Keynote Talk

Advancing NASA's On-Board Processing Capabilities with Reconfigurable FPGA Technologies: Opportunities & Implications

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Abstract

Future NASA missions will require measurements from high data rate instruments. Recent internal studies at NASA's Jet Propulsion Laboratory (JPL) estimate approximately 1–5 Terabytes per day of raw data (uncompressed) are expected. Implementations of on–board processing algorithms to perform lossless data reduction are required to drastically reduce data volumes to within the downlink capabilities of the spacecraft and existing ground stations. Reconfigurable Field Programmable Gate Arrays (FPGAs) can include embedded processors thereby providing a flexible hardware and software co–design architecture to meet the on–board processing challenges of these missions while reducing the critical spacecraft resources of mass and volume of earlier generation flight–qualified single board computers such as the Rad750. Reconfigurable FPGAs offer unique advantages over one–time programmable (OTP) FPGAs with the flexibility to update processing algorithms as needed during the development cycle and even post–launch. So what's the downside? The space radiation environment poses challenges to these devices and in general, new technology introduces risk, either real or perceived, to one-of-a-kind space missions that cost hundreds of millions up to $1 billion. This talk will highlight both the opportunities and implications of advancing NASA's future on-board processing capabilities with reconfigurable FPGA technologies.

Brief Bio

Paula Pingree earned her Bachelor of Engineering degree from Stevens Institute of Technology in Hoboken, NJ and began her career in the Aerospace field at GE Astro Space in NJ. She has since spent 15 years at NASA's Jet Propulsion Laboratory in Pasadena, CA and earned her Master's degree in Electrical Engineering at California State University, Northridge. At JPL, Ms. Pingree has contributed to the design, integration, test and operations of several flight projects including the Cassini mission to Saturn, the Mars Global Surveyor orbiter, the New Millennium technology mission known as Deep Space 1 and the Deep Impact mission to comet Tempel 1. Most recently she delivered the Electronics Unit for the upcoming Juno mission's Microwave Radiometer instrument, scheduled for launch to Jupiter in Aug. 2011. Ms. Pingree is the supervisor of the Flight Instrument Electronics group at JPL and is also Principal Investigator for an advanced technology task to develop an on-board processing platform, featuring the Xilinx Virtex-5 FPGA, to optimize the imaging system for an instrument known as MSPI (Multi-angle Spectropolarimetric Imager) that is under development for a future decadal survey mission to study the Earth's Aerosols, Clouds and Ecosystem.