IMPLEMENTING SPACEWIRE RMAP LINKS IN FLASH-BASED FPGA TECHNOLOGY

Session: SpaceWire Components

Short Paper

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ABSTRACT

Aeroflex Gaisler (Sweden) is developing the software and the digital part of a Motion Control Chip (MCC) in an activity that is being lead by ÅAC Microtec (Sweden) under a contract with the European Space Agency (ESA). The Motion Control Chip (MCC) is a freestanding component that can control up to three brushed motors or one brush-less motor in torque, position or velocity mode, and will be implemented as an advanced 3D-multi-chip-module (3D-MCM).

The baseline design includes a field programmable gate array (FPGA) as a naked die for the implementation of the digital part. To allow for programmability and future enhancements, a re-programmable FPGA has been selected. The choice of a re-programmable over a one-time programmable FPGA has been driven by various factors, the two most prominent being that the 3D-MCM should be possible to program to different customer's needs and that qualification of programming procedures for one-time programmable FPGAs as a naked die is not straightforward.

The Actel ProASIC3 RT3PE3000L FPGA part has been chosen for the implementation of the digital logic. Although this part can tolerate a total ionizing dose (TID) of up to 20 krad and is basically single event latch-up (SEL) free, it exhibits some sensitivity to single event upsets (SEU) and transients (SET) that needs to be taken into account during logical design.

The system can be interfaced either via a CAN interface or via SpaceWire links. The advantage of using SpaceWire links with built-in RMAP target capability is that the system can be controlled remotely, allowing upload of software to the non-volatile Flash PROM memory or directly to the volatile SRAM memory etc.

The full paper will discuss in detail the functionality and architecture of the FPGA design, the mitigation techniques that where used against radiation effects, the digital IP cores, such as the SpaceWire IP core implementing a complete RMAP target, that have been integrated to form the system-on-a-chip design, and the foreseen type of systems in which the device is envisaged to be used such as exoskeletons, robotic arms, drills, wheels and masts on rovers, etc.

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