LINEAR TEMPERATURE CONTROL USING PID & FUZZY LOGIC CONTROLLER

Mr. Pranay Ambade[1],Mr. Mandar Isasare[2], Vinit Uprikar[3], Priyanshu Modak[4], Viveta Sonderkar[5] ,Himanshu Vaidya[6],
Assistant Prof, Department of Electrical Engineering, JD College Engineering and Management, Nagpur, Maharashtra, India1,2
UG Student, Department of Electrical Engineering, JD College Engineering and Management, Nagpur, Maharashtra, India3,4,5,6

***ABSTRACT*:** Through our project we are showing the control of constant temperature according to the desired value (set point) in a closed loop using PID controller system. For this we are using a microcontroller, a temperature sensor for sensing the temperature of then closed loops. By using the microcontroller we compare the desired value with current value and it is displayed in the LCD. Also to provide the constant temperature, Fan or a heater is turned on or off according with the variations of current temperature in the from desired set point.

KEYWORDS:PID Controller, Microcontroller, Sensors.

INTRODUCTION

The objective of our project "TEMPERATURE PID CONTROLLER" is maintaining the constant temperature in a particular area using PID controller. Whatever the process or the parameters (temp , flow, speed.) the principles of control are similar. Input and output signals are specified in this project is digital. control of the circuit is achieved by means of a closed loop circuit. This project is prepared in order to control the temperature of a furnace in the best and easiest possible way.

The control system is that means by which any quantity of interest in machine, mechanism or other equipment is maintained or altered in accordance with a desired manner. Here we have used the closed loop system ; that is the feedback system. The feedback signal is derived from the output of the system. This signal gives the capability to act as self-controlling mechanism . The beneficial effects of the feedback in the system with high loop gain. The controlled variable accurately follows the desired value and also the feedback in a control system greatly improves the speed of its response.

One of the primary purposes of using feedback in control systems is to reduce the sensitivity of the system to parameter variations.

The project deals with a simple aspect of giving information about the controlling of temperature in a furnace. In this project we are developing a system which can control temperature of a furnace automatically. The system is be capable of taking decisions accordingly of overheating of blast furnace and cooling of a furnace.

This project is done by using microcontroller (PIC 16F873A) which was developed by microchip company with several features than processors with cheap cost. A temperature LM 35 is used in sensing the temperature and relays like heater or fan are used for adjusting the

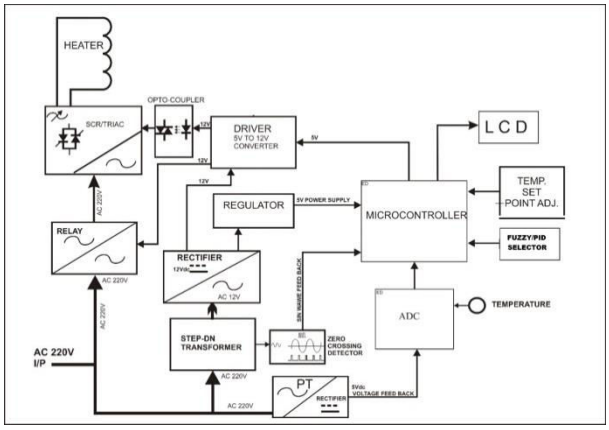
temperature with desired temperature value. The functions occurring are displayed on the liquid crystal display.

In this system, it can implement any applications about controlling or monitoring the temperature without any human effort. In addition to that a **FUZZY** controller is also used to simply ON/OFF the process where there isn't any accuracy matters.

METHODOLOGY

- The block diagram for "linear temperature PID controller" circuit consist of:
  - Power supply
  - Relay
  - Display section
  - Microcontroller (PIC 16F886)
  - Rectifier
  - Regulator
  - Step down transformer (220/12v AC)
  - ADC
  - Opto-coupler

- A fixed two terminal voltage regulator has a regulated dc output voltage of 5v and provide it to microcontroller.



- At the heart of the circuit is microcontroller PIC 16F873A with many advantages. The output of microcontroller is given to the display and driver.
- Relays we used here are heater , they are used for adjusting the obtained temperature with the desired temperature value.
- The display section , displays voltage when required and temperature. It is the main observable part of this whole system
- Zero crossing detector : We are condoling AC voltage .so we have to check both half cycles positive and negative. It gives command to microcontroller that on which instant zero is crossing. It is the main circuit if it is not operated properly then the whole circuit will damage.
- PT : Potential transformer are a parallel connected type of instrument transformer . There are designed to present negligible load to the supply being measured and have an accurate voltage ratio and phase relationship. Here, it is acting as a step down transformer which is use to convert high input voltage to low voltage.
- Relay is an electrically operated switch. Here microcontroller is controlling relay if the voltage high than the required voltage then microcontroller is generating tripping pulse and relay will get turn off. So here relay is acting as a protective device for TRIAC.
- Driver is used for amplifing the voltage upto required value.
- Opto-coupler : It protect or isolate a low voltage part from high voltage part.

LITERATURE REVIEW

Proportional Integral Derivative (PID) Controllers have been widely used in many process industries for several decades, due to their simplicity, flexibility and efficiency. **Zeigler and Nichols** (1942) developed the PID Controller tuning concept for open and closed loop operations. The controller tuned parameters with Zeigler-Nichol's method, perform well in disturbance rejection, and poorly in tracking reference changes.

Cohen and Coon (1953) proposed the open loop tuning or process reaction curve method. In the open loop tuning method, the connection between the controller and the final control element is disconnected, and the step input is applied as an input to the final control element and the process parameters are obtained from the process reaction curve. The above mentioned method requires limited process knowledge, but it offers lower damping and high sensitivity to the system.

Wills (1962) proposed the tuning maps concept for three mode controllers. In the above mentioned paper, the overall approach for the calculation of proportional gain, integral time and derivative time was discussed, and the tuning concepts were highlighted.

Miller etal (1967) proposed a comparison of the controller tuning technique, in which the investigation of the process reaction curve method is demonstrated and the process reaction curve approximation is done; comparatively Miller etal (1967) is better than Cohen and Coon (1953).

Parker (1972) introduced the concept of the design of Proportional Integral Derivative (PID) Controllers by the optimal linear regulator theory. In the above method, the optimal regulator was used to generate the Proportional Integral Derivative (PID) Controller's parameters, such as proportional gain, integral time and derivative time.

Hagglund etal (1985) developed the auto tuning technique for the Proportional Integral Derivative (PID) Controller, based on the dominant pole design.

Astrom etal (1986) introduced the concept of the expert systems in which the software programs are supplemented by man machine interfaces. The design and application of knowledge based expert systems for system control, improves the efficiency, effectiveness and performance under uncertain and varying operating conditions.

Rivera etal (1986) introduced the design procedure of the Internal Model Controller to establish PID rules with a well described approach. The Internal Model Controller was developed (Morari and Zufiriou 1987), and it 25 overcomes the problem of disturbance rejection but its design calculation is complicated for higher order processes.

Deshpande (1988) introduced optimization methods to obtain the PID parameters by the optimization of the Integral Square Error (ISE), Integral Absolute Error (IAE), Integral Time Square Error (ITSE) as the performance indices. Corripio (1990) compared the performance of the error criteria, in which the Minimization of Integral Absolute Error (IAE) generally produces intermediate responses between fast responses, obtained from the minimization of the Integral Square Error (ISE), and slow responses obtained from the minimization of the Integral multiplied Time Absolute Error (ITAE).

Result

Sr	SET Temp	Process Temp	Time in Secs.	
			PID	Fuzzy
1	85	29		98
		2nd ON 3rd ON	11 7	
2	70	28		90
			10 6	
3	106	29		103
			11 6	
4	55	29		96
			11 6	

Hence Concluded			
PID	Average of	8.5	
Fuzzy	Average of		96.75
Conclusion PID control is 90% efficient as compare to Fuzzy			

Conclusion

Our project eliminates the disadvantages which were prevalent with the earlier contactors based ON\OFF system. The current system which is employed is nothing but a larger scale execution of our model. The advantages of this system included:

- Allows flexibility in use and fine temperature control.
- Ensure a longer life period of the equipment.
- Reduces energy losses.
- Lesser breakdowns and energy losses ensure higher productivity.

Applications

PID based SCR control system used for several heating application . Its currently in use for the following :

- Lead melting for manufacturing of storage batteries
- Plate drying ovens
- Furnaces

Future Scope

PID based SCR control system used for several heating application . In future, it can be used for the following:

- Reduces continuous power supply
- Reduces fault current in circuit breakers
- Avoiding breakdowns

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