1 it is working correctly. the most

1 Introduction PID is basically a closed loop system in which a DC motor speed is controlled by using FVC(frequency to voltage converter) which will take input from the substractor and give output to encoder the phototransistor will convert this input signal into the electrical signal then it will be feedback to the refrence or potiontiometer A PID controller stands for proportional integral derivative controller. It is a control loop feedback mechanism. PID algorithm consists of three basic coefficients: ? Proportional, ? Integral ? Derivative These three coefficient are required to get optimal response.

This system can be made up of various components arranged in equally various ways. 1. 1 Overview A PID controller is designed in a circuit by using various tools and components. PID controller basically find the transfer function. • KP = Gain of Proportional   • KI = Gain of Integral   • KD = Gain of Derivative   10   Figure 1 PID Circuit diagram   The variable (e) represents the tracking error, the difference between the desired input value (R) and the actual output (Y). This error signal (e) will be sent to the PID controller and the controller will calculate both the derivative and the integral of this error signal. The signal (u) immediately after the controller is now equal to the proportional gain (KP) for the magnitude of the error plus the integral gain (Ki) multiplied by the integral of the error plus the derived gain (KD) for the derivative error. This signal (u) will be sent to the system and the new output (Y) will be obtained.

This new output (Y) will be sent to the sensor to find the new error signal (e). The controller takes this new error signal and calculates its derivative and becomes integral again 1. 2 Project Idea PID controller provides accurate

results which will also match to mathematical calculation . If it matches to mathematical calculating it is working correctly. The most common configuration issues include: 1. Choosing the Wrong Algorithm 11 2. Improper Tuning 3. Over – or Under – Filtering 4.

Improper Configuration of Control Strategy 5. Spanning and Scaling 6. Scan-related Issues 1. 3 The Problem & Its Effects The choice of control algorithm is crucial to good process control. The wrong algorithm choice can lead to: • Inability to track set point   • Creating sustained oscillations • Excessive wear-and tear on the control valve • Excessive process movement in response to set point changes At the business level, these problems can have a direct effect on quality, and indirect effects on energy costs and production rate. 1. 4 Purpose of the Project   The wide use of feedback controllers did not become feasible until the development of wide band high-gain amplifiers to use the concept of negative feedback.

This had been developed in telephone engineering electronics by Harold Black in the late 1920s, but not published until 1934. In the 1950s, when high gain electronic amplifiers became cheap and reliable, electronic PID controllers became popular, and 4–20 mA current loop signals were used which emulated the pneumatic 12 standard. Most modern PID controllers in industry are implemented in distributed control systems (DCS), programmable logic controllers (PLCs), or as a panel-mounted digital controller.

It is necessary to understand the PID controller to develop a PID controller we less percentage error. To understand PID controller accurately we will

create PID controller to understand its basic principles and Compare the results with the mathematical results and decide the percentage of error between them. 1. 5 Project Specifications PID controller for pneumatic and hydraulic control circuits. It Consisting of Bus bar, mass flow rail, contact for 4 mm security plugs, mounting with protection against accidental contact with a built-in lock grid ledge in the fixture for electrical port and control unit or else with plug-in adaptors for the profile plate. The PID controller is made up of the following function areas:- COMPONENTS Technical data Description Power supply 24 V The PID controller requires a power supply of 24 V.

This voltage is converted internally to +/- 15 V and fed to the controller electronics. 13 Differential inputs -24 – +24 V A differential input is provided in each case on the PID controller for the set point and actualvalue signals. The differential signal can be measured against analogue ground. The differential inputs are fitted with low-pass filters to suppress interference. Over modulation of below -10 V or above +10 V is indicated by LEDs. Comparator ? The comparator is connected in series with the signal inputs and calculates the system deviation between the set point and actual value. Summation point The sum of the instantaneous error over time and gives the accumulated offset that should have been corrected Limiter 0 – +10 V -10 – +10 V Limit the block output to values one specify as the Lower saturation Output The correcting variable can be tapped against analogue ground at the output. Correcting variable offset ? 5 ±3.

5 V at 0 – +10 V   0 ±7 V at -10 – +10 V The correcting variable offset can be used to impose constant voltages on the control signal in order, for example, to compensate for the zeropoint shift of actuators. 1. 6 Applications of the Project   PID controllers are applicable to many control problems and often work satisfactorily without improvements or adjustments.

14 • It is widely used in the process industry, in the automation system and in process and in-process dynamics In particular the dead time of the cycle. • PID controllers provide reasonable control of the more industrial process, provide a non-high demand. • PI control is generally adequate when the plant / process dynamics is essentially first order. • PID control is generally good if the dominant dynamics of the plant are second-order More elaborate control strategies are needed if the process has long delays or is slightly attenuated Vibratory modes 1. 7 Project Plan This project is divided in two parts . The first half was about designing and working of circuit in proteous. The second half is about placing components on circuit and test of PID controller. This project should be completed within five weeks.

The work load is divided in to four parts. Selection of the project and its proposal and the end resulted will be conducted by first member and the remaining tasks like designing and placing the component's will be handle by other member of the project. 1. 8 Project Milestones TASK DURATION SOURCE PERSON 1. PROJECT PORPOSEL 01 Weeks SYED NEHAL HASSAN SHAH 2. Proteous design 03 weeks HARIS SHAFIQ 3. Compenent placing 04 weeks HARIS SHAFIQ 4.

TESTING of PID controller 05 weeks SYED NEHAL HASSAN

SHAH 15   CHAPTER 2 2   LITERATURE REVIEW This project concerns the characteristics of the PID controller and its operation. This project indicates the operation of the main component of the PID controller which is proportional (P), the integral (I) and derivative (D) controls and how to use them to obtain a desired response. Controller of three terms are: 1 KP = proportional gain 2 KI = integral gain 3 KD = derived gain A proportional controller (KP) will have the effect of reducing the rise time and will reduce, but will never eliminate, the steady state error.

An integral control (Ki) will have the effect of eliminating the steady state error, but it could worsen the transient response. A derivative control (KD) will have the effect of increasing system stability, reducing overshoot and improving transient response. To understand the three-term controller and its relationship to the PID controller, there is a complete table. CL RESPONSE RISE TIME OVERSHOOT SETTLING TIME S-S ERROR KP Decrease Increase Small Change Decrease 16   KI Decrease Increase Increase Eliminate KD Small Change Decrease Decrease Small Change 2. 1 Background Theory The basic idea behind a PID controller is to read a sensor, then calculate the desired output of the actuator by calculating the proportional, integral and derivative responses and adding these three components to calculate the output. A sensor is used to measure the process variable and provide feedback to the control system. The reference point is the desired or command value for the process variable, for example 100 degrees Celsius in the case of a temperature control system. The whole idea of this algorithm revolves around the manipulation of the error.

The error, as is evident, is the difference between the process variable and the set point. ERROR = PV – SP These 3 modes are used in different combinations: o P – Sometimes it is used or PI: more used or PID: sometimes used o PD: very rare, useful for controlling the servomotors o . 17 2. 2 Related Technologies Proportional Integral Derivatives (PID) controllers are used in most automatic process control applications in today's industry to regulate flow, temperature, pressure, level and many other industrial process variables. The following are the modern technologies used in industries. 1.

Automate temperature control with a PID controller. 2. The method of proportional control. 3. Proportional control only 2.

2. 1 Related Technology 1   The proportional control mode changes the controller output in proportion to the error. If the error increases, the control action increases proportionally. The adjustable setting for proportional control is called the Controller Gain (Kc). A higher controller gain increases the amount of proportional control action for a given error.

If the controller gain is set too high, the control loop will begin oscillating and become unstable. If set too low, the control loop will not respond adequately to disturbances or set point changes. 2. 2. 2 Related Technology 2 A PID controller can be configured to produce only a proportional action by turning off integral and derivative modes. Proportional controllers are easy to understand and easy to tune: the controller output is simply the control error multiplied by the controller gain plus an error. Polarization is necessary for the controller to maintain a non-zero output while the error is zero (process

variable at the set point). The disadvantage is compensation, which is a prolonged error that can not be eliminated only with proportional control.

Under proportional control, the displacement will remain present until the operator manually changes the polarization at the controller output to eliminate displacement. This is known as manual reset of the drive. 18 2.

3 Related Projects 2. 3. 1 Temperature Control System using PLC PLC is one of the main topics in Instrumentation and Control Engineering.

To build a temperature control system using a PLC it is possible to use RTD or thermistor and a heater. When the temperature exceeds the predefined level, it is possible to circulate a refrigerant (water) around the tank. When the temperature drops below the set point, a heater will automatically turn on. A PID controller can be used for better control action than on-off control. 2. 3.

2 Automatic Bottle filling project using PLC In this project, a conveyor can be used to pass a bottle (cups). The IR sensor will detect the presence of a bottle. At the same time, the transporter will stop. When a timer is generated in the PLC, a solenoid valve will begin to fill the bottle. When the timer is complete, the solenoid valve will close and the conveyor will start. 2.

4 Related Studies/Research Control methods PID controller parameters are the PID controller is widely used in many industrial process control fields thanks to its simple algorithm, good robustness and high reliability. Based on the summary of the adjustment process, the principle and the respective characteristics of the ZN frequency response method, Cohen-Coon method,

the Astrom-Hagglund method and the CHR method, the simulation experiments are conducted on the three objects. Typical controls Based on the simulation results, the advantages and disadvantages of the four engineered control methods used to set the PID controller parameters are analyzed and compared limitations 2. 5 Limitations Problem 1: It tunes the loop with quarter-amplitude-damping response, which overshoot and oscillates quite a bit. 19 Problem 2: It leaves the loop with very little robustness, which can lead to loop instability.

Problem 3: It will give very poor response if the process is dead-time dominate.   The Ziegler-Nichols closed-loop tuning method does a little better with issues 3 and 4 above, but issues 1 and 2 remain a problem. In addition, this method is very sensitive to control valve problems like dead band.   20 CHAPTER 3 3 PROJECT DESIGN AND IMPLEMENTATION There are four main things to design the PID controller. 1.

Obtain an open-loop response and determine what needs to be improved. 2. Add a proportional control. 3.

Add a derivative control. 4. Add an integral check. To construct PID first thing is to design proportional control in which there will be resister and op amp IC because Open-loop gain is infinite in the ideal operational amplifier but finite in real operational amplifiers. In configurations with a voltage-sensing negative feedback, the output impedance of the amplifier is effectively lowered; thus, in linear applications, op-amp circuits usually exhibit a very low output impedance. For the derivative control and integral

there will add three resister and a capacitor . The capacitor will be at start for derivative and end of the integral due to their properties. 21 3.

1 Project Design Methodology Figure 2 Differentiator   a)   An op-amp circuit measures the voltage change by measuring the current through a capacitor and outputs a voltage proportional to the current. The right side of the capacitor is maintained at a voltage of 0 volts, due to the " virtual earth" effect. Therefore, the current " through" the condenser is due only to the variation in the input voltage. A constant input voltage will not cause a current through C, but will change the input voltage.   Figure 3 I-controller 22   b) As before, the negative feedback of the operational amplifier ensures that the investment input is kept at 0 volts (virtual terrain). If the input voltage is exactly 0 volts, there will be no current through the resistor, so the capacitor will not be charged and therefore the output voltage will not change. There is no guarantee of what voltage will be at the outlet with respect to the ground in this condition, but even so the output voltage will be constant. c) Finally, it is necessary to add the three PID terms together.

Again, the OP4 summing amplifier serves us well. Since the error amplifier, the PID and the summing circuits are investment types, it is necessary to add a final OP5 operational inverter so that the final output is positive. Analysis 3.

2 Procedure   The adopted procedure was very simple to implement. There used simple method because it is less expensive and provide accurate result. 3. 3 Design of the Project on software 3. 3.

1 Proteus Diagram Figure 4 Design of PID 23   In Proteus the design circuit was same as the block diagram . The IC was op amp with two capacitor and ten resistor and V (ref) 5v. 3. 4   Details about Hardware   Following are the components used in the project. Capacitor: A device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator. Resistor: A device having resistance to the passage of an electric current.

OP amp(IC):   An operational amplifier (or an op-amp) is an integrated circuit (IC) that operates as a voltage amplifier. Voltage source: TO supply voltage. LED: LIGHT EMITING DIODE TO CHECK THE CIRCUIT. PCB: On which components are placed. SENSOR: The sensor tells the actual velocity at the motor, 3. 5 Details about Software The circuit was design on the Proteus in which first step was to create the project according to the block diagram . In component list there were capacitors and resistors Op – amp IC.

After that in component list there is voltage source and ground. The components was added according to the block diagram. The working of all the components was same as describe above in sections. 24 3. 6 Details of Simulations After the components were attached in Proteus the circuit was simulate and by change the value of resistor and capacitor the results can be achieve. The graph was seen on the lab computer to conform the hardware circuit was working correctly. 3.

7 Summary The project was about the designing the PID controller on software to get the basic idea of working circuit. The software was used design the circuit on Proteus as a new project. The components was added

according to block diagram and LED was also added to check the working of the circuit. As shown in the previous sections to create the three part of the circuit. First step was add a proportional control to improve the rise time and add a derivative control to reduce the overshoot. So through an integral control one can reduce the steady-state error. After creating the above parts we were able to join the circuit on Proteus .

Supply the voltage to the circuit and can also see the graph on computer.   25   CHAPTER 4 4 TOOLS AND TECHNIQUES In this section different tools were used to reach the result and adopted different technique to short the work. Following are the hardware, software and simulation tools that were used in the project. 4. 1 SOFTWARE Proteus: To check the working of circuit and this software is also use to get the circuit.

MATLAB: To check the signal generated from the source after passing through the three main parts. 1. Proportional control to improve the rise time. 2. Derivative control to reduce the overshoot. 3.

Integral control to reduce the steady-state error. 4. 2 HARDWARE PCB: It is used as a hardware circuit. In this the print of the circuit was taken from Proteus and paste on the PCB for the component placing.

After completing the circuit on PCB and checking the circuit with DMM so there will be not open circuit. To check the terminal of the point different mode of DMM was used. It will produce the sound if connected and no sound for the no connection. 4. 3 Hardware Tools used PCB: A printed circuit board, or PC board, or PCB, is a non-conductive material with conductive lines

printed or etched. Electronic components were mounted on the board and the traces connect the components together to form a working circuit or assembly. A printed circuit board (PCB) is the board base for physically supporting and wiring surface-mounted and socketed components in most electronics.

26 KNOB: Device designed to close or open an electric circuit when a button or knob is depressed, and to return to a normal position when it is released. DC motor: is a motor that takes DC power in and converts it to rotational motion. Since DC motors can ordinarily only be told how fast to go (on a scale from -100% to 100% duty cycle) In order to make a control system, motor was used as a feedback device such as an encoder. After completing the circuit on PCB it time to check the circuit with DMM so that all connection is connected. To check the terminal of the through DMM mode. It will produce the sound if connected and no sound for the no connection. 4. 4 Software simulation tool Proteus: The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation.

The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. By this software we accomplish two task. 1) To check circuit working. 2) Design of circuit. MATLAB: TO check the three main components of the circuit. For that process first step was to attached the cable from our circuit to the port of a computer and run the software . When the graph appear changes can be made . Through knob we change signals oscillation and rise time , peak time and can also find SteadyState error.

The goal was to minimize the error occur in signal. 4. 5 Summary This chapter was about the implement the technique used to concise the work and the tool that were used in the hardware and software. How the first was to place components to make the working PCB circuit and the result obtain from Mat lab. The design that was selected from Proteus. Through Mat lab the variation in signal and to minimize the error by changing the three knob of the main three components and their effect. 27 CONCLUSION PID controller simply gives a control output that is directly related to the instantaneous error. The proportional, integral and derivative control modes each fulfill a unique function.

Increasing the proportional feedback gain reduces steady state error but using to high value of proportional feedback gain destabilize the system. Increasing the integral control decrease steady state error but can also make system less stable. Increasing derivative usually increase damping and improve stability but no effect on steady state error.

The PID controller is the combination of three controller. They are combine to improve the system stability, reduce steady state error and increase damping in close loop system.   28 FUTURE WORK This PID controller can be used in many projects and industries. Test and Measurement Factory and Process Automation Machine Automation Military and Aerospace Oil and Gas Environmental Monitoring