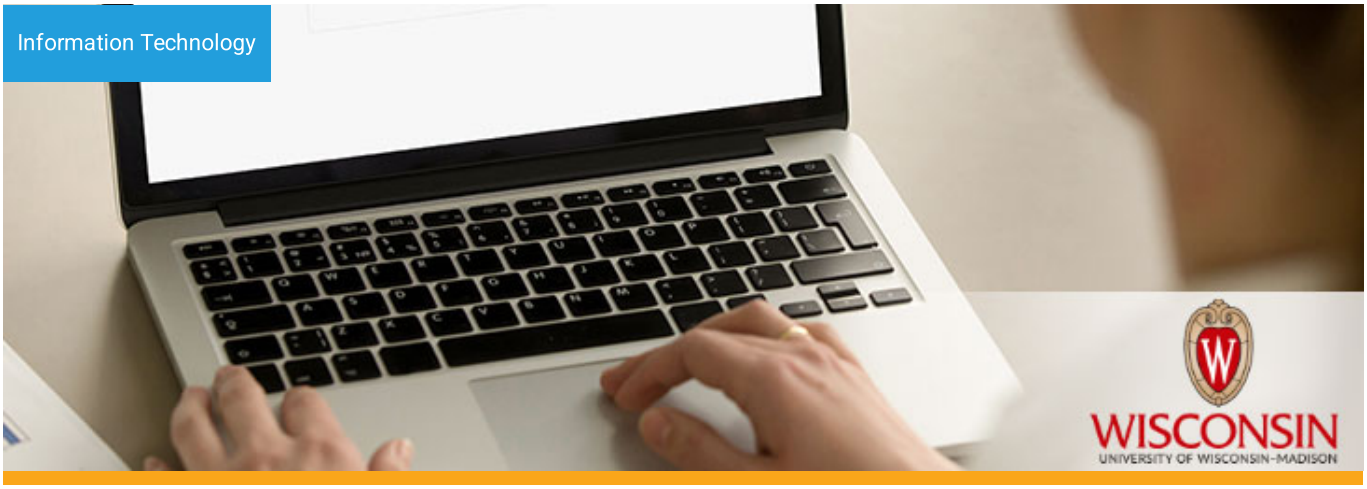
Information Technology



Voltage Regulator Control for Processors Conserves Energy

View U.S. Patent No. 9,547,355 in PDF format.

WARF: P140423US01

Inventors: Nam Sung Kim

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a voltage regulator system that improves power efficiency under different processing loads.

Overview

Managing the power consumption of computer systems is important for reducing energy costs as well as prolonging battery life on portable devices. Power delivered to a computer normally passes through one or more voltage regulators (VRs) that reduce it to a lower working voltage needed by the processor core. These VRs can be a major source of power loss, consuming as much as 22 percent of the total power in a computer system.

One method to reduce the amount of power consumed by a processor is to operate it in different 'P-states,' wherein each P-state supplies the processor with a different clock frequency and operating voltage. However, using P-state to infer how much current is being consumed by the processor core can be misleading. This is because seemingly intensive, high power tasks may actually consume low amounts of energy for a significant amount of time.

The result is an inefficient voltage regulation process.

The Invention

A UW–Madison researcher has developed an improved VR system for next-generation hardware providing direct rather than inferred current measurements. In the new system, a controller manages the number of active phases of each VR according to a determined electrical current demand from the processor.

Relying on electrical current demand (rather than P-state) boosts VR efficiency, particularly in situations where low current demand occurs under heavy processor demand because of certain power variations.

Applications

- Voltage regulator technologies
- Likely implemented within firmware using existing hardware in processors
- Mobile, desktop and server devices

Key Benefits

- Reduces total power consumption
- Provides more precise adjustment of VR operation
- Serves as a simple proxy for VR voltage
- Allows for more sophisticated control of VR efficiency

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- Determines processor voltage/current load without the need for actual sensors

Stage of Development

The new system has been shown to reduce the total power consumed by a processor and its VR by more than 19 percent and 25 percent, respectively, with negligible performance impact.

Additional Information

Related Technologies

- WARF reference number P130132US01 describes a multiplier circuit that adjusts computing accuracy during run time to conserve energy.

Tech Fields

- Information Technology : Computing methods, software & machine learning
- Information Technology : Hardware

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