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RADIATION EFFECTS VULNERABILITY EVALUATION OF SPACEBORNE ELECTRONICS USED IN COMPUTATION INTENSIVE SPACE TASKS

Abstract

Energetic particles radiation effects are one of the most concerns to avionics systems and even in terrestrial environment, because the energetic ions can cause errors to computation systems only if the charge generation by particles striking is larger than the noise margin of the subsequent gates to cause a circuit upset. Many literatures have proposed the vulnerability analysis to system programe and corresponding hardware to get a guideline for radiation hardness. These analyses often concerntrate on control intensive tasks evaluation and the processor dedicated for control-intensive tasks. This paper tries to answer the question from the perspective of vulnerability factor that how the single particle strike affects the computation intensive tasks of the future space mission with massive images and signals processing. This paper firstly gives a scope of faults, errors and how faults propagates to be an observable error. Following, the vulnerability based analysis method is discussed. Next, the characteristics of a dedicated processor for massive computation are analyzed. With a set of benchmarks frequently used in image and signal processoing, we obtained the most vulnerable components and appropriate error mitigating techniques are adopted to promote the system reliability.