

An Electronic System Reliability Analysis Method Based on Petri Net Considering Hybrid Fault of Software and Hardware

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ABSTRACT

Considering the close interaction between software and hardware in complex electronic systems, the fault modes, fault mechanisms and fault processes of common software and hardware in such systems are analyzed. Based on software and hardware fault analysis and combined with improved Petri net, the mixed modeling and analysis of software and hardware in complex electronic system were conducted. The model considers the complex interaction relationship between software and hardware in the system. An example will be given, and an improved Petri net model is used to build a reliability analysis model for a typical equipment, and further qualitative and quantitative analysis is carried out to verify the feasibility of the method.

KEYWORDS: petri nets, electronic system, software, hardware, hybrid fault, reliability analysis

1. INTRODUCTION

Complex electronic systems usually take computer systems as the core, and the software and hardware in the system are combined organically to complete the functions specified by the system [1]. At present, many researches on electronic systems start from the perspective of software reliability or hardware reliability. Few researchers consider the interaction between software and hardware in the system during the reliability analysis process. In fact, the interaction between software and hardware has a great impact on the fault of the system. Based on this, we propose a new fault mode, which is called hardware and software hybrid fault [2].

Petri net model was adopted to evaluate the reliability of software and hardware of electronic system [8]. Petri net is a graphical and mathematical modeling and analysis method, and it is very easy to improve. In the field of reliability, the improved Petri net is mainly used for qualitative analysis of the system [7], such as fault diagnosis [5, 6]. It can express the logical relationship of faults; be suitable for describing the change of system state and behavior; accurately describe the generation and propagation characteristics of faults in the system; and reflect the dynamic propagation process of faults. We can use Petri nets to describe the hardware and software hybrid fault modes proposed by the subject [3, 4], and clearly show the interaction and propagation of software and hardware experienced during the fault generation process. The above characteristics of Petri net

provide an effective way to solve the reliability modeling and analysis problems of electronic systems. In this paper, we will study a method for reliability modeling and reliability analysis of electronic systems using Petri nets based on the above theory.

The rest of this paper is organized as follows. In the second part, according to the close connection between electronic system software and hardware, the usual software and hardware faults in the system are combined to propose the common fault modes in complex electronic systems--software and hardware hybrid faults. Part three introduces the basic theory of Petri nets and improves it. In the fourth part, an example is given to describe how to use improved Petri net to do reliability modeling and analysis of common electronic systems under the premise of considering mixed fault of software and hardware. The fifth part is the conclusion of this paper.

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