

LIST OF AUTHORS AND CONTRIBUTIONS WITH ABSTRACTS

(under completion)

Abrahamsen Eirik Bjorheim, Aven Terje, Iversen Rune Saeboe

An integrated framework for safety management and uncertainty management in petroleum operations

Keywords

Safety management, uncertainty management, petroleum operations

Abstract

In petroleum operations, the safety management and the uncertainty management have traditionally been completely separated functions. The two disciplines are to large extent based on different scientific pillars and it has been difficult to obtain an integrated approach. However, the recent introduction of risk perspectives highlighting the uncertainty component of risk has provided an improved basis for development of such an approach. By seeing risk as the two-dimensional concept covering events and consequences on the one hand side and uncertainties on the other, the content and boundaries of risk assessments are changed. The gap between the two disciplines can to large extent be bridged. The purpose of the present paper is to present and discuss an integrated framework for these disciplines and traditions, based on this risk perspective. An example is included to show the practical implications of the framework.

Abrahamsen Eirik Bjorheim, Aven Terje, Røed Willy

A new visualizing tool for communicating cost-effectiveness of safety measures

Keywords

Cost-effectiveness analysis, safety measures, uncertainty

Abstract

A cost-effectiveness analysis (CEA) is often used as basis for comparisons between competing safety measures. In a CEA indices such as the expected cost per expected number of lives saved are calculated. These indices are presented to the decision-makers, and seen in relation to reference values, they form the basis for assessment of the effectiveness of the safety measures.

The appropriateness of using cost-effectiveness indices based on expected values have been thoroughly discussed in the literature. It is argued that uncertainty is not properly taken into account by the CEA, and extended frameworks for CEA are required. This paper represents a contribution to this end, by presenting a diagram that visualizes uncertainty in addition to the expected values as in the traditional CEA. In the paper we discuss the use of the diagram in communication between analysts and other stakeholders, in particular the decision-makers. An example is presented to illustrate the applicability of the tool.

Albeanu Grigore, Averian Alexandru, Duda Iordan

Towards web applications reliability engineering

Keywords

Web application, software reliability, software vulnerability, software security.

Abstract

There is an increasing request for web-based software systems, some of them to be used very intensive. The customers ask not only for fast design and implementation, but also for a high quality product. Considering reliability as an important quality attribute, this paper describes the current state of the art in designing, implementing, and testing web-based applications. An important attention is given to web-based software vulnerabilities and how to deliver secure software. Then, reliability modeling in the case of secure web-based software is discussed.

Berg Heinz-Peter

Corrosion mechanisms and their consequences for nuclear power plants

Keywords

Corrosion, corrosion types, operating experience, nuclear power plants

Abstract

It is well known that operational conditions in light water reactors strongly influence the corrosion processes. This paper gives an overview which types of corrosion are identified in operating practice based on the evaluation of events which are reported to the authorities in line with the German reporting criteria. It has been found that the main contributor is the stress corrosion cracking. Several examples of different corrosion mechanisms and their consequences are provided for PWR although a high standard of quality of structures, systems and components has been achieved. Recommendations have been given to check the plant specifications concerning the use of auxiliary materials or fluids during maintenance as well as to examine visually the outer surfaces of austenitic piping with regard to residua of adhesive or adhesive tapes within the framework of in-service inspections. However, events in the last two years shows that such problems cannot be totally avoided.

Berg, Heinz-Peter, Gersinska, Rainer, Sievers, Jürgen

Proposal for estimating leak and break frequencies of piping systems in probabilistic safety assessment

Keywords

Leak and break frequencies, probabilistic safety assessment, piping system, nuclear power plant

Abstract

Recently the details on the estimation of leak and break frequencies in piping systems contained for the probabilistic safety assessment have been updated and extended introducing new methodical aspects and data. The statistical method based on the evaluation of the German operational experience for piping systems with different diameters was updated by the inclusion of structure reliability models based on fracture mechanics calculation procedures. As an example of application the statistical estimation method for leak and break frequencies of piping systems with a diameter of 50 mm from the volume control system of a German pressurized water reactor was updated. Moreover, the evaluation of the operational experience was extended with respect to cracks, leaks and breaks in the volume control system of German pressurized water reactors (PWR) up to the year 2006 and the operating time was accordingly extended to 341 years. Under these conditions new calculations of

leak and break frequencies have been performed and the results have been compared with the previous values.

Blokus-Roszkowska Agnieszka, Kołowrocki Krzysztof

Reliability and availability of a ground ship-rope transporter in variable operation conditions

Keywords

Transportation system, reliability, risk, availability, system operation process

Abstract

In the paper the environment and infrastructure influence of the ground ship-rope transporter operating in Naval Shipyard in Gdynia on its operation processes is considered. The results are presented on the basis of a general model of technical systems operation processes related to their environment and infrastructure. The transporter operation process is described and its statistical identification is given. Next, the reliability, risk and availability evaluation of the transporter in variable operation conditions is presented. In addition, the reliability and availability basic characteristics of the system assuming its components' failure dependence are determined. Finally, the obtained results for the ground ship-rope transporter under the assumption that its components are dependent and independent are compared.

Blokus-Roszkowska Agnieszka, Kołowrocki Krzysztof

Reliability and availability of a shipyard ship-rope elevator in variable operation conditions

Keywords

Transportation system, reliability, risk, availability, system operation process

Abstract

In the paper the environment and infrastructure influence of the ship-rope elevator operating in Naval Shipyard in Gdynia on its operation processes is considered. The results are presented on the basis of a general model of technical systems operation processes related to their environment and infrastructure. The elevator operation process is described and its statistical identification is given. Next, the elevator is considered in varying in time operation conditions with different its components' reliability functions in different operation states. Finally, the reliability, risk and availability evaluation of the elevator in variable operation conditions is presented.

Briš Radim

Direct unavailability calculations of highly reliable systems

Keywords

Highly reliable system, unavailability, acyclic graph.

Abstract

The paper presents a new analytical algorithm which is able to carry out direct and exact reliability quantification of highly reliable systems with maintenance (both preventive and corrective). A directed

acyclic graph is used as a system representation. The algorithm allows take into account highly reliable and maintained input components. All considered models are implemented into the new algorithm. The algorithm is based on a special new procedure which permits only summarization between two or more non-negative numbers that can be very different. If the summarization of very small positive numbers transformed into the machine code is performed effectively no error is committed at the operation. Reliability quantification is demonstrated on a real system from practice and on its highly reliable modifications. The selected system is frequently used system - high pressure injection system occurring in many late references.

Cadini Francesco, Avran Diana, Zio Enrico

Particle filtering for the estimation of system mode of operation

Keywords

Fault diagnosis, state estimation, particle filtering, Monte Carlo sampling, hybrid dynamic system

Abstract

Efficient diagnosis and prognosis of system faults depend on the ability to estimate the system state on the basis of noisy measurements of the system dynamic variables and parameters. The system dynamics is typically characterized by transitions among discrete modes of operation, each one giving rise to a specific continuous dynamics of evaluation. The estimation of the state of these hybrid dynamic systems is a particularly challenging task because it requires keeping track of the transitions among the multiple modes of system dynamics corresponding to the different modes of operation. In this paper, a Monte Carlo estimation method is illustrated with an application to a case study of literature which consists of a tank filled with liquid, whose level is autonomously maintained between two thresholds. The system behaviour is controlled by discrete mode actuators, whose states are estimated by a Monte Carlo-based particle filter on the basis of noisy level and temperature measurements.

Cadini Francesco, Zio Enrico, Goela Lucia R., Petrescu Cristina A.

Multi-objective genetic algorithms for the reliability analysis and optimization of electrical transmission networks

Keywords

Multi-objective genetic algorithms, critical infrastructures, reliability efficiency, group closeness centrality measure

Abstract

The results of two applications of multi-objective genetic algorithms to the analysis and optimization of electrical transmission networks are reported to show the potential of these combinational optimization schemes in the treatment of highly interconnected, complex systems. In a first case study, an analysis of the topological structure of an electrical power transmission system of literature is carried out to identify the most important groups of elements of different sizes in the network. The importance is quantified in terms of group closeness centrality. In the second case study, an optimization method is developed for identifying strategies of expansion of an electrical transmission network by addition of new lines of connection. The objective is that of improving the transmission reliability, while maintaining the investment cost limited.

Cha Ji Hwan, Yun Won Young

On a general standby system and its optimization

Keywords

Warm standby, accelerated life testing, virtual age, switching time, mean lifetime.

Abstract

Redundancy or standby is a technique that has been widely applied to improving system reliability and availability in the stage of system design. In this paper, we consider a standby system with two units in which the first unit (unit 1) starts its operation under active state and the other unit (unit 2) is under cold standby state at the starting point. After a specified time s (switching time), the state of unit 2 is changed to warm standby state and, as soon as the operating unit 1 fails, the state of unit 2 is changed to active state. If unit 1 fails before time s , the system fails. Units can fail at both active and warm standby states. A general method for modeling the standby system is adopted and, based on it, system performance measures (system reliability and mean life) are derived. We consider the problem of determining optimal switching time which maximizes the expected system life. Some numerical examples are studied.

Duffey Romney

Managing and Predicting Risk, Safety and Stability in a Challenging World

Keywords

Accidents, errors, experience, learning, outcomes and risk

Abstract

It should be obvious that we must learn from our mistakes, so all of society, and ourselves, should have progressively safer, less risky systems and behaviors as we learn. Accidents are seemingly random in their occurrence, but in fact, this very apparent randomness is also containing information. The information we have researched and analysed covers nearly 200 years of knowledge from literally millions of multitudinous observations. The failure rate provides the expression for the probability of any outcomes, and the resulting curve is called the Human Bathtub. By quantifying the randomness, the uncertainty and the disorder, we have provided a new objective measure of “safety culture”, “organizational learning” and “engineering resilience”. We have linked individual learning and skill acquisition to the systematic risk reduction observed for entire systems with increasing experience. The results will be of interest to those interested and engaged in risk management, and in the social sciences where risk perception is important.

Grabski Franciszek, Załęska-Fornal Agata

Bootstrap methods for the censored data in empirical Bayes estimation of the reliability parameters

Keywords

Bootstrap method, resampling method, estimate, bootstrap replicates

Abstract

Bootstrap and resampling methods are the computer methods used in applied statistics. They are types

of the Monte Carlo method based on the observed data. Bradley Efron described the bootstrap method in 1979 and he has written a lot about it and its generalizations since then. Here we apply these methods in an empirical Bayes estimation using bootstrap copies of the censored data to obtain an empirical prior distribution.

Guo Renkuan, Nyirenda Juwa, Guo Danni

Random fuzzy poisson processes

Keywords

Credibility measure, credibilistic fuzzy variable, random fuzzy variable, average chance distribution

Abstract

Poisson processes, particularly the time-dependent extension, play important roles in reliability and risk analysis. It should be fully aware that the Poisson modeling in the current reliability engineering and risk analysis literature is merely an ideology under which the random uncertainty governs the phenomena. In other words, current Poisson Models generate meaningful results if randomness assumptions hold. However, the real world phenomena are often facing the co-existence reality and thus the probabilistic Poisson modeling practices may be very doubtful. In this paper, we define the random fuzzy Poisson process, explore the related average chance distributions, and propose a scheme for the parameter estimation and a simulation scheme as well. It is expecting that a foundational work can be established for Poisson random fuzzy reliability and risk analysis.

Guo Renkuan, Nyirenda Juwa, Dunne Tim, Guo Danni

Random fuzzy continuous-time Markov chains

Keywords

Stochastic semigroup, rate matrix, Credibility measure, repairable system, random fuzzy Markov process

Abstract

Continuous-time Markov chains is an important subclass in stochastic processes, which have facilitated many applications in business decisions, investment risk analysis, insurance policy making and reliability modeling. It should be fully aware that the existing continuous-time Markov chains theory is merely an ideology under which the random uncertainty governs the phenomena. However, the real world phenomena are often revealing the randomness and vagueness co-existence reality and thus the probabilistic continuous-time Markov chains modeling practices may be not adequate. In this paper, we define the random fuzzy continuous-time Markov chains, explore the related average chance distributions, and propose a scheme for the parameter estimation and a simulation scheme as well. It is expecting that a foundational work can be established for reliability modeling and risk analysis, particularly, repairable system modeling.

Guze Sambor, Kwiatkowska-Sarnecka Bożena, Soszyńska Joanna

The computer program to verify the hypothesizes and to predict of the parameters for operational process

Keywords

Joint Research Project, computer program, verifying hypothesizes, operational process

Abstract

The theoretical background and technical information for the program are presented. Further, the components of the program are described and user manual is given.

Guze Sambor, Smolarek Leszek

Modelling the ship safety on waterway according to navigational signs reliability

Keywords

Safety, consecutive “ m out of k ” systems, reliability, navigational signs, IALA buoyage system

Abstract

An approach to safety analysis connected with consecutive “ m out of n ” systems is presented. Further, the consecutive “ m out of n : G ” system is defined and the recurrent formulae for its reliability function evaluation are proposed. Next the IALA buoys and leading lights system are introduced. Moreover, the safety states model for ship navigation are defined. Further, analysis of safety during manoeuvre in restricted area with curved draws is illustrated.

Harnpornchai Napat

Genetic algorithms-aided reliability analysis

Keywords

Genetic algorithms, reliability analysis, simulation methods, complex systems, multiple failure modes

Abstract

A hybrid procedure of Genetic Algorithms (GAs) and reliability analysis is described, discussed, and summarized. The procedure is specifically referred to as a Genetic Algorithms-aided (GAs-aided) reliability analysis. Two classes of GAs, namely simple GAs and multimodal GAs, are introduced to solve a number of important problems in reliability analysis. The problems cover the determination of Point of Maximum Likelihood in failure domain (PML), the computation of failure probability using the GAs-determined PML, and the determination of multiple design points. The MCS-based method using the GAs-determined PML is specifically implemented in the so-called an Importance Sampling around PML (ISPML). The application of GAs to each respective problem is then demonstrated via numerical examples in order to clarify the procedures. With an aid from GAs, reliability analysis is possible even if there is no information about the geometry or landscape of limit state surfaces and the total number of crucial likelihood points. In addition, GAs significantly improve the computational efficiency and realize the analysis of rare events under constrained computational resources. The implementation of GAs to reliability analysis for building up the hybrid procedure is readily because of their algorithmic simplicity.

Hryniewicz Olgierd

Confidence bounds for the reliability of a system from subsystem data

Keywords

Reliability, system, confidence intervals, binomial data, exponential data

Abstract

The paper is concerned with the construction of lower bounds for the reliability of a system when statistical data comes from independent tests of its elements. The overview of results known from literature and obtained under the assumption that elements in a system are independent is given. It has been demonstrated using a Monte Carlo experiment that in the case when these elements are dependent and when their dependence is described by Clayton and Gumbel copulas these confidence bounds are not satisfactory. New simple bounds have been proposed which in some practical cases have better properties than the classical ones.

Jurdziński Mirosław, Guze Sambor, Kamiński Piotr

Time differences in operation stages on ferry “Stena Baltica” during passage the open water areas

Keywords

Navigation, reliability, large system, asymptotic approach, limit reliability function

Abstract

The paper deals with analysis of ships operation stages in open water areas effected by environmental constraints influencing on ship sea keeping parameters in application to ferry “Stena Baltica” operated in the Baltic Sea between Gdynia and Karlskrona harbors.

Kołowrocki Krzysztof, Kwiatkowska-Sarnecka Bożena, Soszyńska Joanna

Preliminary reliability, risk and availability analysis and evaluation of bulk cargo transportation system in variable operation conditions

Keywords

System operations process, multi-state system reliability, risk and availability optimization

Abstract

In the paper, definitions and theoretical results about system operations process, multi-state system reliability, risk and availability optimization are illustrated by the example of their application of the bulk cargo transportation system operating in Gdynia Port Bulk Cargo Terminal. The bulk cargo transportation system is considered in varying in time operation conditions. The system reliability structure and its components reliability functions are changing in variable operation conditions. The system reliability structures are fixed with a high accuracy. Whereas, the input reliability characteristics of the bulk cargo transportation system components and the system operation process characteristics are not sufficiently exact because of the lack of statistical data. The obtained evaluation may be a very useful example in simple and quick systems reliability characteristics evaluation, especially during the design and improving the transportation systems operating in ports.

Kołowrocki Krzysztof, Soszyńska Joanna

Reliability, risk and availability based optimization of complex technical systems operation processes

Part 1

Theoretical backgrounds

Keywords

Reliability, availability, complex system, operation process, optimization

Abstract

A convenient new tool for solving the problem of reliability and availability evaluation and optimization of complex technical systems is presented. Linking a semi-markov modeling of the system operation processes with a multi-state approach to system reliability and availability analysis is proposed to construct the joint general model of reliability and availability of complex technical systems in variable operation conditions. This joint model and a linear programming is proposed to complex technical systems reliability and availability evaluation and optimization respectively. Theoretical results are applied in maritime industry to reliability, risk and availability optimization of a port piping oil transportation system.

Kołowrocki Krzysztof, Soszyńska Joanna

Reliability, risk and availability based optimization of complex technical systems operation processes

Part 2

Application in port transportation

Keywords

Reliability, availability, complex system, operation process, optimization

Abstract

A convenient new tool for solving the problem of reliability and availability evaluation and optimization of complex technical systems is presented. Linking a semi-markov modeling of the system operation processes with a multi-state approach to system reliability and availability analysis is proposed to construct the joint general model of reliability and availability of complex technical systems in variable operation conditions. This joint model and a linear programming is proposed to complex technical systems reliability and availability evaluation and optimization respectively. Theoretical results are applied in maritime industry to reliability, risk and availability optimization of a port piping oil transportation system.

Kołowrocki Krzysztof, Soszyńska Joanna

Methods and algorithms for evaluating unknown parameters of operation processes of complex technical systems

Keywords

System operation process, distribution, sojourn times

Abstract

The paper objectives are to present the methods and tools useful in the statistical identifying the unknown parameters of the operation and reliability and safety models of complex industrial systems and to apply them in the maritime industry. There are presented statistical methods of determining unknown parameters of the semi-markov model of the complex system operation processes. There is

also presented the chi-square goodness-of-fit test applied to verifying the distributions of the conditional system operation process sojourn times in the particular operation states. Moreover, there are presented the methods of estimating the unknown intensities of departure from the reliability state subsets of the exponential distribution of the component lifetimes of the multistate system in various operation states and the goodness-of-fit method applied to testing the hypotheses concerned with the exponential form of the multistate reliability function of the particular components of the system in variable operations conditions. Applications of these tools to operation and reliability characteristics of a ferry operating at the Baltic Sea waters are presented as well.

Kołowrocki Krzysztof, Soszyńska Joanna

Methods and algorithms for evaluating unknown parameters of reliability models of complex technical systems

Keywords

Unknown parameters, density function

Abstract

The paper objectives are to present the methods and tools useful in the statistical identifying the unknown parameters of the operation and reliability and safety models of complex industrial systems and to apply them in the maritime industry. There are presented statistical methods of determining unknown parameters of the semi-markov model of the complex system operation processes. There is also presented the chi-square goodness-of-fit test applied to verifying the distributions of the conditional system operation process sojourn times in the particular operation states. Moreover, there are presented the methods of estimating the unknown intensities of departure from the reliability state subsets of the exponential distribution of the component lifetimes of the multistate system in various operation states and the goodness-of-fit method applied to testing the hypotheses concerned with the exponential form of the multistate reliability function of the particular components of the system in variable operations conditions. Applications of these tools to operation and reliability characteristics of a ferry operating at the Baltic Sea waters are presented as well.

Kołowrocki Krzysztof, Soszyńska Joanna

Safety and risk evaluation of Stena Baltica ferry in variable operation conditions

Keywords

Safety function, operation process, semi-markov process

Abstract

Basic safety structures of multi-state systems of components with degrading safety states related to their variable operation conditions are defined. For these systems the conditional and unconditional multi-state safety functions are determined. A semi-markov process for the considered systems operation modelling is applied. Further, the paper offers an approach to the solution of a practically important problem of linking the multi-state systems safety models and the systems operation processes models.

Theoretical definitions and results are illustrated by the example of their application in the safety and risk evaluation of the Stena Baltica ferry operating at the Baltic Sea. The ferry transportation system has been considered in varying in time operation conditions. The system safety structure and its components safety functions were changing in variable operation conditions.

Kołowrocki Krzysztof, Soszyńska Joanna

Statistical identification and prediction of the port oil pipeline system's operation process and its reliability evaluation in variable operation conditions

Keywords

Semi-markov processes, system operations process, reliability

Abstract

In the paper a Semi-markov processes are used to construct a general model of complex industrial systems' operation processes. Main characteristics of this model are determined as well. In particular case, for a port oil pipeline transportation system, its operation states are defined, the relationships between them are fixed and particular model of its operation process is constructed and its main characteristics are determined. Further, the joint model of the system operation process and the system reliability is defined and applied to the reliability evaluation of the port oil pipeline transportation system.

Kosmowski Kazimierz

Functional safety analysis including human factors

Keywords

Hazardous plants, functional safety, human factors, layer of protection analysis, alarm system

Abstract

In this paper selected aspects of human factors are discussed that should be taken into account during the design of safety-related functions for a complex hazardous installation and its protections. In such installations the layer of protection analysis (LOPA) methodology is often used for simplified risk analysis based on defined accident scenarios. To control the risk the safety instrumented functions (SIFs) are identified and their safety integrity levels (SILs) determined with regard to results of risk assessment. Given SIF is to be realised by the electric/ electronic/ programmable electronic systems (E/E/PES) or safety instrumented systems (SIS) and the human-operator. The SIL is to be verified according to requirements and criteria given in international standards IEC 61508 and IEC 61511. Selected issues related to designing the alarm system (AS) with regard to human factors are outlined. Some aspects of human reliability analysis (HRA) as a part of human-machine interface (HMI) assessing and probabilistic modelling of the system are shortly discussed.

Kowalski Marcin, Magott Jan, Nowakowski Tomasz, Werbińska-Wojciechowska Sylwia

Analysis of transportation system with the use of Petri nets

Keywords

Logistic support system, transportation system, procurement process, Petri nets, simulation process

Abstract

The paper considers problem of city transportation system performance. Reliability analysis of such a complex system is complicated by several factors. One of them is the possibility of logistic support elements unreliability defined as unavailability of spare elements when desired, what in result may

lead to decrease of performance of the system being supported. Thus, both systems must be considered in a single model. However, the simultaneous setting of all structural parameters (e.g. redundancy, repair shop capacity) and control variables (e.g. spare part inventory levels, maintenance policy parameters, repair job priorities, time resource) is mathematically a hard problem. That is why this paper investigates two models of such a system with the use of Monte Carlo simulation and Petri net technique. Some comparison results are discussed.

Kwiatkowska-Sarnecka Bożena

Models of reliability and availability improvement of series and parallel systems related to their operation processes

Keywords

Multi-state systems, reliability and availability improvement

Abstract

Integrated general models of approximate approaches of complex multi-state series and parallel systems, linking their reliability and availability improvement models and their operation processes models caused changing reliability and safety structures and components reliability characteristics in different operation states, are constructed. These joint models are applied to determining improved reliability and availability characteristics of the considered multi-state systems related to their varying in time operation processes. The conditional reliability characteristics of the multi-state systems with hot, cold single reservation of component and the conditional reliability characteristics of the multi-state systems with reduced rate of departure by a factor of system components are defined.

Lisi Roberto, Milazzo Maria Francesco, Maschio Giuseppe

Quantitative assessment of explosion risk in workplaces

Keywords

Risk assessment, explosion, safety, workplace, ATEX

Abstract

The Directive 99/92/EC deals with the safety and health protection of workers potentially exposed at explosive atmospheres. The application of this Directive requires the assessment of specific risks due to the presence of potentially explosive atmospheres. These can generally be originated by releases of flammable substances typical of industries classified at major hazard, but they often could be generated also in all other industries where flammable materials are handling. Risk assessment of explosive atmospheres is required in both the cases, to this purpose, in this article a quantitative approach has been proposed. The paper describes the main aspects of the methodology, based on a probabilistic risk assessment, and finally its application to a case-study.

Lumanpauw Ernest, Mohamed Salahuddin Habibullah, Kołowrocki Krzysztof, Soszynska Joanna, Xie Min

A computational tool for general model of industrial systems operation processes

Keywords

Stochastic process, semi-markov model, computational tool, reliability

Abstract

The complexities of real industrial systems operation processes require computational methods that can analyze the large data and evaluate the behaviours of these systems. The use of methods such as Bayesian Network, Formal Safety Assessment and Statistical-Model based method were discussed as possibilities. Of which, a computational tool, based on the Semi-Markov model, was developed. This tool was then applied to analyze the behaviour of the operation processes of the oil transportation system in Dębogórze, Poland. The analyses showed that the computational solutions generated compared favorably well with the analytical calculations, enabling possible extensions of the tool to include reliability and optimization evaluations to be explored.

Mennis Evangelos, Platis Agapios, Nikitakos Nikitas

Ship's diesel electrical system availability modeling

Keywords

Markov, diesel generators, PRA, reliability

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Abstract (12

One of the most critical systems for a ship operation is the diesel generator set. This is why the ship preserves four different diesel generators except the power battery packs. The paper describes the generator operation and the main failure conditions. Assuming that the failure rate of the system parts is constant the paper shows how the diesel generator system could be modelled in the context of Markov theory.

Milczek Beata

Examples of series-“m out of k” systems and their limit reliability functions

Keywords

Reliability, large system, asymptotic approach, limit reliability function

Abstract

The paper is concerned with mathematical methods in asymptotic approach to systems reliability analysis. The complexity of the reliability investigation of large-scale systems is proposed to be approximately solved by assuming that the number of system components tends to infinity and finding the limit reliability function of the system. Some general results in the form of auxiliary theorems and examples of limit reliability functions of homogeneous and regular series-“ m out of k ” systems with exponential and Weibull reliability functions of system components are presented.

Marek Młyńczak

Physical and reliability aspects of failure in mechanical objects

Keywords

Physical degradation, mechanical object, reliability, failure

Abstract

Mechanical objects are operated in real world where degradation of material components and variability of processes managed by a man are the main factors influencing its efficiency. Machine degradation is a long-lasting process concerning its material structure, components and connections. Loss of machine operation ability is due to failures caused by wear and tear, fatigue, corrosion, overloading, material ageing and many other destructive processes. It is observed close relation between failure modes and reliability models so that knowledge about failures may help analysts creating reliability models and determine the best operational decisions. In the paper it is discussed relation between physical phenomenon and theoretical models as a common platform of decision processes.

Nowakowski Tomasz, Werbińska-Wojciechowska Sylwia

Models of logistic support systems

Keywords

Logistic support system, maintenance modeling, inventory models, procurement process

Abstract

We present an overview of some recent developments in the area of inventory planning and maintenance scheduling issues. The emphasis is on spare part inventory models, which authors divided into four main groups of models: models of optimal spare part inventory policy for system under PM, number of spare parts optimization models, storage reliability models, multi-echelon system models. Later, in the paper there is considered the time dependent system of system where the system total task must be executed during the constrained time resource. There is used the simulation approach to investigate the influence of parameters of the procurement process (order quantity, critical inventory level, lead-time length) on the system of systems behavior.

Pantanali Claudio, Bianco Cristina

Quantitative OHS evaluation: RATE procedure compared with traditional reliability methodologies

Keywords

RATE, SME, OHS

Abstract

The most careful and consolidated risk analysis methods, as FTA, ETA, FMEA/FMECA, focus attention on system reliability. But, looking at OHS, deep analysis on European data on accidents at work and on work environment in general, shows how reliability is only one aspect of safety problem. Then, these methods are hardly adaptable when the main aim is obtain a quantitative assessment of risk for workers; besides, other methodologies are nearest to OHS but give only qualitative results like HAZOP, or base their analysis on not-dimensional values, fixed by analyst on his personal experience, like methods proposed by UNI EN 1050, by standard MIL-STD-882c and by AISS. RATE is proposed as a new quantitative methodology for OHS, particularly dedicated to SMEs considered as the most interested from these aspect. The paper compares hypothesis and procedures which traditional quantitative methodologies and RATE are based on, to give evidence at the main approach aspects that have to be modified in order to move from reliability to OHS.

Rahim Yousif, Refsdal Ingbjørn, Kenett Ron

The 5C model: a new approach to asset integrity management

Keywords

5C model, asset integrity, technical integrity, asset management, asset integrity management

Abstract

As organizations grow more complex in operation and more global in scope, assets and technical integrity become key success factors. A company's asset integrity business process needs to be mapped in order to 1) provide a proper overview of operation and business processes, 2) identify all critical interfaces and 3) ensure that all gaps and overlap in processes are eliminated.

Achieving asset integrity requires companies to sustain their activities and identify the hazards, weaknesses and objectives of their strategic assets. Technical integrity emphasizes a complete overview of technical conditions and related information, and the ability of the companies to document the technical state of its assets. It is based on an integrated view of the current state of operations, and the identification of all critical interfaces, in order to ensure that all gaps and unnecessary overlaps in processes are eliminated.

Companies look increasingly at their asset integrity management system as a means to extend the life of their assets, beyond the original design conditions and production capacity.

Establishing an asset integrity management system requires the documentation of the company's technical integrity management, a strategy and the processes for carrying it out, identifying gaps; selecting corrective interventions and conducting follow up actions.

The paper will discuss various aspects of asset integrity management, including its planning and implementation. We begin with an introduction to asset technical integrity, provide some theoretical backgrounds, present a model we call 5C and conclude with a summary and discussion.

Tanguy Christian

Mean time to failure for periodic failure rates

Keywords

Reliability, mean time to failure

Abstract

The paper is concerned with the determination of the Mean Time To Failure (MTTF) in configurations where the failure rate is periodical. After solving two configurations exactly, we show that when the period of the failure rate oscillations is small with respect to the average failure rate, the MTTF is essentially given by the inverse of the average failure rate, give or take corrections that can be expressed analytically. This could be helpful in the description of systems the environment of which is subject to changes.

Valis David, Vintr Zdenek, Koucky Miroslav

Contribution to reliability analysis of highly reliable items

Keywords

Highly reliable item, reliability analysis, field data assessment

Abstract

In recent years the effect of electronic elements has become more and more significant in many areas of human activity. Engineering is one of the areas which have been also importantly affected. The paper deals with dependability namely reliability analysis procedure of a highly reliable item. The data on manufacturing and operating of a few hundred thousands pieces of electronic item are available and it is statistically a very important collection/set. However, concerning some items the manufacturing procedure was not checked and controlled accurately. The procedure described in the paper is based on the thorough data analysis aiming at the operating and manufacturing of these electronic elements. The results indicate some behaviour differences between correctly and incorrectly made elements. It was proved by the analysis that dependability and safety of these elements was affected to a certain degree. Although there is a quite big set of data the issue regarding the statistical comparability is very important.

Valis David, Vintr Zdenek, Koucky Miroslav

Selected approaches for reliability comparison of highly reliable items

Keywords

Statistical inequality, highly reliable item, reliability analysis, statistical testing, fuzzy logic, risk analysis

Abstract

The application of electronic elements introduces a number of advantages as well as disadvantages. The paper deals with advanced method of dependability - reliability analysis procedure of a highly reliable item. The data on manufacturing and operating of a few hundred thousands pieces of the highly reliable devices are available and from the statistical point of view they are very important collection/set. However, concerning some pieces of the items the manufacturing procedure of them was not made, controlled and checked accurately. The procedure described in the paper is based on the thorough data analysis aiming at the operation and manufacturing of these electronic elements. As the data sets collected are statistically non-coherent the objective of the paper is to make a statistical assessment and evaluation of the results. Failure rates calculations and their relation comparability regarding the both sets are presented in the paper.

Zajac Mateusz, Valis David

Fundamental risk assessment in reduced data conditions in particular example

Keywords

Risk assessment, container terminal.

Abstract

The paper represents discussion about risk assessment for transshipment system in reduced data condition. As a particular example transshipment system is presented. Article can be treated as first estimation. Future work and objectives are characterized in the end.

Zamojski Wojciech

Dependability of services networks

Keywords

Dependability, networks, services, functional-dependability models, Petri nets

Abstract

In the tutorial paper systems and networks are considered as a union of all their resources essential for the realization of predicted tasks. System dependability is discussed with respect to the occurrence of incidents and treats that may cause damage to the system resources and, in consequence, to the executed tasks. The maintenance policy system is based on two main concepts: detection of unfriendly events and system responses to them.

It is proposed to analyse the network system from the functional and user point of view, focusing on business service realized by a network system. Services networks are modelled as the Petri net models which may be useful for analyses of dependability parameters and for setting up a maintenance policy of the services net.

Gdynia, 05.06.2009.