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# Colorado State University Engineering Professors Receive Award to Design Green Supercomputers

**FORT COLLINS** - Sudeep Pasricha, H. J. Siegel, Tony Maciejewski and Pat Burns, engineering professors at Colorado State University, have received $850,000 from the National Science Foundation for research that will enable the next generation of green supercomputing. The CSU team includes graduate and undergraduate students.

H.J. Siegel, Sudeep Pasricha, and Tony Maciejewski, computer engineering professors at Colorado State University.

The grant was awarded for the research proposal "Energy Efficient and Stochastically Robust Resource Allocation for Heterogeneous Computing." Pasricha, assistant professor in CSU's Electrical and Computer Engineering Department, is the principal investigator, with Siegel, Maciejewski and Burns serving as co-PIs.

"High energy consumption in supercomputing is inevitable given the rising complexity of these systems in an attempt to solve some of the most challenging problems in science," Pasricha said. "The goal is to bring together researchers and practitioners to collectively investigate the problem of energy-efficient computing for massively parallel supercomputers of the future."

The research team will design novel theoretical foundations, metrics, and mathematical optimization techniques for robust, energy-efficient, and power-constrained resource management in heterogeneous large-scale parallel computing systems. In doing so, the research will attack rising energy consumption, which is one of the biggest challenges facing high-performance computing (HPC) systems today.

"HPC systems are the backbone of the worldwide Internet and cloud computing revolution," said Maciejewski, head of CSU's Electrical and Computer Engineering Department. "As these systems become even more integrated with everyday life, it's very important that we focus on limiting their carbon footprint and reducing their energy costs, which can run into several millions of dollars every year for many HPC systems."

The three-year research project led by CSU also involves collaboration with researchers and state-of-the-art HPC systems at Oak Ridge National Laboratory, the National Center for Atmospheric Research, and Lagrange Systems.

"Computing systems are often a heterogeneous mix of machines and networks that experience degraded performance due to such problems as machine failures, changes in workload, or other uncertainties," said Siegel, who is the Abell Distinguished Professor of Electrical and Computer Engineering at CSU. "It is essential to consider robustness and energy together to ensure that computation proceeds without unforeseeable interruptions and in a sustainable manner."

Pasricha is the director of CSU's Multicore Embedded Computing Lab, which is funded by the Air Force Office of Scientific Research, Semiconductor Research Corp., NASA and NSF. His research focuses on the design and optimization of hardware and software for embedded, mobile, and high-performance

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computing, with an emphasis on energy efficiency, fault tolerance and integration of emerging technologies.

Siegel and Maciejewski serve as co-directors of the CSU Center for Robustness in Computing Systems, which has been funded by the Colorado Commission on Higher Education Technology Advancement Group; DARPA, and an earlier NSF grant.
Siegel's research focuses on distributed computing and communication systems, heterogeneous computing, parallel processing, computer architectures and algorithms, and interconnection networks. Maciejewski's research and teaching interests center on the design and analysis of robust systems, including fault-tolerant robotic systems for operation in hazardous or remote environments.

Burns has been performing research in the area of thermal systems for 38 years, analyzing and modeling facility thermal systems. In addition to his position as a professor of Mechanical Engineering at CSU, he is the Vice President for Information Technology and responsible for the university's main HPC computing centers.

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