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Analysis techniques for dependability - Petri net techniques

可信性分析技术 佩特里网技术

(English Translation)

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Table of Contents

Preface	
Introduction	
1 Scope	
2 Normative reference documents	
3 Terms, definitions, symbols and abbreviations	1
3.1 Terms and definitions	
3.2 Symbol	
3.3 Abbreviations	
4 Overview of Petri Net	
4.1 Non-temporal low-level Petri net	
4.2 Temporal low-level Petri net	
4.3 Advanced Petri Net	
4.4 Extension and modeling of Petri net	5
5 Petri net credibility modeling and analysis	
5.1 General steps of modeling	
5.2 Detailed steps of modeling	
6 Relationship to other credibility models	11
Appendix A (Informative) Structure and Dynamics of Petri Net	
Appendix B (Informative) Availability of m/n redundancy	
Appendix C (Informative) Brief Example	
Appendix D (informative) Modeling of typical credibility concepts	
Appendix E (informative) Level crossing example	
Reference	

Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents" Drafting.

This document is equivalent to IEC 62551:2012 "Credibility Analysis Technology Petri Net Technology".

Please note that some content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents.

This standard is proposed by the Ministry of Industry and Information Technology of the People's Republic of China.

This standard is under the jurisdiction of the National Standardization Technical Committee on Reliability and Maintainability of Electrical and Electronic Products (SAC/TC24).

Introduction

This document provides a basic method for representing the basic elements of Petri nets [1], as well as application guidelines for this technology in the field of credibility.

The inherent ability of Petri net modeling enables it to describe the behavior of the system by modeling local states and local event relationships. rely on with this background, Petri nets have been applied in many industrial fields (such as information, communications, transportation, production, processing and manufacturing, and energy engineering) gained widespread recognition.

Traditional methods (such as fault trees and reliability block diagrams) cannot handle polymorphic systems, cannot model the behavior of dynamic systems, and encounter state State combinatorial explosion problem (such as Markov process). are quite limited in dealing with real industrial system problems and therefore require additional modeling and Calculation method.

The credibility calculation of industrial systems aims to evaluate the various states of the system and events (such as failure, repair, regular inspection, night, day, etc.) Models how a system evolves from one state to another when it occurs.

Petri net has a graphical representation and can effectively support the modeling of reliability engineers. It is a very promising credibility construction method.

modeling and computing technology.

Analytical calculations are usually only applicable to small systems and/or require strong premise assumptions (such as exponential laws, small probabilities). as a processor when building an industry-level system, a qualitative breakthrough in method may be required, such as changing from analytical calculation to Monte Carlo simulation.

This document aims to define the basic principles of unified Petri nets from the perspective of credibility, and to integrate the current modeling and analysis methods of Petri nets into Qualitative and quantitative assessment methods as system trustworthiness and risk-related measures.

Credibility analysis technology Petri net technology

1 Scope

This document provides the basic method of Petri net aiming at credibility, supports system modeling, model analysis and provides analysis results. Book the method is oriented towards the measurement of all characteristics related to trustworthiness, such as reliability, availability, production availability, maintainability and safety (e.g. safety integrity Sexuality level (SIL) [2] related measure).

This document deals with the following issues related to Petri nets.

- a) Define basic terms and symbols, describe their use and graphical representation methods;
- b) outline terminology and its relationship to credibility;
- c) Introduce specific methods, including.
 - 1) Use Petri net to establish credibility model;
 - 2) Use Petri net-based technology to conduct qualitative and quantitative credibility analysis;
 - 3) Interpretation of analysis results.
- d) Outline the relationship between Petri nets and other modeling techniques;
- e) Provide practical cases.

This document does not give guidance on solving mathematical problems that arise when analyzing Petri nets. Related guidance can be found in [3] and [4].

This document is applicable to all industries requiring qualitative and quantitative credibility analysis.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations for undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to this document.

ular(IEV)-Part 192: Dependability) Note. GB/T 2900.99-2016 Credibility of electrical terminology (IEC 60050-192:2015, IDT)

3.1 Terms and definitions

The terms and definitions defined in IEC 60050-192 and the following apply to this document.

3.1.1

componentcomponent

The smallest component unit that physically cannot be further decomposed while maintaining its specific function.

[Source. IEC 60050-151:2001,151-11-21] 3.1.2 eventevent something that happens at a certain moment.

Note: From a purely physical perspective, an event acts as a point in space-time.