

Quantitative Approach to Safety Assessment of the Railway Interlocking System

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Abstract

The paper deals with a quantitative approach to safety assessment process applicable to the safety-related systems, specially the railway interlocking one. The authors present the methodology based on the Failure Mode and Effects Analysis (FMEA) and the Fault Tree Analysis (FTA) that is applicable to performing safety analysis of both electronic and computer based systems. The mathematical basis for the FTA is detailed, with a special attention paid to the mechanisms used to determine probability of hazardous events based on primary event occurrence. For the sake of better understanding examples of Markov's graphs for a different number of simultaneous hazardous faults are given. Relation between the presented approach and European Standards is indicated.

1. Introduction

The railway interlocking system is a special kind of control system that in addition to control functions must also

involve safety-related functions. Safety is considered to be a basic property inherent to such kind of systems. There is necessity to build a model describing transition of an interlocking system from failure-free (safe) mode to failure involved (potentially hazardous) mode as a consequence of random external influences in the process of system ageing. For the sake of introduction, let's give some ideas on such a model.

External influences can generally be characterised as the n -dimensional random process with time-dependent random quantities (temperature, voltage, electromagnetic interference etc.) of the n -dimensional random vector. Analysis of influences of this random process on operation of the interlocking system is possible only if its marginal, coupling and conditional characteristics are known. It is a complex task of mathematical statistics.

On the base of data analysis the process must be identified and its prognosis performed for the whole useful life of the interlocking system. In addition, external influences on the interlocking system depend on particular operation environment (i.e. on local conditions). It is unthinkable (for time and financial reasons) to perform the overall analysis of external influences on system safety individually for any operation environment. For the practical use it is acceptable if system requirements specification defines limit values for monitored random variables and in the interlocking system design there are used such technological and circuit solutions (barriers) that enable to omit (fully or partially) external influences. Operation environment of a system must be chosen in accordance with system requirements specification. This solution will also exclude possible

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CSIT'2000
Ufa, Russia, 2000

Safety Assessment A Quantitative Approach

**Veysi Başkan, Hakan
Demirel, Muhammet Gul**



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wireless network Safety issues impacting Industrie 4 0 and Digital transformation

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Handbook Douglas Landoll, 2016-04-19 The Security Risk Assessment Handbook A Complete Guide for Performing Security Risk Assessments provides detailed insight into precisely how to conduct an information security risk assessment Designed for security professionals and their customers who want a more in depth understanding of the risk assessment process this volume contains real wor [SFPE Guide to Fire Risk Assessment](#) Austin Guerrazzi, 2022-11-22 The SFPE Guide to Fire Risk Assessment provides guidance to qualified practitioners in developing selecting and using fire risk assessment methodologies for the design construction and operation of buildings facilities or processes It also addresses fire risk acceptability the role of fire risk assessment and fire risk management in the fire safety design process and associated communication monitoring of fire risk The guide Includes a new flow chart that outlines the risk assessment process It also includes new information related to Risk Perception F N curves Risk communication Residual risk management Risk monitoring Sensitivity analysis The guide also provides clear guidance on conducting qualitative and quantitative analysis It also uses examples that reinforce topics discussed **Certified Information Security Manager Exam Prep Guide** Hemang Doshi, 2021-11-26 Pass the Certified Information Security Manager CISM exam and implement your organization s security strategy with ease Key Features Pass the CISM exam confidently with this step by step guide Explore practical solutions that validate your knowledge and expertise in managing enterprise information security teams Enhance your cybersecurity skills with practice questions and mock tests Book Description With cyber threats on the rise IT professionals are now choosing cybersecurity as the next step to boost their career and holding the relevant certification can prove to be a game changer in this competitive market CISM is one of the top paying and most sought after certifications by employers This CISM Certification Guide comprises comprehensive self study exam content for those who want to achieve CISM certification on the first attempt This book is a great resource for information security leaders with a pragmatic approach to challenges related to real world case scenarios You ll learn about the practical aspects of information security governance and information security risk management As you advance through the chapters you ll get to grips with information security program development and management The book will also help you to gain a clear understanding of the procedural aspects of information security incident management By the end of this CISM exam book you ll have covered everything needed to pass the CISM certification exam and have a handy on the job desktop reference guide What you will learn Understand core exam objectives to pass the CISM exam with confidence Create and manage your organization s information security policies and procedures with ease Broaden your knowledge of the organization s security strategy designing Manage information risk to an acceptable level based on risk appetite in order to meet organizational goals and objectives Find out how to monitor and control incident management procedures Discover how to monitor activity relating to data classification and data access Who this book is for If you are an aspiring information security manager IT auditor chief information security officer CISO or risk management

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Table of Contents Safety Assessment A Quantitative Approach

1. Understanding the eBook Safety Assessment A Quantitative Approach
 - The Rise of Digital Reading Safety Assessment A Quantitative Approach
 - Advantages of eBooks Over Traditional Books
2. Identifying Safety Assessment A Quantitative Approach
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Safety Assessment A Quantitative Approach
 - User-Friendly Interface
4. Exploring eBook Recommendations from Safety Assessment A Quantitative Approach
 - Personalized Recommendations

- Safety Assessment A Quantitative Approach User Reviews and Ratings
- Safety Assessment A Quantitative Approach and Bestseller Lists
- 5. Accessing Safety Assessment A Quantitative Approach Free and Paid eBooks
 - Safety Assessment A Quantitative Approach Public Domain eBooks
 - Safety Assessment A Quantitative Approach eBook Subscription Services
 - Safety Assessment A Quantitative Approach Budget-Friendly Options
- 6. Navigating Safety Assessment A Quantitative Approach eBook Formats
 - ePub, PDF, MOBI, and More
 - Safety Assessment A Quantitative Approach Compatibility with Devices
 - Safety Assessment A Quantitative Approach Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Safety Assessment A Quantitative Approach
 - Highlighting and Note-Taking Safety Assessment A Quantitative Approach
 - Interactive Elements Safety Assessment A Quantitative Approach
- 8. Staying Engaged with Safety Assessment A Quantitative Approach
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Safety Assessment A Quantitative Approach
- 9. Balancing eBooks and Physical Books Safety Assessment A Quantitative Approach
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Safety Assessment A Quantitative Approach
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Safety Assessment A Quantitative Approach
 - Setting Reading Goals Safety Assessment A Quantitative Approach
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Safety Assessment A Quantitative Approach
 - Fact-Checking eBook Content of Safety Assessment A Quantitative Approach

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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