Reconfigurable Computing for Space

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In this talk, Dr. Donohoe will describe ongoing projects at the University of Idaho to develop reconfigurable computing technology for spacecraft. Spacecraft present some unique computing challenges. Orbiting satellites employ complex sensors such as hyperspectral imagers and imaging radar to analyze phenomena in the atmosphere and on the ground on Earth and in the starts, and deep space probes analyze distant planets. Planetary rovers use machine vision to navigate over planetary surfaces. All these sensors require high-performance on-board computing. Putting high-performance computers in space is not easy, however. Space-borne computers must be small and light weight, durable, autonomous and reliable, consume very little power, and be resistant to radiation.

One solution is reconfigurable computing. While conventional computers execute a serial stream of instructions on fixed hardware, reconfigurable computers “rewire” themselves on the fly to optimize their architecture for the problem at hand. The goal is to achieve the performance of application-specific hardware with the flexibility of software.

The Field Programmable Processor Array (FPPA) is a reconfigurable processor chip being developed at the University of Idaho under NASA funding. It will be fabricated in a radiation-tolerant CMOS technology. The FPPA project includes a suite of design and simulation software. A new project, the Reconfigurable Processing Platform, will put FPPA chips and configurable memory modules on a single processor board.

This talk will give an overview of reconfigurable computing and the FPPA processor, and describe some of the on-board processing applications that it will be used for.