as a divider output which is within meter range. It can be measured by normal meters like voltmeter.

F. Encoder

Speed measurement can be done by using digital encoder. It converts binary information in N output lines. Encoder can convert mechanical movement into digital signal.

G. Strain gauge

A strain gauge is a sensor in which resistance varies with external force. Strain gauge is a device which converts weight, tension, pressure and force into resistance. This resistance can be measured. Strain Gauge can work in two wire communications. Load cell size is 12.7*12.7*75mm

H. Current sensor

Current sensor (ACS712 Hall Effect sensor) is used to sense current. Output of current sensor is an analog voltage proportional to current which is measured on the sensing terminal. Micro-controller ADC is used to read values. To sense up to 20 ampere continuous current low resistance internal conductor used.

I. PID controller

PID controller is most commonly used controller in feedback loop. It can be used in various industrial applications. One of the applications is speed control of DC motor. By changing the values of proportional, derivatives and integral constant we can get desired speed.

III. METHODOLOGY

The loading of DC motor is done by using strain gauge arrangement. It works on principle that if force is applied on its resistance varies with the applied force. The belt pulley arrangement is also provided to measure the torque produced by motor.

As load is applied motor draws the current. The measurement of current, voltage, speed and power is done by programming of Arduino and various current sensor, voltage divider circuit and digital encoder are used.

Encoder is used to measure the speed or revolutions per minute (rpm). This measured value of speed is given to PID controller by using trial and error method. Thus desired speed is obtained.

Buck boost converter is DC to DC converter provides the voltage to motor considering either we have to increase or decrease the speed of motor.

To display all these values of current, voltage, power and speed LCD is interfaced to the Arduino.

IV. CONCLUSION

Voltage, Current, Speed will be displayed on LCD. Current measurement should be done by ACS712 Hall effect sensor. The change in voltage and current should be sensed and displayed on the LCD display so that we can analyse the data according to which the torque can be calculated and it should also be displayed on the LCD. The digital encoder which is used at the DC motor so as to measure the speed and to display it on LCD. The feedback loop provided from the encoder to Arduino i.e. PID Controller, all the error in the set value of the Speed can be minimized that means steady state error is reduced. And the speed would be set to the desired value set by user irrespective of the loading that would be done by the strain gauge.

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