# A Better Way to Cool Computer Chips Receives Support

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Researchers at the University of California, Riverside investigating better ways to cool today's high-performance computer microprocessors have received $275,000 from the National Science Foundation to further their work.

The three-year grant supports a project titled *Thermal Sensing and Control for Efficient Dynamic Thermal Management*, led by Assistant Professor of Computer Science and Engineering Jun Yang, with Assistant Professor of Electrical Engineering Sheldon X.-D. Tan, and Professor of Electrical Engineering Jie Chen. All three are faculty members at the Bourns College of Engineering at UCR.

Yang said today's Very Large Scale Integration (VLSI) microprocessors, which hold more than 100,000,000 transistors, are hindered by high power consumption and the heat they generate, which in turn creates reliability problems, reduces microprocessor service life and can sometimes physically damage the chips.

"We are developing a software-based thermal sensing system that is more accurate at monitoring heat changes during run time," Yang said. "Usually, these chips have only one thermal sensor that cannot get accurate readings for the range of temperatures found throughout the chip."

Not only do today's temperature sensors read just one location on the chip, their efficiency is hindered by the on-chip high-frequency signal

noise due to electronic interference from other processes. Temperature sensors also are unable to quickly process rapid heat buildups so readings may lag behind real-time conditions during the most critical moments. The result of these design shortcomings is significant performance degradation.

Yang proposes a two part solution. First is a fast and accurate software thermal sensor that uses a fine-tuned numerical method to quickly calculate accurate temperatures physically across the microprocessor on a given set of thermal limits.

Second is a heat control method that uses a promising control technique allowing it to operate quickly using the information developed by the software-based thermal sensor. This control system should be able to anticipate areas of heat buildup within the microprocessor and quickly cool them to within target levels.

“We hope that our findings will have broad applications in microprocessor design and development, including general-purpose processors, graphics processors, network processors and a variety of other thermal constrained, high-performance VSLI chips,” Yang said.

Source: University of California, Riverside