

**The Second International Symposium on  
Risk Analysis and Safety of Complex  
Structures and Components  
IRAS 2023**

*Belgrade, Serbia, 02-04 April 2023*

**IRAS23**

# **BOOK OF ABSTRACTS**

*Proceedings of the Second International  
Symposium on Risk analysis and Safety of  
Complex Structures and Components*

Edited by:

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Title

***PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON RISK ANALYSIS AND SAFETY OF COMPLEX STRUCTURES AND COMPONENTS - IRAS 2023***

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## Preface

Dear Colleagues, Dear Friends,

With great pleasure that we welcome you to our beautiful city of Belgrade (Serbia) for the second edition of the International Symposium on Risk Analysis and Safety of Complex Structures and Components (IRAS 2023). But first, a couple of words about the Technical Committee in charge of the conference.

The tasks and objectives of the Technical Committee are the following: - consolidation of the European scientific community to solve scientific and technical safety problems; - development of perspective research directions, computational and experimental methods and technologies in the area of safety of engineering systems; - cooperative researches, held by specialists and scientists from various countries on behalf of reducing the rate of accident risks while operating dangerous objects and systems; - development of modelling the incident theory of large technical systems; - development of mechanical and mathematical models and risk-analysis technologies; - development of reliability and probabilistic approaches for the fatigue and fracture characterization of materials (metals, polymers, composites among others) and structures (metallic, composite, joints, etc); - elaboration of standards using methods of probabilistic risk-analysis of technical systems according to fracture mechanics criteria; - elaboration of standards using reliability and probabilistic models for the large structures and components according to local criteria; - elaboration of standards using risk models of complex hierarchical technical systems; - unification of approaches to safety analysis of large technical systems; - unification of analysis methods of information on technical condition of large technical systems; - creation of unified methods and the harmonization of national regulatory documents in the area of technical systems safety; - elaboration of special study courses, problem books and test books on fracture mechanics, fatigue, reliability theory, and risk-analysis of technical systems.

The Second International Symposium on Risk Analysis and Safety of Complex Structures and Components (IRAS 2023) is organised by ESIS TC12 (with support from local institutions, such as the Faculty of Mechanical Engineering and its Innovation Center). It will take place in the Faculty of Mechanical Engineering of the University of Belgrade, in the City of Belgrade, the capital of Serbia, from 2-4 April 2023.

This conference is intended as a forum for discussion about recent advances in the aforementioned topics, including maintenance, safety, risk analysis, probabilistic assessment, life-cycle performance, fatigue, fracture, damage mechanics, numerical simulations of a wide range of infrastructures, such as engineering technical systems, transportation systems and their applications in various fields, such as civil, mechanical, aerospace, traffic and chemical engineering, as well as to a wide variety of structures and equipment, including but not limited to bridges, buildings, dams, railways, pipelines, wind towers, offshore platforms, naval vessels, nuclear and hydropower plants...

The Organizing Committee of the IRAS 2023 conference sincerely thanks all contributing authors for playing a significant role in the overall success of this event, with their exciting presentations. The members of the International Scientific Committee are also fully acknowledged for their support of the IRAS 2023 event. Special thanks to the Thematic Sessions Organizers and Plenary Speakers for their dedication and knowledge and energy brought to this event. The Organizing Committee would also like to express their gratitude to the sponsors for their time and support without which the conference would be impossible to organize. Finally, chairmen sincerely thank the tireless efforts of Organizing Committee members, as well as students and other Faculty of Mechanical Engineering Innovation Center of Faculty of Mechanical Engineering staff.

The second edition of the IRAS 2023 event, organized between 2<sup>nd</sup> and 4<sup>th</sup> of April, 2023 at the Faculty of Mechanical Engineering of the University of Belgrade, Serbia, gathered around 80 participants from all over the worlds, with more than 20 nationalities demonstrating the vitality of this new event, both in person and on-line. This book gathers the abstracts of the works presented in the conference, including keynote lectures and regular presentations alike. In general, the abstracts were organized into chapters, according to the five main topics of the thematic sessions foreseen in the programme of the conference, in accordance with the general topics covered by the TC12.

2<sup>nd</sup> International Symposium on Risk Analysis and Safety of Complex Structures and  
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The editors of the Proceedings of the Second International Symposium on Risk Analysis and Safety of  
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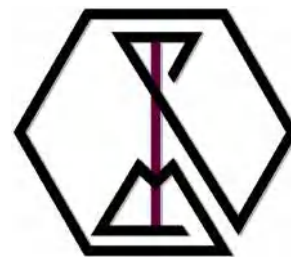
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## **Methodology for pressure equipment risk assessment based on fracture mechanics and influence of human and organizational factors**

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### **Abstract**

During the last couple of decades, there was a definitive increase in the need for process safety control due to working conditions and systems becoming more complex, up to a point where the existing methodologies could no longer provide satisfying results. Hence, the topic of this paper involves the development of an original methodology for risk assessment of pressure equipment, based on fracture mechanics and the influence of human and organizational factors. This methodology resulted from the systemization of existing knowledge in the field of process safety, innovations and integration of existing tools and models for risk assessment, as well as from improvements in working with pressure equipment in general and combining of above approaches with fracture mechanics, which allowed the solving of main issues that existed in these fields. This was achieved by establishing and verifying new methodologies and models, with particular focus on simplicity and adaptability to practical application, along with solving of problems related to the lack of systematic and practical approach to assessing of the influence of human and organizational factors on risk. In order to verify the newly proposed methodology, a case study was conducted in Serbia, related to Bajina Bašta hydropower plant, which confirmed the accuracy and simplicity of the methodology in question. It was shown that the application of this methodology enabled a systematic approach to quantitative risk assessment for pressure equipment in any and all companies which work with such equipment, regardless of their size or field of work. Thus, it was concluded that the proposed methodology has offered valuable insights, both to the scientific and public communities, through its improvement of process safety.

**Keywords:** risk; human factor; organizational factor; fracture mechanics