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Developments of a pid temperature control system for a PCR chip

A Polymerase Chain Reaction on chip needs a precise temperature control for the reaction cycle. It is necessary to create and develop a good temperature control system for the operation of the PCR chip. Thin Pt film will be used as the heater and temperature sensor. The heating circuit will be controlled by a PID (Proportional, Integral, and Derivational) controller based on LabView and a power MOSFET operated using PWM. The PCR chip needs heating/cooling cycles which require a temperature increase to a certain point and maintain for some time and go to some other points (94, 72 and 54 C). For testing purpose, a testing circuit was created using a power MOSFET, a RTD (Platinum Resistance Temperature Detector) as the temperature sensor and a piece of graphite as the heater. The Pt RTD was used in this circuit, because the Pt resistance has a linear relationship with the temperature and could be used to calibrate the deposited Pt film on chip. A LabView program was developed to control the heating power through a Power MOSFET by modulating the duty cycle of the VGS pulse train. The main function of the program includes temperature sensing, PID temperature controlling, data logging, etc. The parameters of the PID were tuned up by Ziegler-Nichols frequency response method. Experiment shows good control of the temperature within +/- 1 degree.