

Hot Plate Controller using PID

1 Introduction

PID controller, which consist of proportional, integral and differential parts is widely used in controlling systems. PID systems in general work as a control feedback loop mechanism. In these systems, error; the difference between required output and the current output is calculated continuously and adjusted using proportional, integral and differential parts until the desired, stable output level is reached. In this project the temperature of a hot-plate is controlled using PID.

2 Requirements/Outcomes

You need to design an Analog PID Controller to control the temperature of a hotplate with following specifications.

- Temperature range: up to 200°C
- The complete design should be in analog domain
- It should be able to maintain any given temperature value (in the given range)
- All the groups together need to create a common platform to measure the temperature and plot the temperature variation with time (For evaluation)

3 Additional Information

- Schematic design of the circuit needs to be prepared.
- The calculations need to be clearly given.
- You are allowed to use one PCB for the product and PCB should be designed using Altium Designer.
- Marks will be allocated based on the transient time of the controller
- Any change of project specification is negotiable only before the mid review
- All circuits must be simulated using software (e.g., Multisim, LTspice, PLECs)

- All circuits should be tested on the breadboard and reviewed by the assigned supervisor before moving further
- Circuits must be designed using professional EDA software (e.g., Altium Designer, OrCAD)
- Schematics should be verified and evaluated by the assigned supervisor
- Design for manufacturability should be considered when designing the PCB
- Complete set of design and manufacturing documents
 - Schematics, Layout, 3D file
 - Gerber files, Assembly files
 - BoM

must be generated and properly documented.

- Students are encouraged to procure components from international component distributors (e.g., Mouser, DigiKey, Arrow Electronics, LCSC)
- Students are encouraged to get the PCBs manufactured from international PCB manufacturers (e.g., JLCPCB, PCBway)
- Main functionality of the project must be achieved with basic electronic components such as resistors, capacitors, inductors, diodes, transistors and other analog integrated circuits.
- Using any other pre-built programmable ICs are prohibited.
- Microcontrollers can be only used for user interface operation.
- Enclosure design must be done using a professional software (Solidworks)
- Enclosure and 3D model of the circuit must be assembled and inspected before manufacturing.
- 3D printing, Laser cutting and Sheet metal bending can be used to manufacture the enclosure.
- Students are encouraged to consider the 3D model and PCB co-design (design in parallel by taking their integration into consideration) when designing.
- Final implementation of the project need to done in a PCB.
- Follow provided “General guidelines”.