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Testing the integrated package of tools supporting decision making on identification, prediction and optimization of complex technical systems operation, reliability and safety
Part 1
Integrated Safety and Reliability Decision Support System – IS&RDSS

Keywords

reliability, safety, operation processes, availability, optimization

Abstract

The paper is composed of six parts and presents the main practical tool created in the scope of the Poland-Singapore Joint Research Project, the Integrated Safety and Reliability Decision Support System - IS&RDSS. In the paper first part, there are presented the procedure of the IS&RDSS usage in the form of detailed and clear scheme-algorithm and the list of the project final reports and these reports supporting bibliography. In the remaining paper parts, there is presented the IS&RDSS application to the reliability analysis of an exemplary complex technical system.

1. Introduction

The final stage of the project results in the packages of practical tools in the form of guidebooks, computer programs, procedures and regulations [1]-[44]. At this stage, these tools are applied and tested in the maritime and coastal transportation industry to provide practically validated individual safety and reliability decision support systems for individual maritime transport sectors as well as an overall Integrated Safety and Reliability Decision Support System for Maritime and Coastal Transport. This created in the project the integrated support system is more general and may be applied not only in maritime industry sectors but in other industry sectors as well. Therefore, it is called more generally the Integrated Safety and Reliability Decision Support System and is marked shortly by IS&RDSS.

The IS&RDSS is the main results of the project prepared in the form of the guide-book [28] composed of Tasks 10.0-10.15 of WP10: Safety and Reliability Decision Support Systems for Various Maritime and Coastal Transport Sectors, and it is based on the results of the following project tasks: Task 7.1 - Methods of complex technical systems operation processes modelling [1], Task 7.2 - Methods of complex technical systems reliability, availability and safety evaluation and prediction [2], Task 7.3 - Methods of unknown parameters of complex technical systems operation, reliability, availability, safety models evaluation [3], Task 7.4 - Methods of complex technical systems reliability, availability and safety improvement [4], Task 7.5 - Methods of complex technical systems operation, reliability, availability, safety and cost optimization [5] included in the Workpackage WP7: Integrated Package of Solutions for Complex Industrial Systems and Processes Safety and Reliability Optimization.

The IS&RDSS is supplemented by Tasks 8.1-8.16, [6]-[21] of the Workpackage WP8: Packages of

Tools for Complex Industrial Systems and Processes Safety and Reliability Optimization, including the computer programs supporting the calculations.

The IS&RDSS is testified in Tasks 9.1-9.6, [22]-[27] of the Workpackage WP9: Applications and Testing of Packages of Tools in Complex Maritime Transportation Systems and Processes Safety and Reliability Optimization, where it is applied to the operation, reliability, safety and operation cost modelling, identification, prediction and optimization of the port, shipyard and maritime technical transportation systems and the exemplary system.

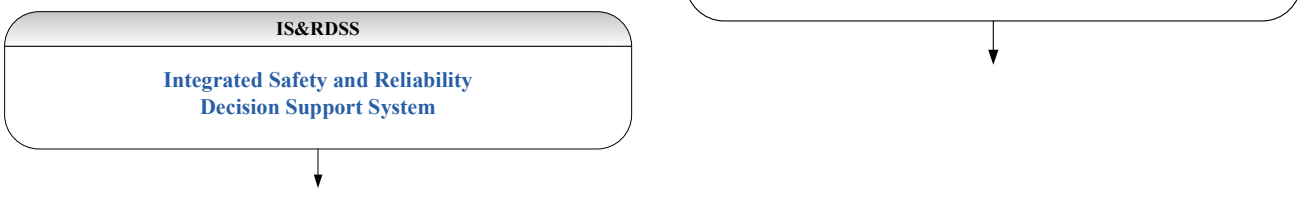
The IS&RDSS is supplemented by Tasks 11.1-11.16, [29]-[44] of the Workpackage WP11: Education, Training, Results Dissemination and Implementation, that are the training courses directed to the industry.

To make studying those all results included in the final project reports [1]-[44], additionally, at the end of the guide-book, the list of the supporting bibliography 1-87 is given.

The procedure of the IS&RDSS usage is presented in the paper in the form of detailed and clear scheme-algorithm that is placed at the beginning of the guide-book [28]. The procedure should start from the scheme-algorithm item IS&RDSS 0, and next either to study if it is necessary or to omit its introductory item IS&RDSS 1 and to continue with the items IS&RDSS 2-15. The user should follow the successive steps of the scheme using the support given in the forms of practical instructions and theoretical backgrounds placed at the further parts of the guide-book [28].

To make the use of the IS&RDSS easy and fluent, it is suggested to study its practical application to the reliability analysis of the exemplary complex technical system presented in the paper and its wide and detailed practical applications in maritime and coastal transport industry performed in Tasks 9.1-9.6, [22]-[27] of the Workpackage WP9.

2. Scheme of IS&RDSS



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5.2. System reliability and safety modeling – Theoretical backgrounds
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5.2.2. Safety of multistate system component in variable operation conditions

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6.2.1. Estimating parameters of conditional multistate exponential reliability and safety functions of system components
6.2.1.1 Estimating system components intensities of departure from reliability and safety state subsets on basis of data coming from components reliability and safety states changing processes
6.2.1.2 Evaluating system components intensities of departure from reliability and safety state subsets on basis of data coming from experts
6.2.2. Identification of conditional multistate exponential reliability and safety functions of system components
6.2.2.1 Identifying system components conditional multistate exponential reliability and safety functions on basis of data coming from components reliability and safety states changing processes
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15.2.2. Suggestions on new strategy of system operation process organizing
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15.2.4. Suggestions on new strategy of system reliability or safety structures organizing and system components improvement
15.2.5. Other suggestions

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