

Radiation-Hardened Electronics for Advanced Communications Systems

Novel approach enables high-speed special-purpose processors

Advanced reconfigurable and reprogrammable communication systems will require sub-130-nm electronics. Legacy single event upset (SEU) radiation-tolerant circuits are ineffective at speeds greater than 125 MHz. In Phase I of this project, ICs, LLC, demonstrated new base-level logic circuits that provide SEU immunity for sub-130-nm high-speed circuits. In Phase II, the company developed an innovative self-restoring logic (SRL) circuit and a system approach that provides high-speed, SEU-tolerant solutions that are effective for sub-130-nm electronics scalable to at least 22-nm processes. The SRL system can be used in the design of NASA's next-generation special-purpose processors, especially reconfigurable communication processors.

The SRL semicustom library is designed to replace triple modular redundancy (TMR) as the on-chip means for fault tolerance. With these building blocks in place, advanced reconfigurable and programmable high-speed devices can be implemented. ICs designed and fabricated a robust test circuit. Radiation testing to fully characterize SRL verified the SRL synthesis library for developing advanced communication systems with clock speeds even higher than 700 MHz. The innovation enables the development of special-purpose, high-speed application-specific integrated circuits (ASICs).

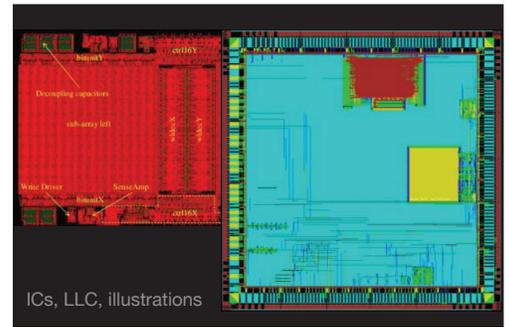
Applications

NASA

- ▶ Sub-130-nm electronic foundation for SEU-tolerant electronics
- ▶ Electronic base for reconfigurable communication systems
- ▶ Single-chip communication systems

Commercial

- ▶ Aircraft systems
- ▶ Security organizations
- ▶ Financial systems
- ▶ Automobile systems
- ▶ Real-time control electronics



Phase II Objectives

- ▶ Design SRL synthesis library for use with commercial computer-aided design tools:
 - Traditional latches, logic, and arithmetic elements
 - Low-voltage digital switching (LVDS) modules
 - On-chip random access memory (RAM) cells
 - Serial-to-parallel and parallel-to-serial converters
- ▶ Design and fabricate SRL test chip for performance and radiation testing:
 - SRL latches to conclusively prove high-speed operation
 - Control legacy radiation hardening by design (RHBD) cells
 - Nonredundant storage elements
 - LVDS circuits
 - Memory cells

Benefits

- ▶ Utilizes high-quality commercial complementary metal oxide semiconductor (CMOS) processes for SEU-tolerant ASICs
- ▶ Offers high-speed, radiation-hardened, fault-tolerant capabilities

Firm Contact

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Proposal Number: 10-2 01.02-9491