SIMULATION OF TEMPERATURE CONTROLLED FAN USING MATLAB

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ABSTRACT:-High heat flux on a chip or high temperature region on a microprocessor chip called HOTSPOTS. The hotspots degrade the performance of the microprocessor chip. The existing cooling methods requires heat sink & Air to cool a chip. This simulation investigate the PID Control for remediate the hotspot on heatsink. Whenever the heat sink reach the hotspot temperature, the control algorithm enable the fan ON & regulate the fan speed to maintain the uniform surface temperature of heat sink.

Keywords - Hotspots, PID control.

I. INTRODUCTION:

Computers generate heat when they work. Is it a result of information processing? A computer's CPU works by either enabling electric signals to pass through its microscopic transistors or by blocking them. As electricity passes through the CPU or gets blocked inside, it gets turned into heat energy. While a processor in a high-performance workstation may run hot due to heavy use, a processor in a regular computer that overheats is almost always a sign of a malfunctioning system. Electronic device need to be in uniform temperature for good performance.

A. HOTSPOTS IN MULTI CORE PROCESSOR:

Microprocessor chip and packages are an integrated circuits. They are the keystone of modern electronics Microcontrollers, microprocessors, and FPGAs, all packing thousands, millions, even billions of transistors into a tiny chip, are all integrated circuits. One of the guiding principles of computer architecture is known as Moore's Law.

Moore's law - One of the guiding principles of computer architecture is known as Moore's Law. In 1965 Gordon Moore stated that the number of transistors on a chip will roughly double each year (he later refined this, in 1975, to every two years).

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III. PROBLEM DESCRIPTION:

High heat flux on a chip or high temperature region on a chip called HOTSPOTS. It affects the performance of microprocessor chip.

A. OBJECTIVE:

By maintain the uniform surface temperature on the heat sink the hotspot on the microprocessor chip is reduced by enabling the PID based control techniques. This will regulate the regulate the fan speed & provide the effective heat transfer.

B. METHODLOGY:

Methodology for proposed work, PID based control is one of the best way for provide effective cooling & maintain device reliability.

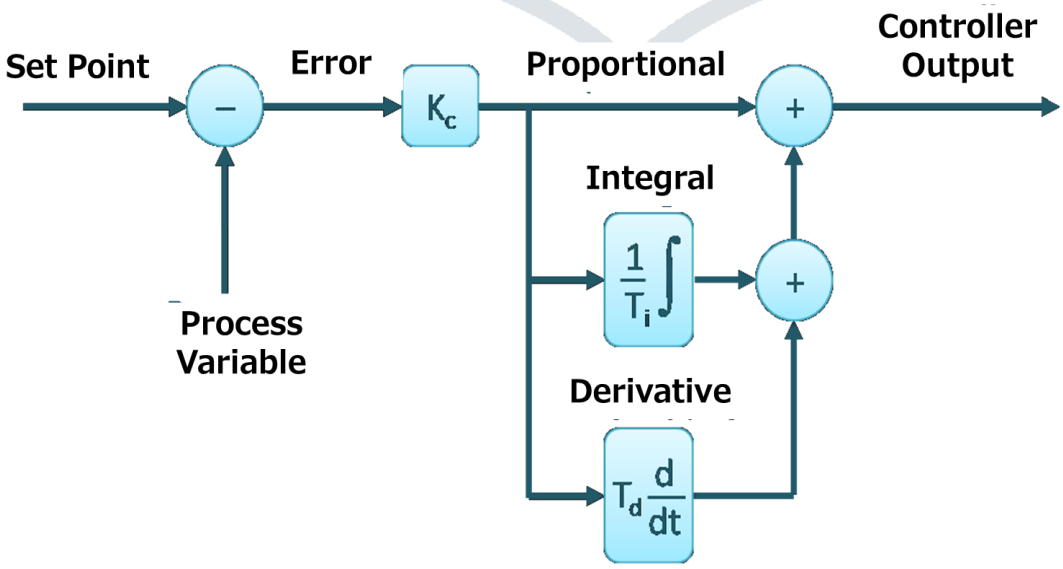

Fig 1 – PID Control

1. PID Tuning on MATLAB:

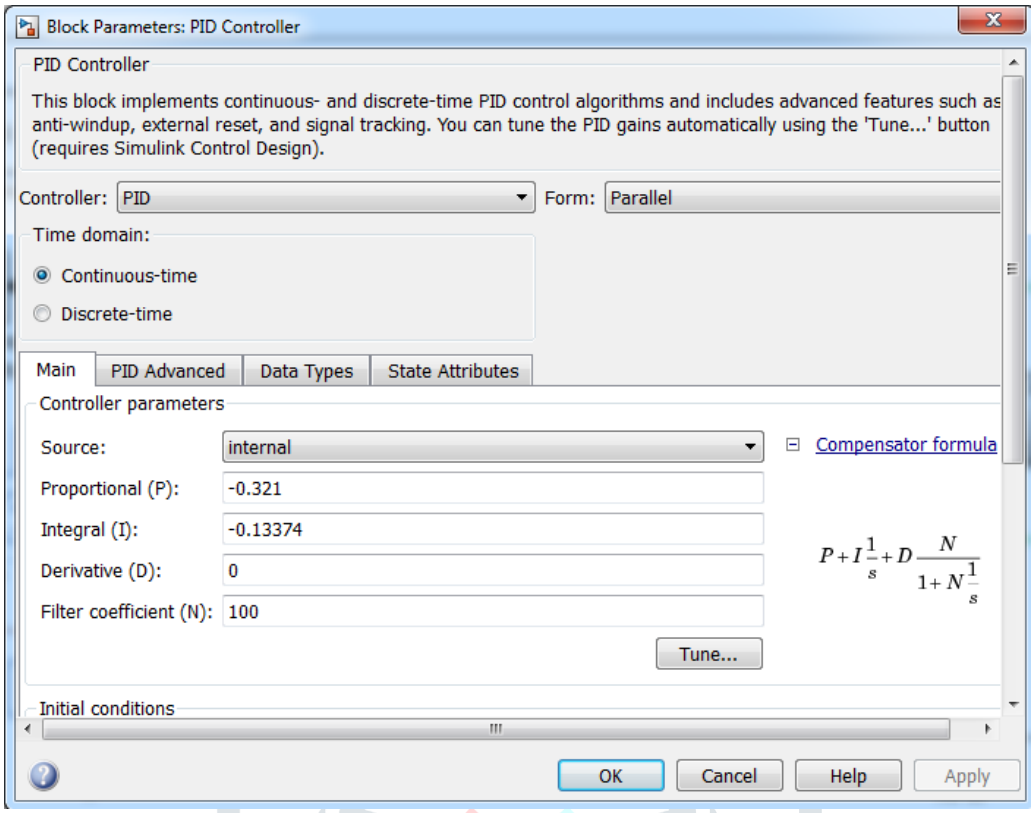

Fig 2 – PID gain Tuning in Matlab

IV. MODEL DEVELOPMENT:

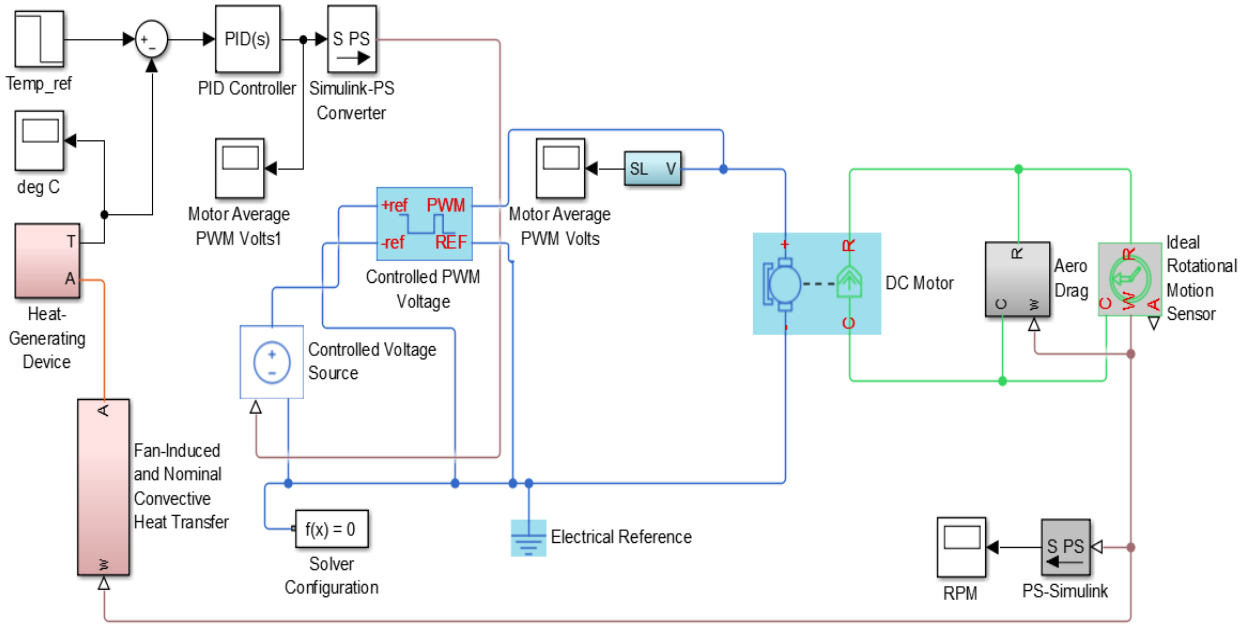

Fig 3 – Mat lab Simulink Model of Fan speed control

The heat generating device represent the Microprocessor chip & Heat Sink Model. By tune the PID Controller it regulate the fan speed & maintain the uniform surface temperature of heat generating device.

V. SIMULATION RESULTS:

When Hotspot temperatures appears on Heat sink (71ºC, 81ºC, 91ºC), The PID Control regulate the Fan speed (600, 800, 1000RPM) & maintain the temperature to 61ºC.

1. Hotspot on 71^0C :

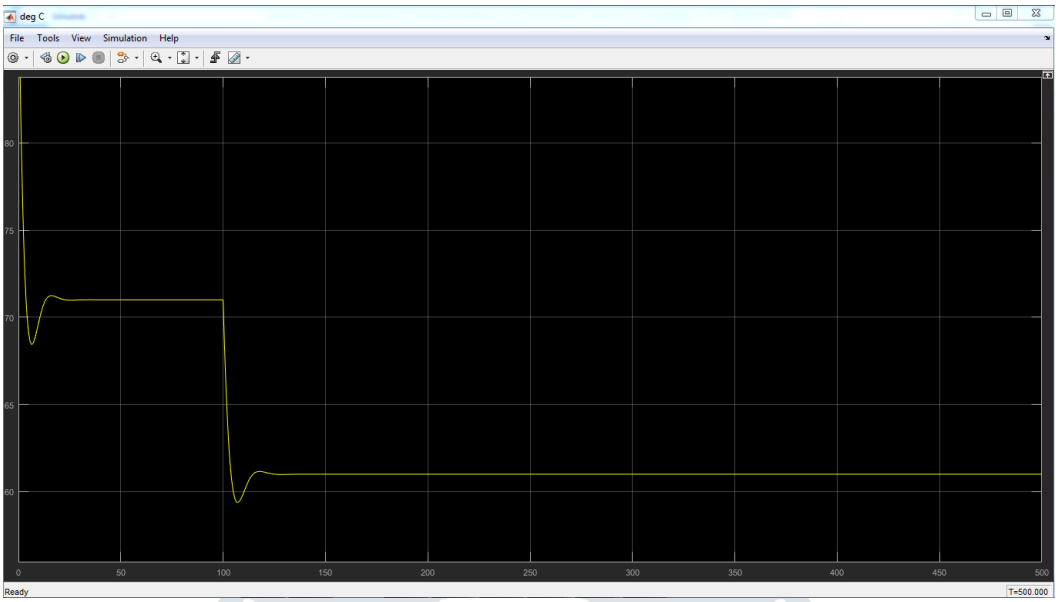

Fig 4 - Temperature reduced from 71ºC to 61ºC

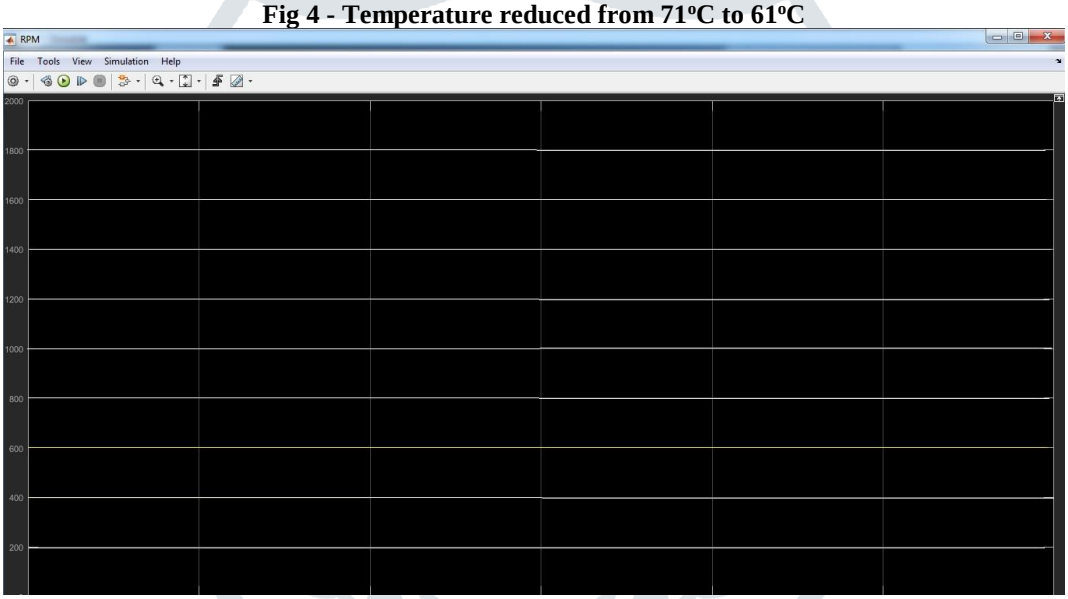

Fig 5 - Fan Speed at 600 Rpm for Hotspot 71ºC

2. Hotspot on 81^0C

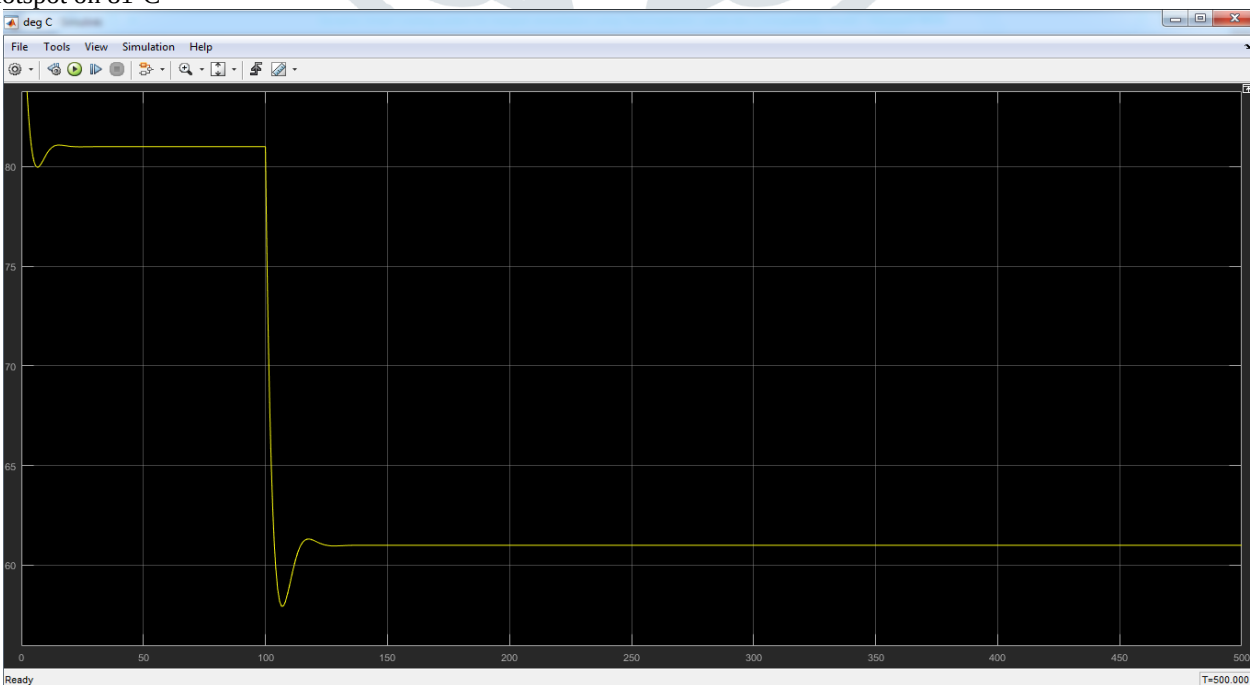

Fig 6 - Temperature reduced from 81ºC to 61ºC

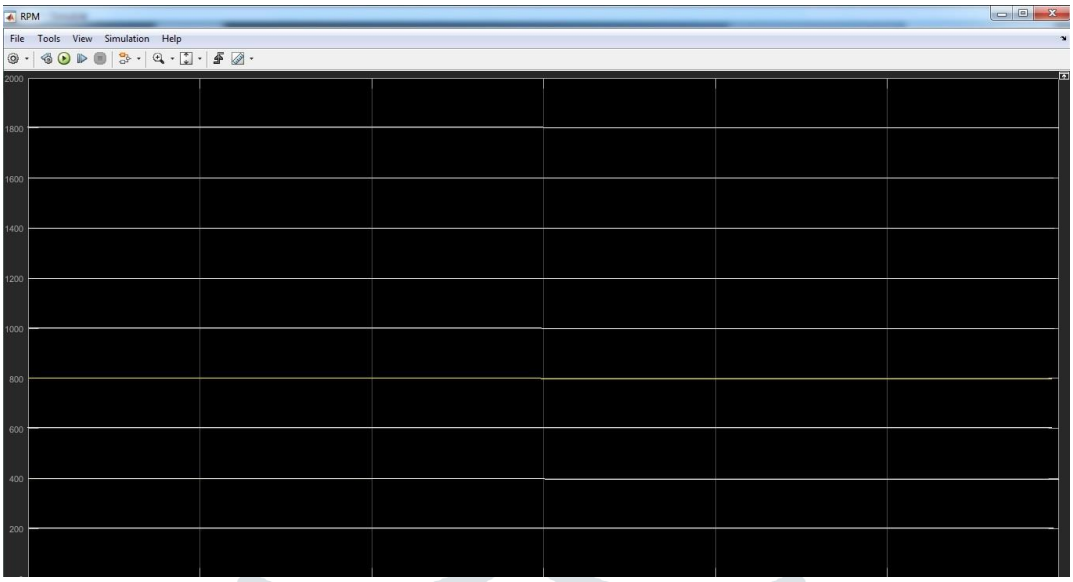

Fig 7 - Fan Speed at 800 Rpm for Hotspot 81ºC

3. Hotspot on 91ºC

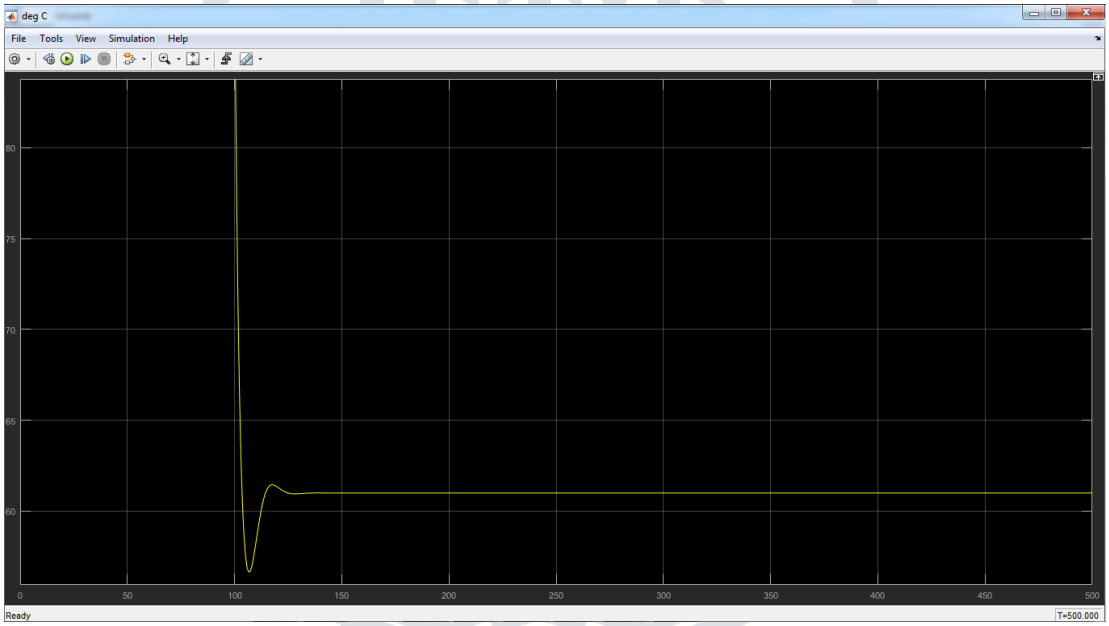

Fig 8 - Temperature reduced from 91ºC to 61ºC

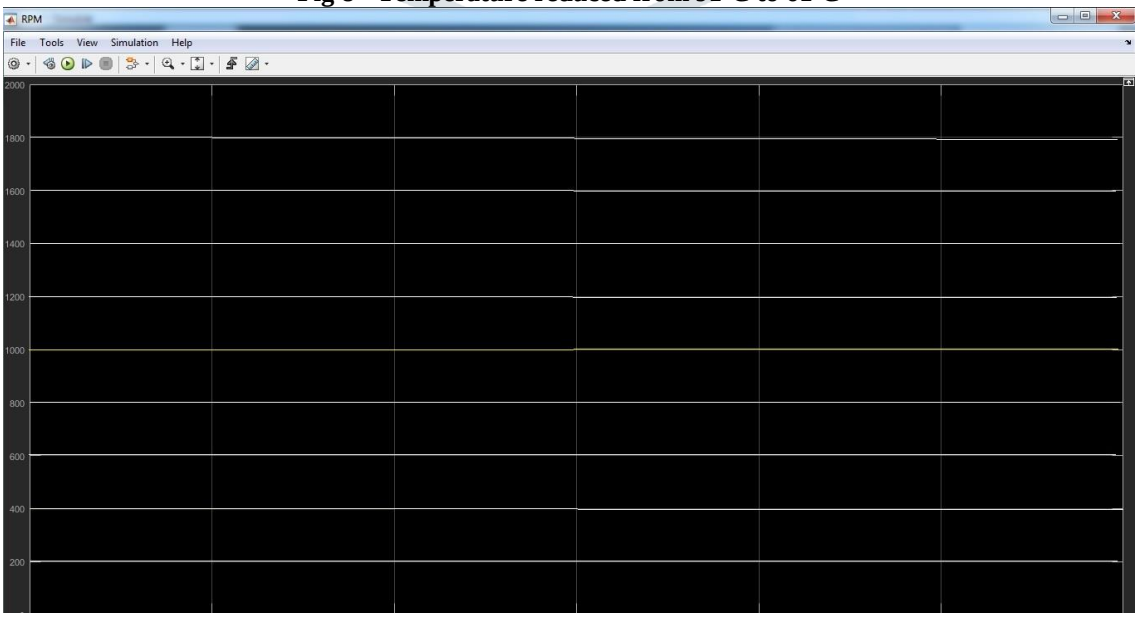

Fig – 9 Fan Speed at 1000 Rpm for Hotspot 91ºC

VI. CONCLUSION:

Whenever the HOTSPOT appears on Heat Sink, The PID control enables the cooling Fan on & regulate its speed to maintain the Uniform Surface temperature of Heat sink. In this way the effective cooling is provided for microprocessor chip & Improve its efficiency.

VII. ACKNOWLEDGMENT*:*

I express my deep sense of gratitude to my Project guide Dr. G.Kumaraguruparan - Associate Professor, Dr. C. Muruganantham - Professor and Head Department of Mechanical engineering and our Principal Dr.V. Abhaikumar for inspiring guidance and encouragement, which has enabled me to do this work.

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