Field Programmable Gate Array Failure Rate Estimation Guidelines for Launch Vehicle Fault Tree Models

Abstract

Today's launch vehicles complex electronic and avionic systems heavily utilize the Field Programmable Gate Array (FPGA) integrated circuit (IC). FPGAs are prevalent ICs in communication protocols such as MIL-STD-1553B, and in control signal commands such as in solenoid/servo valves actuations.

This paper will demonstrate guidelines to estimate FPGA failure rates for a launch vehicle, the guidelines will account for hardware, firmware, and radiation induced failures. The hardware contribution of the approach accounts for physical failures of the IC, FPGA memory and clock. The firmware portion will provide guidelines on the high level FPGA programming language and ways to account for software/code reliability growth. The radiation portion will provide guidelines on environment susceptibility as well as guidelines on tailoring other launch vehicle programs historical data to a specific launch vehicle.

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