AzTE Arizona Technology Enterprises

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A Smart Temperature and Energy Aware Multi-core Controller

AzTE Case # M13-116P

Background

The transition to multi-core processors has allowed their continued improvement within their limited power budget by using threads on multiple cores. By reducing the power per core and increasing the number of cores initially allowed, it is possible to circumvent the power wall of single core processors. Unfortunately, multi-core scaling is fast becoming curtailed by rising power dissipation. The maximum possible temperature a chip can tolerate is the limit of power dissipation. This limit is also known as the utilization wall. One way to overcome the utilization wall is to improve the energy efficiency of the processors.

Invention Description

Researchers at Arizona State University have developed a controller which can predict the optimal voltage/frequency setting needed to achieve energy efficiency through online power and thermal estimations while minimizing prediction error by using a filter to eliminate sensor noise. The controller's model is self-optimizing over time. Instead of a fixed objective function, STEAM optimizes for the generalized form of energy efficiency (performance-per-watt). The proposed Smart Temperature and Energy Aware Multi-core (STEAM) Controller, to our knowledge, is the first controller to determine the energy efficient operating point online.

Intellectual Property Status:

Patent Pending

Potential Applications

- All multi-core platforms
  - Desktops
  - Laptops
  - Mobile devices

Benefits and Advantages

- **Improved Models** – new power and thermal models which account for both dynamic power and leakage power leading to improved prediction accuracy
- **Faster** – simple, yet accurate thermal models, leading to faster prediction computation
- **More Robust** – In a real world implementation, the STEAM controller outperformed all existing policies on Linux by at least 32%
- **Easy to Use** – controller does not require any changes on the deployed platform

Contact

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