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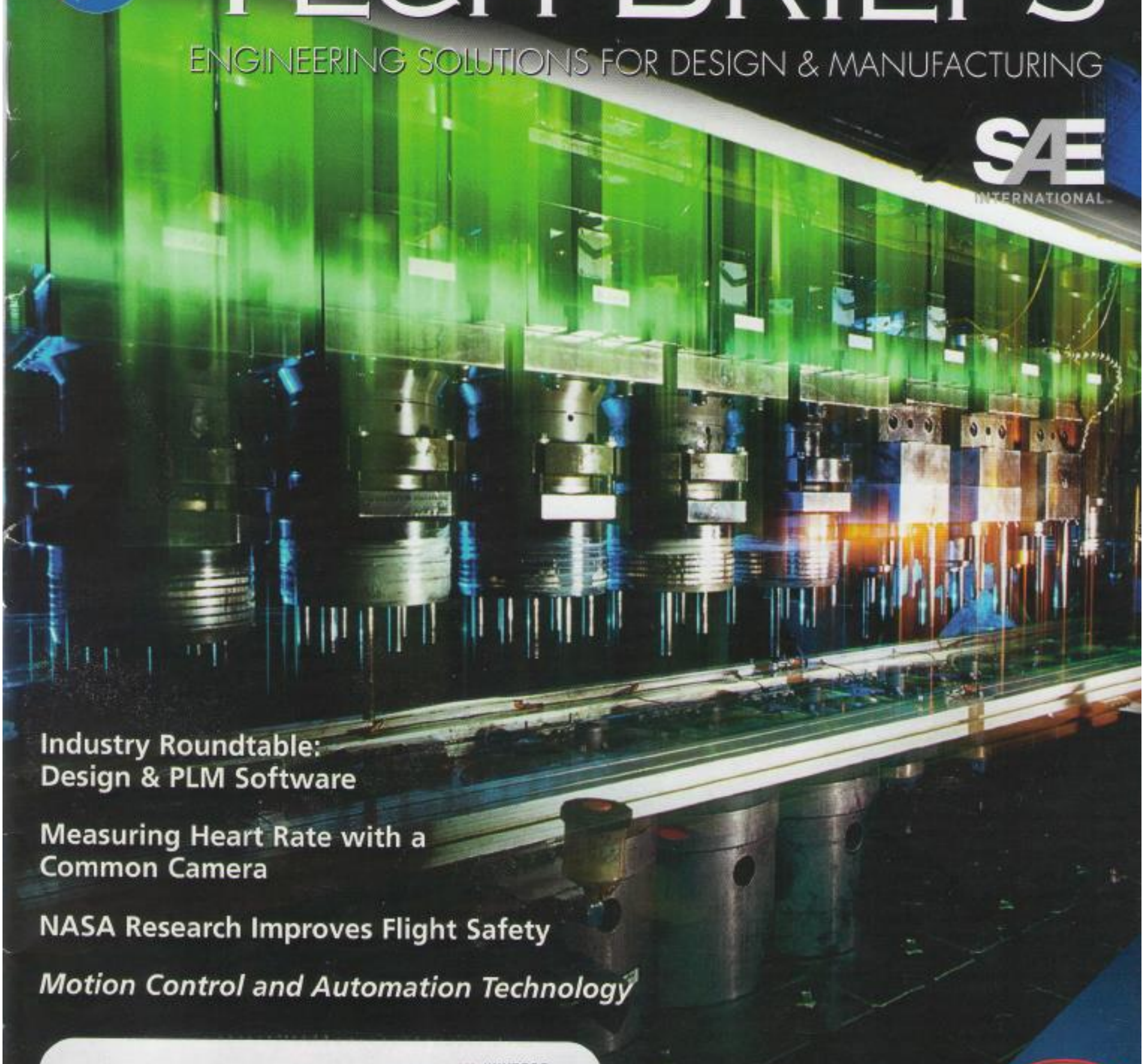

Industry Roundtable: Design & PLM Software

Measuring Heart Rate with a Common Camera

NASA Research Improves Flight Safety

Motion Control and Automation Technology

Entry of an encrypted password allowing access to the protected item could be used to avoid prompt issuance of an alarm signal.

This work was done by Stevan M. Spremo and Usen E. Udoh of Ames Research Center. ***For more information, download the Technical Support Package (free white paper) at www.techbriefs.com/tsp under the Electronics/Computers category.***

Inquiries concerning rights for the commercial use of this invention should be addressed to the Ames Technology Partnerships Division at 1-855-NASA-BIZ (1-855-6272-249) or sumedha.garud@nasa.gov. Refer to ARC-15684-1.

Sensor for Spatial Detection of Single-Event Effects in Semiconductor-Based Electronics

The positional ionizing radiation sensor detects energy levels that cause faults in electronic circuits.

Marshall Space Flight Center, Alabama

Ionizing radiation has a detrimental effect on digital electronics that need to operate in extraterrestrial environments. As space missions become longer and more complex, there is a need for flight computers that can withstand harsh radiation environments while delivering the increased computation and power efficiency required by future missions. Field-programmable gate arrays (FPGAs) are becoming an attractive platform for flight computers due to their inherent flexibility through in-flight reprogrammability. FPGAs promise to deliver reconfigurable computing platforms that can dynamically alter hardware architectures to address the current application demand. While FPGAs are attractive from a performance perspective, they can be especially susceptible to single-event effects caused by ionizing radiation. In addition to traditional circuit faults caused by radiation, FPGAs are prone to faults in their configuration memory. These faults can physically alter the hardware, leading to failures that cannot be recovered from using traditional fault mitigation techniques.

A sensor was designed to detect the spatial location of radiation strikes of energy levels that can cause faults in commercial FPGA substrates. A tile-based computing architecture has been designed to take advantage of the sensor information to spatially avoid regions with potential faults, and then perform a repair procedure in the background.

The sensor is integrated with the many-tile computing system implemented on an FPGA to provide environmental information to the computer in order to improve its fault tolerance. The X-Y location of ionizing radiation strikes is passed to the computer, and is used to spatially avoid and repair potentially faulted regions of the computer fabric.

There have been numerous sensor designs for monitoring position and energy of radiation with variations in resolution and system integration. The design selected utilizes double-sided strip detectors and silicon drift detectors for their simple design, speed, and ease of production without sacrificing position and energy resolution. The principle of the strip detector is based on a large area p-n diode, very similar to a solar cell. The difference stems from the electrodes in the radiation sensor, which are broken up into narrow strips running orthogonal to each other on both sides of the substrate, each of them being read-out with a separate electronic channel. The location of the ionizing radiation is given by the position of the intersection of the strips receiving the signals from the front.

This sensor is unique in that it detects energy levels that are only capable of causing faults in semiconductor-based electronics. The use of the sensor to provide environmental information to a digital circuit so that the digital circuit can preemptively mitigate a possible fault is a novel use-model for a radiation sensor.

This work was done by Brock LaMeres and Todd Kaiser of Montana State University for Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32975-1