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Abstract

System reliability has become a main concern during the computer-based system design process. It is one of the most important characteristics of the system quality. The continuous increase of the system complexity make the reliability evaluation extremely costly. Therefore, there is need to develop new methods with less cost and effort. Furthermore, the system is vulnerable to both software and hardware faults. While the software faults are usually introduced by the programmer either at the design or the implementation stage of the software, the hardware faults are caused by physical phenomena affecting the hardware components, such as environmental perturbations, manufacturing defects, and aging-related phenomena. The software faults can only impact the software components. However, the hardware faults can propagate through the different system layers, and affect both the hardware and the software. This paper discusses the differences between the software testing and the software fault injections techniques used for reliability evaluation. We describe the mutation analysis as a method mainly used in software testing. Then, we detail the fault injection as a technique to evaluate the system reliability. Finally, we discuss how to use software mutation analysis in order to evaluate, at software level, the system reliability against hardware faults. The main advantage of this technique is its usability at early design stage of the system, when the instruction set architecture is not available. Experimental results run to evaluate faults occurring the memory show that the proposed approach significantly reduces the complexity of the system reliability evaluation in terms of time and cost.

Keywords: System Reliability, Hardware, Software, Mutation Testing, Fault Injection, Soft Errors.

1. Introduction

Reliability is one of the most important characteristics of the system qual-

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