Analysis techniques for dependability - Petri net techniques (IEC 62551:2012)

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NATIONAL FOREWORD

See Eesti standard EVS-EN 62551:2012 sisaldab Euroopa standardi EN 62551:2012 ingliskeelset teksti.	This Estonian standard EVS-EN 62551:2012 consists of the English text of the European standard EN 62551:2012.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 16.11.2012.	Date of Availability of the European standard is 16.11.2012.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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Analysis techniques for dependability - Petri net techniques

(IEC 62551:2012)

Techniques d'analyse de sûreté de fonctionnement - Techniques des réseaux de Petri
(CEI 62551:2012)

Analysemethoden für Zuverlässigkeit - Petrinetze
(IEC 62551:2012)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 56/1476/FDIS, future edition 1 of IEC 62551, prepared by IEC/TC 56 "Dependability" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62551:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-08-06
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-11-06

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The text of the International Standard IEC 62551:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61508 Series	NOTE	Harmonised as EN 61508 Series (not modified).
IEC 61508-4:2010	NOTE	Harmonised as EN 61508-4:2010 (not modified).
IEC 61508-1:2010	NOTE	Harmonised as EN 61508-1:2010 (not modified).
IEC 61165:2006	NOTE	Harmonised as EN 61165:2006 (not modified).
IEC 60812:2006	NOTE	Harmonised as EN 60812:2006 (not modified).
IEC 61025:2006	NOTE	Harmonised as EN 61025:2007 (not modified).
IEC 61078:2006	NOTE	Harmonised as EN 61078:2006 (not modified).
IEC 61511-3:2003	NOTE	Harmonised as EN 61511-3:2004 (not modified).
IEC 61703:2001	NOTE	Harmonised as EN 61703:2002 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) - Chapter 191: Dependability and quality of service	-	-

CONTENTS

INTRODUCTION

This International Standard provides a basic methodology for the representation of the basic elements of Petri nets (PNs) [1][1] and provides guidance for application of the techniques in the dependability field.

The inherent power of Petri net modelling is its ability to describe the behaviour of a system by modelling the relationship between local states and local events. Against this background, Petri nets have gained widespread acceptance in many industrial fields of application (e.g. information, communication, transportation, production, processing and manufacturing and power engineering).

The conventional methods are very limited when dealing with actual industrial systems because they are neither able to handle multi-state systems, nor able to model dynamic system behaviour (e.g. fault tree or reliability Block diagrams), and can be subject to the combinatory explosion of the states to be handled (e.g. Markov process). Therefore, alternative modelling and calculating methods are needed.

Dependability calculations of an industrial system intend to model the various states of the system and how it evolves from one state to another when events (failures, repairs, periodic tests, night, day, etc.) occur.

Reliability engineers need a user-friendly graphical support to achieve their models. Due to their graphical presentation, Petri nets are a very promising modelling technique for dependability modelling and calculations.

Analytical calculations are limited to small systems and/or by strong hypothesis (e.g. exponential laws, low probabilities) to be fulfilled. A qualitative increase is needed to deal with industrial size systems. This may be done by going from analytical calculation to Monte Carlo simulation.

This standard aims at defining the consolidated basic principles of the PNs in the context of dependability and the current usage of Petri net PN modelling and analysing as a means for qualitatively and quantitatively assessing the dependability and risk-related measures of a system.

[1] Figures in square brackets refer to the bibliography.

ANALYSIS TECHNIQUES FOR DEPENDABILITY – PETRI NET TECHNIQUES

1 Scope

This International Standard provides guidance on a Petri net based methodology for dependability purposes. It supports modelling a system, analysing the model and presenting the analysis results. This methodology is oriented to dependability-related measures with all the related features, such as reliability, availability, production availability, maintainability and safety (e.g. safety integrity level (SIL) [2] related measures).

This standard deals with the following topics in relation to Petri nets:

a) defining the essential terms and symbols and describing their usage and methods of graphical representation;

b) outlining the terminology and its relation to dependability;

c) presenting a step-by-step approach for

   1) dependability modelling with Petri nets,

   2) guiding the usage of Petri net based techniques for qualitative and quantitative dependability analyses,

   3) representing and interpreting the analysis results;

d) outlining the relationship of Petri nets to other modelling techniques;

e) providing practical examples.

This standard does not give guidance on how to solve mathematical problems that arise when analysing a PN; such guidance can be found in [3] and [4].

This standard is applicable to all industries where qualitative and quantitative dependability analyses is performed.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-191:1990, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service*

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms and definitions given in IEC 60050-191, as well as the following terms and definitions, apply.

3.1 Terms and definitions

3.1.1
component
constituent part of a device which cannot be physically divided into smaller parts without losing its particular function