

FPGA Reliability and Failure Rate Analysis for Launch and Space Vehicles Environments

Abstract

Field Programmable Gate Arrays (FPGAs) integrated circuits (IC) are one of the key electronic components in today's sophisticated launch and space vehicle complex avionic systems, largely due to their superb reprogrammable and reconfigurable capabilities combined with relatively low non-recurring engineering costs (NRE) and short design cycle. Consequently, FPGAs are prevalent ICs in communication protocols and control signal commands. This paper will demonstrate guidelines to estimate FPGA failure rates for ascent and in space operations. The guidelines will account for hardware and radiation-induced failures, as well as Bayesian updates to failure rates. The hardware contribution of the approach accounts for physical failures of the FPGA IC. The radiation portion will expand on FPGA susceptibility to different space radiation environments.

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