

数字太敏 SoC 的抗 SEU 加固设计

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摘要: 针对航天应用中数字式太阳传感器高可靠性的要求, 对基于 Leon3 处理器平台的数字式太阳传感器 SoC 在 RTL 级进行抗 SEU 加固设计. 出于加固后整个系统速度和面积的考虑, 本文针对 SoC 中不同部分采取不同的加固方法, 综合使用了三模冗余、EDAC (Error Detection And Correction) 电路、CPU 流水线重启和 Cache 强制不命中等容错方法. 使用故障注入的方法测试寄存器文件加固后系统的软错误敏感性, 对寄存器加固效果进行评估. 并在 FPGA 上进行原型实现, 对比加固前后的速度及开销情况.

关键词: 数字太敏; SoC; SEU; 故障注入; FPGA

SEU Tolerant Design for Digital Sun Sensor SoC

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Abstract: For the high reliability of digital sun sensor in aerospace applications, the SEU tolerant design for Leon3 based digital sun sensor SoC in RTL level was fulfilled. In considerations of the speed and size of the entire system, we adopt various strengthening methods for different parts of SoC, including triple modular redundancy, EDAC (Error Detection And Correction) circuit, pipeline restart of CPU, forcing cache to miss, etc. in order to evaluate the strengthening effect of registers, we need the soft error sensitivity getting from the fault injection test on the system with register file strengthened. Then, the prototype was implemented in FPGA and compared the speed and overhead with non strengthened design.

Key words: digital sun sensor; SoC; SEU; fault injection; FPGA

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