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Implementation of Temperature Process Control Using IMC Controller

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ABSTRACT: Objective of this paper in mainly to implement the internal model control(IMC) in temperature process with in a real time data by taking a empirical model from temperature model. From the obtained data and the describing the system behavior in transfer function and deriving the control value IMC(internal model control).further we have calculated the imc value and also determine zn values and compare its value and find the best method to identified and identified value can input for the MyRIO kit and implement in real time gets a good values. its very useful to identifies the model. Imc can easily accuracy from a system model from PID values

KEYWORDS: IMC,IMC-PID, MyRIO, System Identification.

I.INTRODUCTION

IMC is nothing but the internal model control is can be predicted for the purpose of to improve the performance of the smith Predictor in the presence of modelling and the error of modelling error can using identified the temperature control process and then we can follows will such that case in implementing in transfer function can varies will follows in changing of predictor to a values from empirical model of system and find out the transfer function to implement in temperature control are occure are flowrate coming out from a temperature process can used in a controlling a variable in a system.

In this paper, the important and proposed work is to interface the temperature trainer kit with a virtual instrumentation workbench LabVIEW, via myRIO kit. The process variable is obtained from the temperature sensor and sent to the software via NI-myRIO. The obtained variable is processed with the three basic control strategies namely ZN, IMC, . Even these had been implemented earlier by many researchers, our proposed work is to calculate its efficiency in virtual software or via virtual instrumentation workbench.

II. TEMPERATURE PROCESS

Temperature control is important in heating processes its used by the can obtained 1st we set a intial value in temperature process with its onset in a temperature process fetch from a temperature trainer kit .and the relay will be on (SSR) by using of a (value 0 off and 1 on)in relay and we have using in minimum states values in a get from a RTD immediately send to voltage divider made bread board and we MyRIo is used connect with in instant from a temperature process carried out by controller temperature with the change outptut by the rtd. temperature control which is the changes from a control space measured and detected RTD can be sensing by its change of states in temperature process. It can be provided the desire output to corresponding output use of temperature process.

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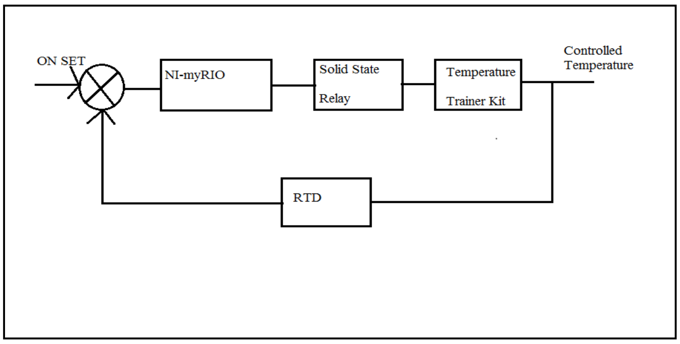

Fig 2.1 :General Block Diagram of Temperature Process

The real time temperature values is obtained through RTD sensor and fed to NI-myRIO were the signals are manipulated in the virtual instruments and output is feed to the control output using the solid state relay. In the process of controlling, the water is heated by a heater which is controlled by the controller

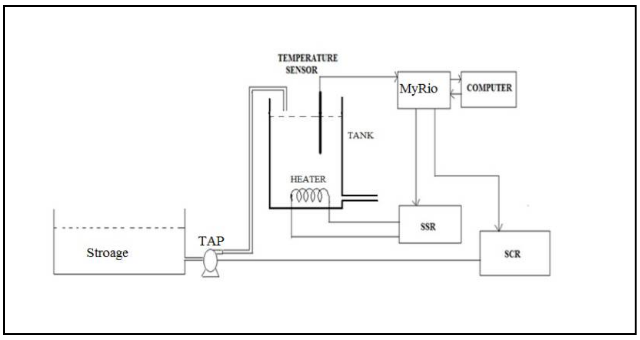

Fig2.2: Experimental Setup for Temperature Process.

III. SYSTEM IDENTIFICATION

Empirical modeling is an finding useful approach for the analysis of different problems and all values across numerous areas/fields of knowledge in that can be stimulated. As it is known, this type of modeling is particularly helpful when parametric models, due to various reasons, cannot be constructed. Based on different methodologies and approaches the system model may desire one further classified in the state, empirical modeling allows the analyst to obtain an initial understanding of the relationships that exist among the different variables that belong to a particular system or process. In some cases, the results from empirical models can be used in order to make decisions about those variables, with the intent of resolving a given problem in the real-life applications. The desired equation finding out values for system identification in the model

$$G(s) = k/(\tau s+1)\, e^{-tds}$$

Where, td – Time delay, K – Process gain, τ - Time constant.

IV.CONTROLLER DESIGN

In the general, the controller set point (r) and process variable (y) is fed to the comparator and the variable (e) represents the tracking error. This error signal (e) is fed to the PID controller, and the controller computes both the derivative and the integral coefficient of this error signal with respect to time. The control signal (u) of the process is equal to the proportional gain (K_p) times the magnitude of the error plus the integral gain (K_i) times the integral of the error plus the derivative gain (K_d) times the derivative of the error.

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This control signal (u) is fed to the plant and the controller output (y) is obtained. The controller output (y) is given as s feedback signal to compare with the reference signal and to find the error signal (e). The controller considers this error signal and computes the control input. The general relation for obtaining the proportional gain, integral gain and derivative gain is given below

$$K_p + \frac{K_i}{s} + K_d s = \frac{K_d s^2 + K_p s + K_i}{s}$$

where K_p = proportional gain, K_i = integral gain, and K_d = derivative gain.

4.1 Internal Model Control Methods:

Internal model control is obtain the value of ultimate gain(K) in the transfer function and then values of Ti, Td, Kp from derived in a *May be satisfies a IMC in that controller gain, temperature process in IMC control.*

Controller	*K*	*Ti*	*Td*	*kp*
PID	*98.1*	*116.5*	*1.4980*	*58.86*

V. PERFORMANCE INDEX

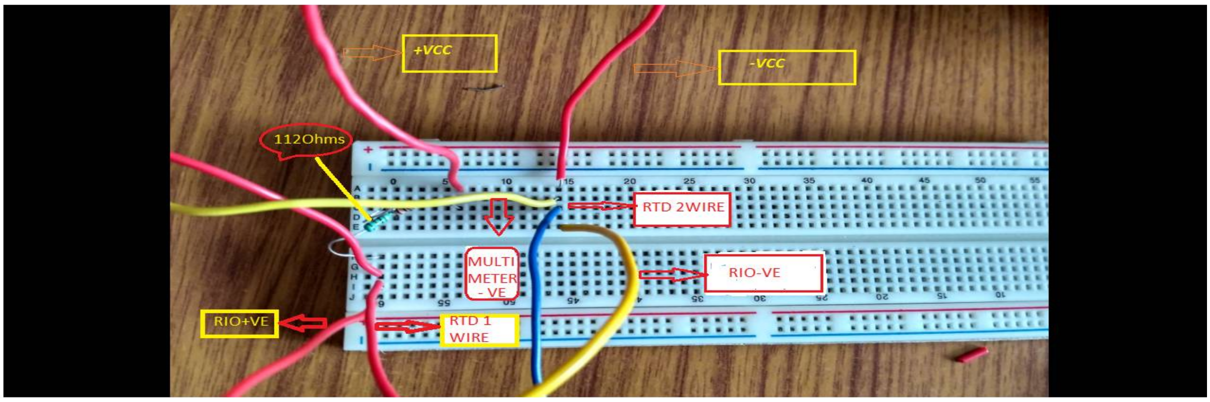
The objective function considered is based on the error performance criterion. The performance of a controller is best evaluated in terms of error criterion. Such criterions are available in the proposed work and the controller performance is evaluated in terms of Integral of Absolute Errors (IAE) criterion, given by

$$I_{IAE} = \int_0^T |e(t)| dt$$

The IAE weighs the error with time and hence emphasizes the error values over the range of 0 to T where T is the expected settling time.

VI. LabVIEW

LabVIEW (Laboratory Virtual Instrument Engineering Workbench), a product of National Instruments , is a powerful software system that accommodates data acquisition, instrument control, data processing and data presentation. All LabVIEW graphical programs, called Virtual Instruments or simply VIs . But in this case the collection of the simple VIs are combined to form a project controller. The Interface between the **Trainer kit and Virutal instrumentation is the NI-myRIO**.



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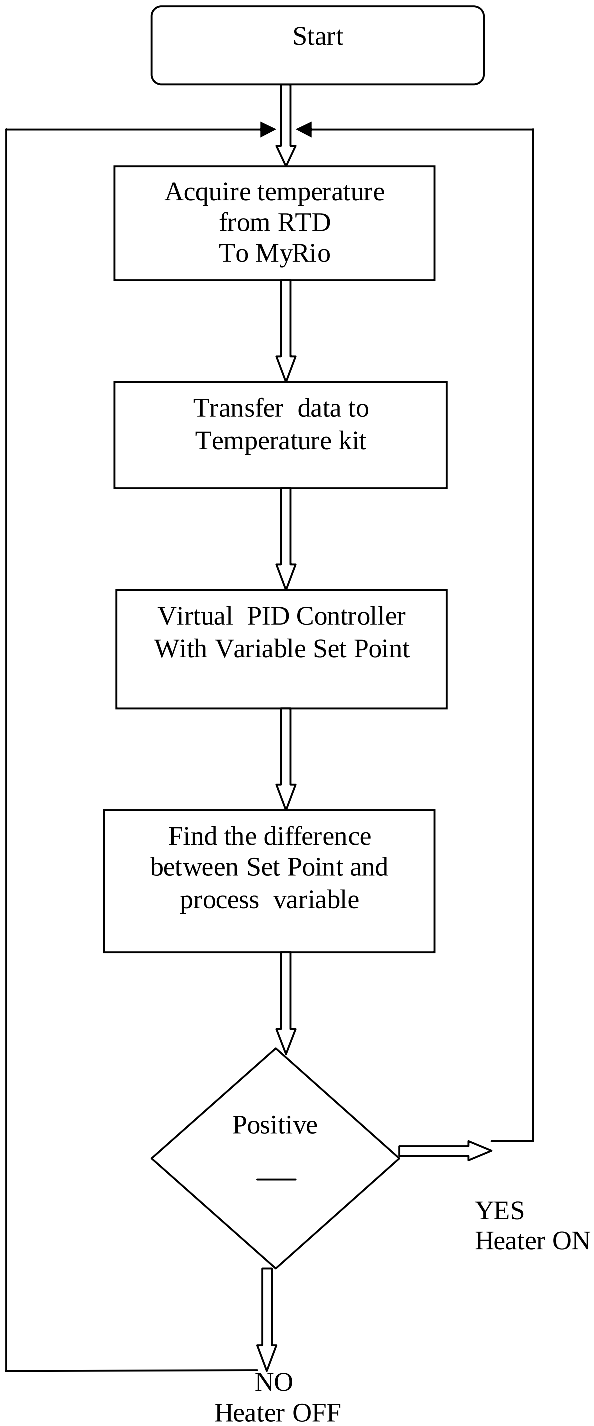

Fig 6.1: Flow Chart For LabVIEW Process

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VII. RESULTS AND COMPARISION

The comparison of ZN and IMC method of tuning in a temperature process will the Imc is a better method get the good rise time and the settling time in the state of empirical model in change of states in get a good settling time can formulated with getting an accurate values in Imc method with its dead time of kp,ki,kd in another will get good output from another values from regarding values in the change temperature process

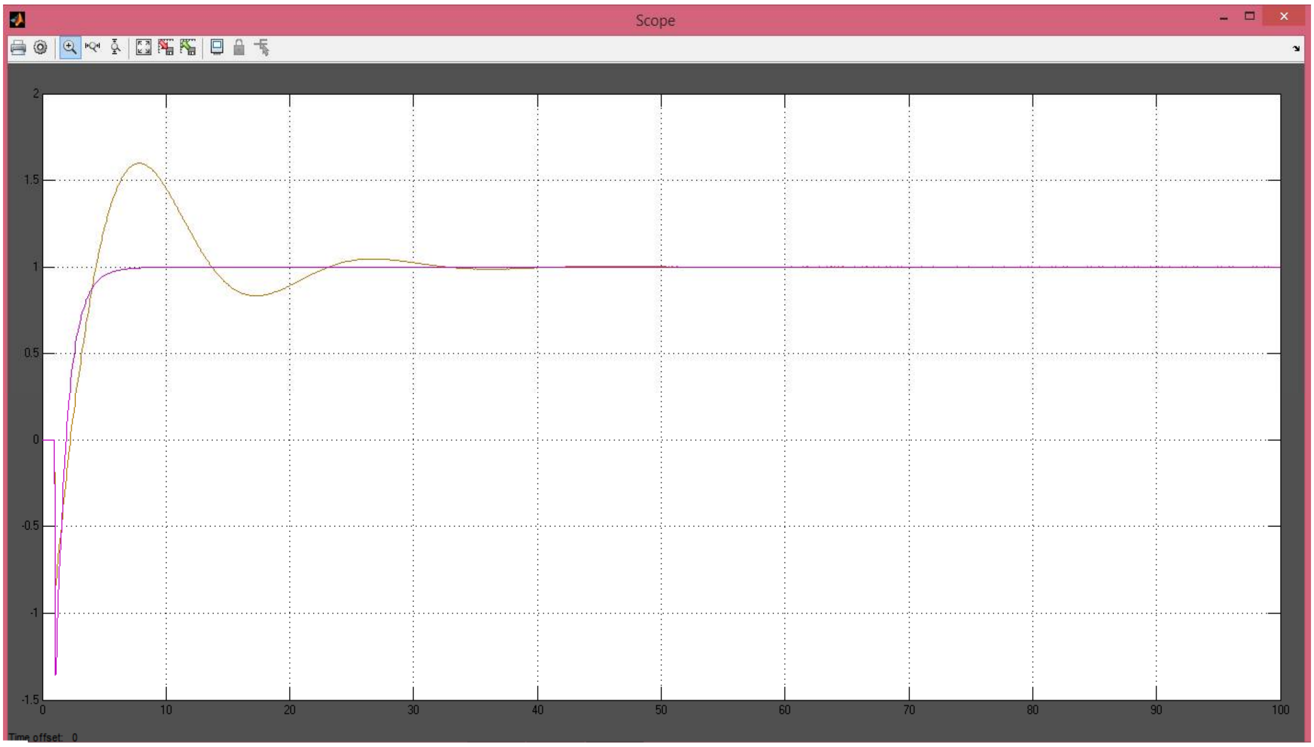

Figure7.1 Result Outcome

It is clear from the responses that the based controller has the advantage of a better closed loop time constant, which enables the controller to act faster with a minimum overshoot and settling time. The response of ZN controller is more sluggish than the IMC based controller. The time domain specification comparison is done for the IMC and Zn based controllers for the responses obtained it, is tabulated below in table7.2

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	Pid ZN-II	Imc
Rise time (seconds)	3.45	3 0
Peak time (seconds)	7.8	-
Overshoot	0.6	-
Settling time (seconds)	48.5	9.2

Table 7.2 :Time domain specification comparison

VIII. CONCLUSION

The get good outcome from the IMC method the y will be connected in a temperature kit acquire the value by doing the empirical modeling with its dead time and controller design with the regular interval of time can be formulation of tablesa the settling time and settling time will be allows the const with its regular intermediate from their lots of in temperature process. At the time time of PID values get from a irregular from their values with minimum values in changes noted in const may follows with its original values from regarding so that will allows in the changing states of PID will in the same region of IMC follows by their relation with the ratio in another becoming its change of order in the IMC tuning of process with their in their time domain specification imc controller tuning in the stats in their ideas.

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