ESREL 2017

# 27th International European Safety and Reliability Conference

June 18-22, 2017,
Portorož, Slovenia

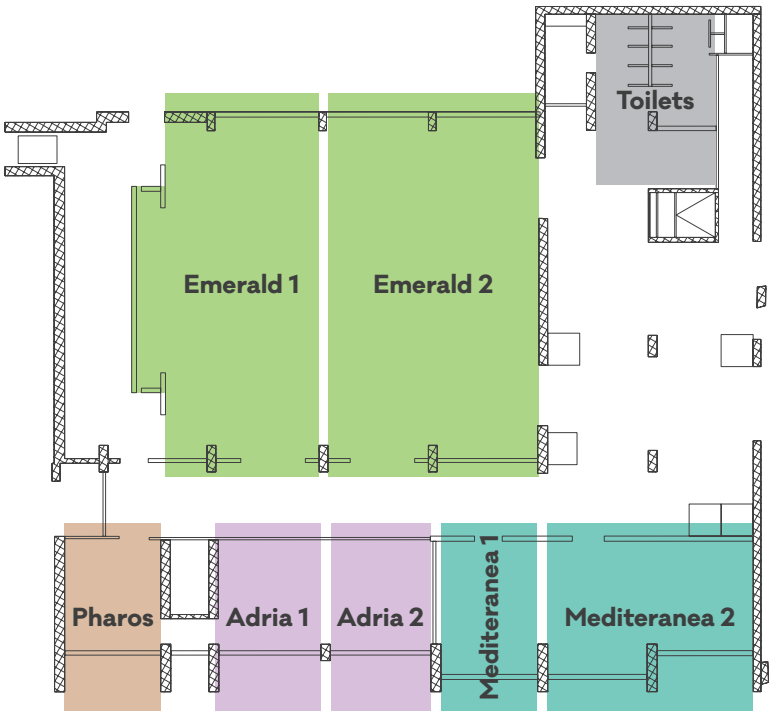
# PROGRAM

## Safety & Reliability Theory and Applications

General Chair: **Marko Čepin**, University of Ljubljana, Slovenia
Technical committee Chair: **Radim Briš**, Technical University of Ostrava, Czech Republic

## FLOOR PLAN OF THE CONFERENCE ROOMS AT FLOOR 11 AND FLOOR 12

Floor 11 is a floor counted from the sea level if entering the hotel from the sea side, and at the same time it is the ground floor if you are entering the hotel from the main entrance from the incoming street.

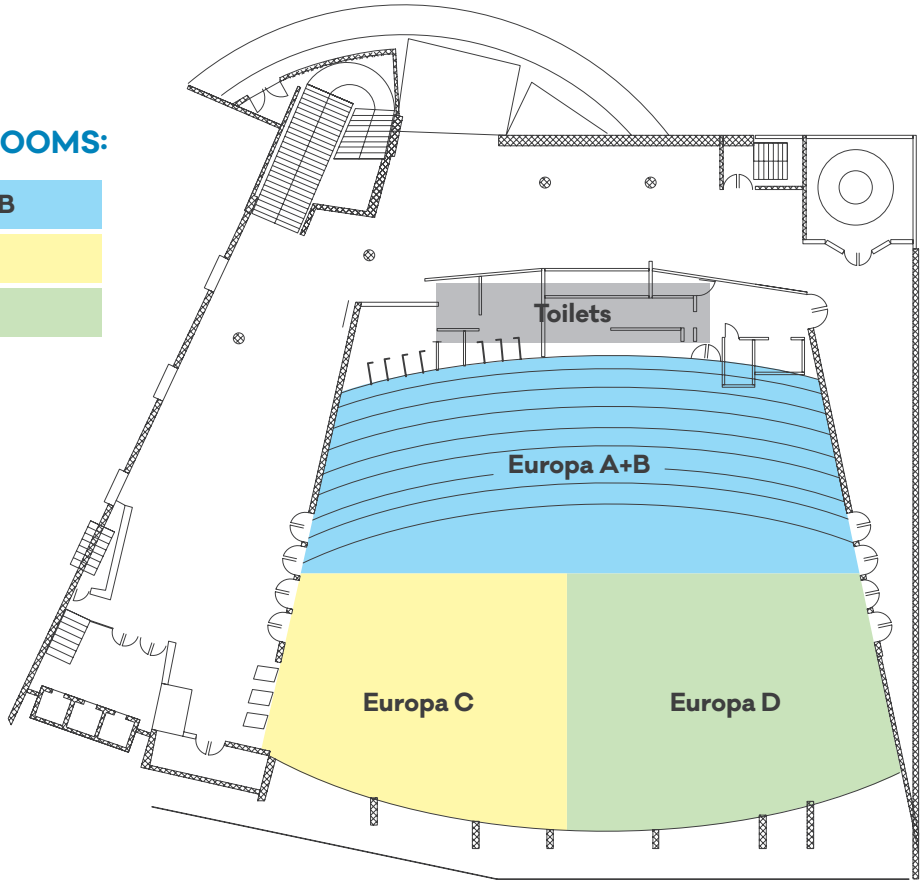



### FLOOR 11, 7 ROOMS:

- Emerald 1
- Emerald 2
- Mediteranea 1
- Mediteranea 2
- Adria 1
- Adria 2
- Pharos

### FLOOR 12, 3 ROOMS:

- Europa A+B
- Europa C
- Europa D



## EUROPEAN SAFETY AND RELIABILITY CONFERENCE - ESREL 2017

# PROGRAM OVERVIEW

| | | |
|---|---|---|
| **12:00-20:00** | **Sunday, June 18, 2017** | **Room** |
| **12:00-16:00** | Pre ESREL workshop - Application and use of risk assessments – key challenges and recent advances, Willy Røed and Roger Flage, University of Stavanger, Norway | **Mediteranea 2** |
| **16.00 - 19.00** | Registration (Grand Hotel Bernardin, near hotel reception) | **Floor 11** |
| **19.00 - 21.00** | ESREL 2017 - Welcome Reception (Grand Hotel Bernardin) | **Floor 11** |
| **9:00-17:20** | **Monday, June 19, 2017 (registration from 8:00 - 15:40)** | |
| **9:00-9:50** | Opening Ceremony, Marko Čepin, University of Ljubljana, Conference General Chair<br>Terje Aven, ESRA Chairman<br>Igor Papič, Dean, Faculty of Electrical Engineering, University of Ljubljana<br>Andrej Stritar, Director, Slovenian Nuclear Safety Administration, invited plenary lecture,<br>Risk, hazard, probability, safety, reliability - how to use these concepts to assure nothing goes wrong in nuclear facilities | **Europa (A+B) at Floor 12** |
| **10:00-10:50** | Invited plenary Lecture, Stefan Hirschberg (Paul Scherrer Institute),<br>Health Risks of Technologies for Power Generation (Chair persons: Marko Čepin, Enrico Zio) | **Europa (A+B) at Floor 12** |
| **10:50-11:10** | Coffee Break | |
| **11:10-12:30** | Parallel morning sessions, 4 papers per session, floor 12: Europa (A+B), Europa C, Europa D, floor 11: Emerald 1, Emerald 2, Mediteranea 1, Mediteranea 2, Adria 1, Adria 2, Pharos | **All rooms** |
| **12:30-14:00** | Lunch | |
| **14:00-15:20** | Parallel sessions, Monday afternoon early, 4 papers per session | **All rooms** |
| **15:20-15:40** | Coffee Break | |
| **15:40-17:20** | Parallel sessions, Monday afternoon late, 5 papers per session | **All rooms** |
| **17:20-18:00** | Meeting of the Technical Committee on Maintenance Modelling and Applications | **Emerald 1** |
| **19:00-20:00** | Walk to Piran in groups (grouped by 27 ESRA Technical Committees, led by ESRA TC Chairs) – 1.5 km in one direction, meeting point: Grand Hotel Bernardin Reception (only in the case of good weather – no rain) | |
| **9:00-17:20** | **Tuesday, June 20, 2017 (registration from 8:50 - 15:40)** | |
| **9:00-9:50** | Invited plenary Lecture, Enrique Lopez Droguett (Universidad de Chile),<br>On the Treatment and Challenges of Model Uncertainty (Chair person: Terje Aven) | **Europa (A+B)** |
| **10:00-11:00** | Parallel sessions, Tuesday morning, 3 papers per session, Panel Discussion, Workshop | **All rooms** |
| **11:00:11:20** | Coffee Break | |
| **11:20-12:40** | Parallel sessions, Tuesday morning late, 4 papers per session, Workshop | **All rooms** |
| **12:40-14:00** | Lunch | |
| **13:00-13:30** | (within lunch time: The Lync/Skype meeting of Nordic Chapter of Society of Risk Analysis ) | **(Pharos room)** |
| **14:00-15:20** | Parallel sessions, Tuesday afternoon early, 4 papers per session, Workshop | **All rooms** |
| **15:20-15:40** | Coffee Break | |
| **15:40-17:20** | Parallel sessions, Tuesday afternoon late, 5 papers per session, Workshop | **All rooms** |
| **17:30-19:00** | ESRA General Assembly Meeting (for members only) | **Emerald 1** |
| **9:00-17:40** | **Wednesday, June 21, 2017 (registration from 8:50 - 15:40)** | |
| **9:00-9:50** | Invited plenary Lecture, Daniel Straub (Technische Universität München),<br>Reliability of smart systems (Chair Person: Coen van Gulijk) | **Europa (A+B)** |
| **10:00-11:00** | Parallel sessions, Wednesday morning early, 3 papers per session | **All rooms** |
| **11:00:11:20** | Coffee Break | |
| **11:20-12:40** | Parallel sessions, Wednesday morning late, 4 papers per session | **All rooms** |
| **12:40-14:00** | Lunch | |
| **14:00-15:20** | Parallel sessions, Wednesday afternoon early, 4 papers per session | **All rooms** |
| **15:20-15:40** | Coffee Break | |
| **15:40-17:40** | Parallel sessions, Wednesday afternoon late, 6 papers per session | **All rooms** |
| **20:00-23:00** | Conference Gala Dinner (Hotel Grand Bernardin) | **Floor 10** |
| **9:00-15:00** | **Thursday, June 22, 2017 (registration from 8:50 - 11:30)** | |
| **9:00-9:50** | Invited plenary Lecture, Antoine Rauzy (Norwegian University of Science and Technology),<br>An Implementation of Model-Based Safety Assessment (Chair person: Radim Briš) | **Emerald 1** |
| **10:00-11:20** | Parallel sessions, Thursday morning, 4 papers per session | **Rooms, Floor 11** |
| **11:20:11:30** | Coffee Break | |
| **11:30-12:15** | ESRA Plenary session, The risk analyst of the future: core competencies and specialties<br>(Terje Aven, Enrico Zio) | **Emerald 1** |
| **12:15-13:00** | Conference Closing Ceremony, ESREL 2018 Announcement | **Emerald 1** |
| **13:00-15:00** | Lunch | |

# CONTENTS



# ACKNOWLEDGMENT

We would like to thank many people for their support and contributions to ESREL 2017.
Firstly, we thank the ESRA leaders and advisors: Terje Aven, Radim Briš, Piero Baraldi, Coen Van Gulijk and Enrico Zio and ESRA assembly for entrusting us the organisation of the ESREL 2017 international conference.
We are grateful to the members of the ESREL 2017 Technical Programme Committee (122 members) and the European Safety and Reliability Association Technical Committee Chairs and Co-Chairs (27 technical committees) for volunteering their time and expertise to provide feedback as part of the contributed paper review process and for chairing the sessions at the conference. Every paper was reviewed by at least two anonymous reviewers.
We thank the colleagues, who organised special sessions of contributed papers (Krzysztof Kołowrocki, Qamar Mahboob, Coen van Gulijk, Arturo González, Emmanuel Raimond, Andrej Prošek), panel discussion (Bob Huisman, Pierre Dersin) and preconference workshop (Willy Røed and Roger Flage).
We thank the ESREL 2017 Plenary Speakers: Andrej Stritar, Stephan Hirschberg, Enrique Lopez Droguett and Antoine Rauzy for offering their unique perspectives on safety and reliability at this conference.
We thank all the authors of contributed papers for their submissions and the participants of the Images of Risk competition. We thank the 68 session chairs, who contributed to the quality of discussions at particular sessions.
We gratefully acknowledge the support of the ESREL 2017 sponsors and exhibitors: silver sponsor and exhibitor: HBM Prenscia, sponsor: Gen Energija, sponsor and exhibitor: SATODEV, sponsor and exhibitor: BQR.
We thank the following organisations for supporting the conference and making it possible: University of Ljubljana, Faculty of Electrical Engineering and European Safety and Reliability Association.
Finally, we would like to thank the ESREL 2017 organizing team including administration from Agencija 101 (Dino Zupančič, Maša Pogorevc, Leon Škrilec and Tamara Korat).

Marko Čepin

# PREFACE

**Welcome to Portorož in Slovenia!**
**The annual European Safety and Reliability Conference ESREL is an international conference under the auspices of the European Safety and Reliability Association (ESRA).**

The 27th edition of the international conference ESREL 2017 provides a forum for presentation and discussion of scientific works covering theories and methods in the fields of safety and reliability and their application to a wide range of industrial, civil and social sectors and problem areas. ESREL 2017 is an opportunity for researchers and practitioners, academics and engineers to meet, exchange ideas and gain insights from each other.

ESREL 2017 is organised by the Faculty of Electrical Engineering, University of Ljubljana. University of Ljubljana is the oldest and largest higher education and scientific research institution in Slovenia, founded in 1919.

The program of ESREL 2017 includes five invited plenary lectures given by world leading scientists, a conference workshop, panel discussions, which include professionals and experts from the industry and internationally recognised researchers, and presentations of contributed papers, which continue the ESREL tradition of sharing new ideas, theories and methods on one side and their applications across multiple industry domains on the other side.

Data about 696 professionals was inserted into the conference organising system. More than 640 abstracts have been submitted, followed by more than 480 papers. The technical programme committee included 122 members who reviewed papers in such a way that at least 2 committee members reviewed each paper and 455 papers have been selected for publication and presentation at the conference.

The form of innovation described in these papers varies across topics with relatively incremental change associated with those better understood problems and more radical innovations proposed for emergent problems or modelling challenges facing industry and society. Topics include established areas, which are covered by the related to the ESRA technical committees such as accident and incident modelling, economic analysis in risk management, foundational issues in risk assessment and management, human factors and human reliability, maintenance modelling and applications, mathematical methods in reliability and safety, prognostics and system health management, resilience engineering, risk assessment, risk management, simulation for safety and reliability analysis, structural reliability, system reliability and uncertainty analysis. Those areas are covered in a wide range of industrial and governmental sectors, including aeronautics and aerospace, chemical and process industry, civil engineering, critical infrastructures, energy, information technology and telecommunications, land transportation, manufacturing, maritime and offshore technology, natural hazards, nuclear industry, occupational safety and security. In addition, contemporary themes are dealt with such as the Marie Skłodowska-Curie innovative training network in structural safety, risk approaches in insurance and finance sectors, dynamic reliability and probabilistic safety assessment, Bayesian and statistical methods, reliability data and testing, organizational factors and safety culture, software reliability and safety, probabilistic methods applied to power systems, socio-technical-economic systems, advanced safety assessment methodologies: extended probabilistic safety assessment, reliability, availability, maintainability and safety in railways: theory and practice, big data risk analysis and management, model-based reliability and safety engineering.

Papers authored by practitioners provide insights into the challenges faced in real-life applications and share insights into the impact of the interventions to manage risk, while scientific papers share theoretical, methodological and empirical research contributions.

At ESREL 2017, we also initiated the competition entitled Images of Risk. Please, visit our exhibition and see a selection of images.

Marko Čepin, Radim Briš

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**Terje Aven (University of Stavanger, ESRA Chairman), general co-chair**

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Visit the new ESRA website at **http://esrahomepage.eu**.

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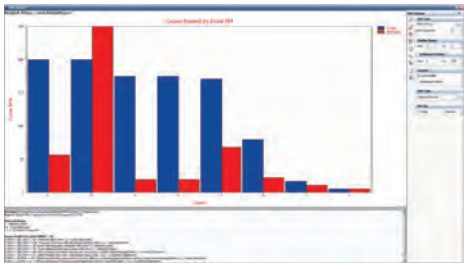

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INVITED PLENARY LECTURE

## DR. ANDREJ STRITAR,
### DIRECTOR OF THE SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

Dr. Andrej Stritar is the director Director of Slovenian Nuclear Safety Administration from the year 2002. Before this position he was a researcher at Jožef Stefan Institute and the Head of the Nuclear Training Centre. Between years 1991-2002 he was the president of the Nuclear Society of Slovenia and its founding member. Dr. Andrej Stritar was president of European Nuclear Society in the years 2002-2003. He was the chairman of ENSREG, a body to advise the European Commission, the Council of the European Union as well as the European Parliament, and had several other international duties.

### RISK, HAZARD, PROBABILITY, SAFETY, RELIABILITY - HOW TO USE THESE CONCEPTS TO ASSURE NOTHING GOES WRONG IN NUCLEAR FACILITIES

INVITED PLENARY LECTURE

## DR. STEFAN HIRSCHBERG,
### LABORATORY FOR ENERGY SYSTEMS ANALYSIS, PAUL SCHERRER INSTITUTE (PSI), VILLIGEN PSI, SWITZERLAND

Dr. Stefan Hirschberg is the Head of the Interdepartmental Laboratory for Energy Systems Analysis at the Paul Scherrer Institut (PSI), Switzerland. The Laboratory consists of three Groups: Technology Assessment, Energy Economics, and Risk and Human Reliability. His research interests include: Life Cycle Assessment, Environmental Impact and External Cost Assessment, Risk Assessment, Sustainability Assessment, Development of Integrated Tools for Decision Support, Analysis of Energy Supply Strategies, and Integrated Assessment of Mobility. Since 2008, he is an individual member of the Swiss Academy of Engineering Sciences (SATW). Before joining PSI in 1992 he was responsible for Risk and Reliability Assessment within ABB, Sweden (1982-1990). During a leave of absence from ABB between 1990 and 1992 he joined the International Atomic Energy Agency (IAEA; Vienna, Austria) as First Officer responsible for activities in the field of Probabilistic Safety Assessment. Between 1974 and 1982, he worked as a researcher in the Department of Reactor Physics at Chalmers University of Technology, Gothenburg, Sweden. He has a M.Sc. degree in engineering physics and Ph.D. degree in reactor physics from Chalmers.

### HEALTH RISKS OF TECHNOLOGIES FOR POWER GENERATION


**ABSTRACT**

The goals of sustainability include minimization of negative health impacts of energy systems. Such effects may arise due to emissions of pollutants from the normal operation of power plants and the associated fuel cycles as well as from accidents, thus contributing to increased mortality and morbidity. In fact, health damages of power generation are major contributors to the corresponding external costs.

The health risks associated with energy supply are of high public interest and are frequently in the focus of attention in debates addressing the advantages and disadvantages of specific options. However, this is subject to major deficiencies and misunderstandings due to the lack of solid basis in terms of systematic comparisons of health effects caused by the normal operation on the one hand and by random or intentional accidents on the other hand. The scope of such comparisons should ideally cover not only the power plants but also the full energy chains. Furthermore, proper attention must be paid to the appropriate, balanced choice of reference technologies since the results are technology-specific and depend on a variety of boundary conditions such as geographical and temporal scope as well as fuel and material supply chains.

The risk profiles of the various technologies vary in the sense that different energy chain stages dominate the risks. Thus, in the fossil chains the upstream stages provide the largest contributions to severe accident risks while in the case of hydro and nuclear power the corresponding risks are concentrated to power plants.

As a part of comprehensive analysis of current and future energy systems we carried out numerous analyses of health effects of a wide spectrum of electricity supply technologies including advanced ones, operating in various countries under different conditions (Hirschberg et al., 2016).

State-of-the-art methods were used for the estimation of health effects. Impacts of normal operation are estimated using detailed Life Cycle Assessment (LCA), Impact Pathway Approach (IPA) allowing accounting for site-specific effects, and combination of these two methods.

Estimation of health effects caused by severe accidents is based on historical experience as represented in our Energy-related Severe Accidents Database (ENSAD), the most comprehensive database worldwide covering accidents in the energy sector. This is supplemented by the results of full scope Probabilistic Safety Assessments. Specifically, for new renewables we use a hybrid approach including statistics (e. g. for wind), modelling (e. g. for solar PV), proxies (e. g. partially for geothermal, biogas) and expert judgment (e. g. for solar thermal or wave and tide). A novel approach to the analysis of terrorist threat against energy infrastructure was developed, implemented and applied to selected energy facilities in various locations. It considers a number of factors including: attractiveness of specific objects as targets for an attack, implementation scenarios depending on resources, time, know-how and countermeasures, and estimation of consequences.

Finally, major limitations of the current approach are identified and recommendations for further work are given.

### REFERENCES

Hirschberg, S., Bauer, C., Burgherr, P., Cazzoli, E., Heck, T., Spada, M. & Treyer, K. (2016) Health effects of technologies for power generation: Contributions from normal operation, severe accidents and terrorist threat, Reliability Engineering & System Safety, 145, pp. 373–387.

## INVITED PLENARY LECTURE

## PROFESSOR ENRIQUE LOPEZ DROGUETT,
### UNIVERSIDAD DE CHILE, CHILE

Enrique López Droguett is Associate Professor in the Mechanical Engineering Department at the University of Chile, and Adjunct Associate Professor at the University of Maryland, USA, and is Associate Editor for the Journal of Risk and Reliability. Dr. López Droguett conducts research on computational methods for reliability, maintenance, prognostics and system health management. He has led many major studies on these topics in the oil and gas sector, nuclear energy, defence, and energy distribution networks. Dr. López Droguett obtained his PhD from the University of Maryland in 1999.

## ON THE TREATMENT AND CHALLENGES OF MODEL UNCERTAINTY

### ABSTRACT

Scientific disciplines generally rely on models to describe or predict the behaviour of the reality of concern. Models are always abstractions of reality and usually reflect a less than perfect state of knowledge regarding that reality. The extent to which the model differs from reality is the essence of uncertainty about the model's predictive or descriptive accuracy. In practice, however, the descriptive

or predictive accuracy of a model has to be seen in relation to the model objective. That is, the quality of a model is measured against its objectives. Using a simple but useful way to characterize models in terms of model form (or structure) and model parameters, one can attribute the uncertainty in model predictions to two sources: one stemming from model form (model uncertainty) and another from model parameters (parameter uncertainty).

Methods for assessing parameter uncertainties are well established and the theoretical and practical issues mainly revolve around improving computational efficiency in complex cases. Treatment of model uncertainty, on the other hand, poses formidable conceptual and practical challenges. Since model uncertainties are very often the dominant sources of uncertainty, finding a solution is essential to those decisions sensitive to the magnitude of uncertainty. In general, decisions in the absence of information on model uncertainty could be less than optimal and even erroneous.

In this talk, a discussion is presented on the philosophical grounds of some relevant notions such as reality, models, and modelling process. In that context the concept of uncertainty, particularly the controversial topics of type and sources of uncertainty, are discussed. Based on these discussions, it is presented a review of the current state of the art in dealing with model uncertainty with a focus on risk and reliability, examine the need and value of approaches to quantification of model uncertainty including practical issues and challenges in dealing with model uncertainty in complex problems.

INVITED PLENARY LECTURE

## PROFESSOR DANIEL STRAUB,
### TECHNISCHE UNIVERSITÄT MÜNCHEN, GERMANY

Daniel Straub is Professor for engineering risk and reliability analysis at TU München. His interest is in developing physically-based stochastic models and methods for decision support in infrastructure, environmental and general engineering systems, with a particular focus on Bayesian techniques. Daniel obtained his Dipl. Ing. degree in civil engineering in 2000 and his PhD in 2004 from ETH Zürich and consequently was a postdoctoral researcher and adjunct faculty at UC Berkeley before joining TU München in 2008. He is frequently active as a consultant to the industry on reliability and risk assessments for structures, infrastructures and the oil and gas industry. His awards include the ETH Silbermedaille and the Early Achievement Research Award of IASSAR. He is also an honorary professor at the University of Aberdeen, UK.

## RELIABILITY OF SMART SYSTEMS


**ABSTRACT**

Technology and engineering are in the midst of a paradigm shift, with systems that are characterised by adjectives like smart, intelligent, adaptive or autonomous becoming ubiquitous. Rapid advances in sensor technology, data management and machine learning drive this change; the underlying key concept behind these technologies is information. This development poses a series of opportunities and challenges to risk management, reliability and quality control of technological systems.

Information reduces uncertainty and enables an improved prediction of hazards and risk. If coupled with a suitable (smart) risk management strategy, information can help to ensure the reliability of engineering systems in a cost-effective manner. Intelligent and automated systems directly use information to react to the environment and manage risks; examples include autopilot systems in aircrafts or cars. In other contexts, information is used by human risk managers to find optimal decisions, such as in predictive maintenance. Procedures and methods for reliability assessment have only partially managed to keep up with these developments. In particular, formal procedures for demonstrating the reliability of systems that include sensor technology are still lacking. But challenges are also associated with the optimization of

risk management strategies under varying information, as well as the design of the sensor and monitoring systems that ensure reliability.

The use of information to manage risk is nothing new; engineers and operators of technological systems have long used information to ensure the reliability of these systems. What is new is the amount and degree of information that is available, and the increased need to formally demonstrate the effect of information on reliability. For example, geotechnical engineers have always used the observational method in their design, but it is only in the current revision of Eurocode that this approach will be formally included in the design standard. In the near future, safety-relevant decisions will increasingly be taken by algorithms, shifting the liability from the user to the producer of the system; an example is the current introduction of highly automated driving vehicles.

In this presentation, I will briefly review Bayesian analysis, which is a key concept in the assessment, optimization and verification of the reliability of smart systems, mainly because it enables a quantification of the effect of information on the reliability. Another major advantage of Bayesian analysis is its flexibility and its efficiency in handling large amounts of data. Through a series of examples, I will demonstrate the use of Bayesian analysis in reliability assessment. I will discuss the need for large amounts of data to verify the reliability of smart systems, an issue that can be partly mitigated by utilizing data from sensors that are already built into systems in-service. I will also touch upon the issue of optimizing sensors and monitoring systems for the purpose of reliability control. Finally, I will show the benefits of adaptive reliability and risk management, and how they can be quantified.

The theory will be illustrated through a broad range of applications, including automated cars, monitoring in aircraft and offshore structures, warning systems for natural hazards and infrastructure risk management.

## INVITED PLENARY LECTURE


# PROFESSOR ANTOINE RAUZY,
## NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY, NORWAY


Antoine B. Rauzy is Professor in the department of Mechanical and Production Engineering at Norwegian University of Science and Technology (NTNU, Trondheim, Norway). He is also the head of the chair Blériot-Fabre, sponsored by the group SAFRAN, at CentraleSupelec (Paris, France). During his career, he moved forth and back between academia and industry, being notably Senior Researcher at French National Centrer for Scientific Research (CNRS), CEO of the start-up company ARBoost Technologies he founded, and Director of the R&D department on Systems Engineering at Dassault Systemes (largest French software developer). He has a background in computer science (PhD and a tenure). He has worked in the Reliability Engineering and System Safety field for more than 20 years and on Systems Engineering for about 5 years. He published over 150 articles in international conferences and journals. His work contributed to renewed mathematical and algorithmic foundations of system reliability theory (e.g. fault tree analyses). He developed state-of-the-art software for probabilistic safety/risk analyses. He is also the main designer of the AltaRica modelling language. He is currently teaching, both at NTNU and at Centrale Paris, foundations of model-based systems engineering, system reliability theory and computer science.

## ALTARICA 3.0: AN IMPLEMENTATION OF MODEL-BASED SAFETY ASSESSMENT

### ABSTRACT


Model-based safety assessment (MBSA) is an emerging paradigm. Briefly speaking, it consists of using high level modelling languages to perform reliability/availability/maintainability/safety (RAMS) studies. The term MBSA is arguably not very well suited as models have been in use since the very beginning of RAMS engineering (a fault tree is a model, a Markov chain is a model...). MBSA just emphasizes that this

"new" approach is the declension in our discipline of model-based systems engineering [INCOSE 2015].

The rationale for introducing high level models is twofold. First, with the increasing complexity and interconnection of systems, RAMS studies must be integrated as early as possible into the design cycle of systems. Concretely, this means that RAMS engineers need to communicate their models to engineers of other disciplines. The experience shows that classical RAMS models such as fault trees, event trees, Markov chains or stochastic Petri nets are too distant from system specifications to support seamless communication. Second, still in reason of this distance, classical models proved hard to maintain throughout the life-cycle of systems. Any modification in system specifications requires a tedious and error-prone impact analysis on RAMS models. The idea of MBSA is to design RAMS models that are closer to those designed by systems architects/engineers. If necessary, these high level models can be compiled into classical models (e.g. fault trees or Markov chains) for assessment purposes.

Rational and trends of MBSA are thus the framework of this communication. More specifically, we shall introduce AltaRica 3.0, an object-oriented language dedicated to RAMS analyses of complex systems [Prosvirnova 2013]. We shall give a snapshot of the AltaRica model design and assessment process.

As its name indicates, AltaRica 3.0 is third version of the language. The AltaRica project started at the end of the nineties. It is a complete redesign of the language to integrate the fifteen years of both academic and industrial experience with its previous version(s) and fully benefit of the object-oriented modeling paradigm.

A full panoply of assessment tools for AltaRica 3.0 models is currently under development, including a step-by-step and stochastic simulators, compilers to fault trees and to Markov chains, a critical sequences generator and a model-checker. These tools will be integrated into the AltaRicaWizard modeling environment. AltaRicaWizard is a freeware developed as a joint effort of teams in France and in Norway. Its development is supported by industry (main partners are Airbus, Safran and Thalès).

With this project, our objective is to set-up the foundations of the next generation of RAMS modeling tools, and beyond RAMS, the next generation of tools to assess performance of complex systems by means of stochastic models. We are deeply convinced that this should result from an international, cooperative effort. That is the reason why tools will be free of use, at least for academic and proof-of-concepts purposes.

In a word, this presentation will give an overview of one of the most advanced researches and developments projects regarding the so-called model-based safety assessment paradigm.

**REFERENCES**

INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, fourth edition. David D. Walden, Garry J. Roedler, Kevin J. Forsberg, R. Douglas Hamelin and Thomas M. Shortell Ed. Wiley-Blackwell. Hoboken, NJ, USA. ISBN 978-111899940O. August, 2015.
Tatiana Prosvirnova, Michel Batteux, Pierre-Antoine Brameret, Abraham Cherfi, Thomas Friedlhuber, Jean-Marc Roussel, Antoine Rauzy. The AltaRica 3.0 project for Model-Based Safety Assessment. Proceedings of 4th IFAC Workshop on Dependable Control of Discrete Systems, DCDS'2013. International Federation of Automatic Control. ISBN 978-3-902823-49-6. pp. 127–132. York, Great Britain. September, 2013.

# IMAGES OF RISK

"Images of Risk" is a competition, where the participants are invited to submit an original image they have created to communicate an interesting aspect of their work. The image may be a photograph, a drawing or diagram. Although we have named the competition "Images of Risk", we consider Risk in this context to include safety, reliability, risk, resilience, maintenance and related terms that fall within the scope of ESREL 2017.

The list of the participants that provided the Images of Risk (the images are available to be viewed at the conference foyers).

| PARTICIPANT AND AUTHOR | GROUP |
|---|---|
| Jennifer E. Lynette | PhD student |
| Nurseda Yildirim Yurusen, Maik Reder | PhD student |
| Aleš Filip | Academia |
| Rui Du | Academia |
| Alessandro Mancuso | PhD student |
| Christian H. A. Kuran | PhD student |
| Terje Aven | Academia |
| Heinrich Mödden | Industry |
| Sónia H. Marques | Academia |
| Inga Zutautaite | Academia |
| Claudia Morsut | Academia |
| Behnaz Hosseinnia | Academia |
| Roberto Rocchetta | PhD student |
| Per Gustafson | PhD student |
| Alexey Leksin | Academia |
| Goran Stanković | PhD student |
| Claudia Vivalda | Academia |
| Dhruv Pandya | PhD student |
| Jiří J. Urbánek and Jiří F. Urbánek | Academia+ PhD student |
| Martin Hromada | n/a |
| Yana Kritskaya | Not ESREL participant |
| Biloborodova Tetiana | Not ESREL participant |

# WORKSHOPS, SPECIAL SESSIONS AND PANEL DISCUSSIONS

WORKSHOP -
## APPLICATION AND USE OF RISK ASSESSMENTS - KEY CHALLENGES AND RECENT ADVANCES

The workshop addresses key challenges and recent advances in application and use of risk assessments in different industries. It is relevant for delegates familiar with basic risk analysis methods, who would like to enlighten their perspectives on how to plan, execute and use risk assessment to adequately support decision making. A main topic is how to effectively deal with uncertainties and knowledge in risk assessments. The workshop includes lectures, case study examples and discussions among the participants.

Duration: 4 hours, Time: 12.00- 16.00, Sunday June 18, 2017, Participation free for ESREL delegates
Lecturers: **Willy Røed and Roger Flage**, University of Stavanger, Norway

Willy Røed has more than 15 years of experience within risk management related subjects. Since he finished his PhD in 2006, he has worked as an industry consultant through the company Proactima, and as a researcher at the University of Stavanger.

Roger Flage is an associate professor at the University of Stavanger, Norway. He has also worked as a consultant in the field of risk assessment and management. Much of his research focuses on treatment of uncertainty in risk assessment, and he is co-chair of the ESRA technical committee on uncertainty analysis.

WORKSHOP - HBM PRENSCIA
## THE INTEGRATION OF RELIABILITY & DURABILITY WITHIN HBM PRENSCIA SOFTWARE

The workshop will take place on
20th June, Tuesday, 10:00-12:30 at the Pharos room.
Presentation (15 minutes) is continued with software workshop.

WORKSHOP - BQR
## EFFICIENT RELIABILITY ENGINEERING IN UAVS AND COMPLEX DESIGNS

The workshop will take place on
20th June, Tuesday, 14:00-17:20 at the Pharos room.
Please register here:
**http://www.bqr.com/register-to-esrel-2017-workshop-on-reliability-and-maintenance/**
Invitation: **http://www.bqr.com/brochures/Invitation.pdf**

SPECIAL SESSION:
## CRITICAL INFRASTRUCTURE SAFETY

**Krzysztof Kołowrocki,** Maritime University, Gdynia, Poland
**Acknowledgements** - The paper presents the results developed in the scope of the EU-CIRCLE project titled "A pan – European framework for strengthening Critical Infrastructure resilience to climate change" that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653824. **http://www.eu-circle.eu/**

SPECIAL SESSION:
## TRUSS, A MARIE SKŁODOWSKA-CURIE INNOVATIVE TRAINING NETWORK IN STRUCTURAL SAFETY

SPECIAL SESSION:
### ASAMPSA_E ADVANCED SAFETY ASSESSMENT METHODOLOGIES: EXTENDED PSA

SPECIAL SESSION:
### RAMS IN RAILWAYS: THEORY & PRACTICE

SPECIAL SESSION:
### BIG DATA RISK ANALYSIS AND MANAGEMENT

SPECIAL SESSION:
### MODEL-BASED RELIABILITY AND SAFETY ENGINEERING

PANEL DISCUSSION:
### INDUSTRIAL CHALLENGES IN LAND TRANSPORTATION

**Bob Huisman, Pierre Dersin,** Tuesday, June 20, 10:00, Room Europa A+B

# ESRA EVENTS

Monday, June 19, 17:20-18:00, Meeting of the Technical Committee on Maintenance Modelling and Applications, Emerald 1.

Monday, June 19, 19:00-20:00, Walk to Piran in groups (grouped by 27 ESRA Technical Committees, led by ESRA TC Chairs) – 1.5 km in one direction, meeting point: Grand Hotel Bernardin Reception (only in the case of good weather – no rain).

Tuesday, June 20, 17:30-19:00, ESRA General Assembly Meeting (for members only), Emerald 1.

# SOCIAL EVENTS

Monday, June 19, 19:00-21:00, ESREL 2017 - Welcome reception (Grand Hotel Bernardin), Floor 11.

Wednesday, June 21, 20:00-23:00, Conference Gala Dinner (Grand Hotel Bernardin – Floor 10).

The number of places at social events is limited (included in registration). Please contact the registration desk for later ticket availability before Monday. Please inform the registration desk about your dietary requirements for Gala dinner before Tuesday noon. Dress code: casual.

# GENERAL INFORMATION

## CHANGES TO TECHNICAL AND SOCIAL PROGRAMMES

ESREL 2017 organisers reserve the right to change the Technical and/or the Social Programmes as, if and when necessary.

## CONFERENCE VENUE

Grand Hotel Bernardin, Obala 2, 6320 Portorož, Slovenia.
Floor 11 is a floor counted from the sea level if entering the hotel from the sea side and at the same time it is the ground floor if you are entering the hotel from the main entrance from the incoming street. Rooms: Emerald 1, Emerald 2, Mediteranea 1, Mediteranea 2, Adria 1, Adria 2, and Pharos are located in the main conference area near the registration. Floor 12 is a floor above the ground floor for the opening plenary and some parallel sessions. Rooms Europa (A+B), Europa C, and Europa D are located there.

## LANGUAGE

The official language of ESREL 2017 is English.

## CONFERENCE APP

The conference app is an easy way to plan your event schedule, access Extended Abstracts, and receive the tips for eating out and things to do in Portorož. You can download the Guidebook app for free on iOS and Android devices from the Apple App Store or Google Play Store. Once installed, you simply search for and download our very own ESREL2017 Guidebook. Note that the first download may take while as it downloads the Extended Abstracts, but later updates will be fast.

The conference app will be used to notify participants of any changes in the technical programme and we recommend that you use it. A web version is also available and can be accessed through the guidebook site guidebook.com.

## CONFERENCE GUIDES

As well as the conference administrators who can be found at the Registration Desk through the entire duration of the conference, ESREL 2017 staff will act as conference guides. A guide will be available in each room for contributed presentations and also generally available to help. Guides will be identifiable by their ESREL2017 t-shirts.

## CATERING

Catering points will be located in Grand Hotel Bernardin. If you have a special dietary requirement and have requested a special meal, please visit the registration desk.

## EXHIBITION

We would like to thank all the ESREL 2017 sponsors and exhibitors. Please, visit them during the conference in Grand Hotel Bernardin on Floor 11 next to the conference reception area.

## GUIDELINES FOR PRESENTERS AND SESSION CHAIRS

Each presentation has been allocated 15 minutes, with an additional 5 minutes for discussion. Please, keep to the scheduled times so that the conference can run smoothly and participants can attend the talks they wish to see.

Session chairs have been asked to keep exactly to the timetable.

Presenters should upload their presentation onto the presentation computers before their session using a USB memory device.

These computers are running the Windows operating system. Please, keep in mind to save your presentation files in several formats (PowerPoint and PDF; please, avoid the latest versions of the computer software to avoid problems with compatibility).

Presenters are strongly discouraged from using their own computers and should do so in exceptional cases only. Changing computers takes time away from other presenters and valuable discussions. In these special cases, presenters should verify that their presentation works by connecting their device to the projector in the room where they will present and test their presentation out before beginning their session. Conference staff will be there during the breaks to help.

Presenters should meet the Session Chair during the break before the session. They are encouraged to provide very short written biographical statements to the Session Chair in advance.

Session Chairs have the responsibility to introduce the speakers, to lead the discussions, and to ensure that the session schedule is observed. Every effort should be made to keep to the 20-minute total time allocation for each presenter to ensure the next talk starts on time. If a session presenter does not show up, the Session Chair should compensate, as much as possible, by allowing for appropriately extended discussion of the presented papers while maintaining the presentation sequence, and ensuring that the next speaker starts at the publicised time.

## INTERNET ACCESS

Free WiFi network is available everywhere at the conference locations.
**Login: ESREL**
**Password: ESREL2017**

## REGISTRATION DESK

All delegates will receive their badge holder with lanyard, pre-booked tickets and all relevant conference information upon arrival at registration desk. The registration and information desk will be open at the following times:

| | |
|---|---|
| Sunday 18th June: | 16:00 – 19:00 |
| Monday - 19th June | 8:00 – 15:40 |
| Tuesday - 20th June, Wednesday - 21th June: | 8:50 – 15:40 |
| Thursday 22th June: | 8:50 – 11:30 |

## SECURITY

Your name badge must be worn at all times otherwise you will not be allowed entry to the main conference sessions.

## FIRST AID

Should you require any assistance, please contact the hotel staff member or a member of the Conference Team located at the registration desk.

# ACCOMPANYING PERSON PROGRAM WHAT TO DO AFTER THE CONFERENCE

**POSTOJNA CAVE https://www.slovenia.info/en/places-to-go/attractions/postojna-cave**
**Take a train into the magical subterranean world**
A legendary tourist train takes you to the underground network of karst tunnels, galleries, and halls. Postojna Cave is the only karst cave with a cave railway. For 140 years it has been taking visitors to see stalactites and stalagmites and other features created by water. During an hour and a half long guided tour, you learn about all of the most important karst features, you see the largest, 5-metre-high stalagmite known as Brilliant, you visit the oldest underground post office in the world and the most famous underground animal – the human fish (proteus).

**The most visited cave**
So far, more than 37 million visitors from all over the world have seen Postojna Cave. They began their visit at the departure platform of the unique cave railway. A 5-kilometre subterranean trail is available

for tourist visits. The train has also been adapted for disabled access.

**Visit the offspring of dragons**
More than 150 animal species live in the karst caves of Slovenia, and the largest among them is the human fish (Proteus anguinus). The only European underground vertebrate can live for up to 100 years and can survive without food for years at a time. A section of the Postojna Cave is the Proteus Cave and Vivarium, where you can learn about this rare and endangered species in greater detail. In 2016, offspring hatched from the eggs of the human fish in the vivarium for the first time. It has been long believed that the human fish is the offspring of a dragon that would swim up to the surface with the rising of subterranean waters. Don't worry: the human fish is adapted to life in darkness and you are not likely to see it outside of the vivarium.

**The birth of a human fish**
In May 2016, offspring of the human fish hatched in the Postojna Cave. This is an extremely rare occurrence, as baby human fish have been hatched in an aquarium only once before. Take a look at why this birth is so significant. **https://www.slovenia.info/en/places-to-go/attractions/postojna-cave**

**PREDJAMA CASTLE**
Predjama Castle is located in the vicinity of the Postojna Cave and is the largest cave castle in the world. For over 800 years it has guarded a 123-metre high rock face. Mysterious underground tunnels connect it with the cave directly beneath. The castle, which has also been a film location, offered refuge to its legendary owner Erazem Predjamski in the 15th century. This robber knight resisted a siege for over a year in his castle with its incredible appearance and location. Visitors can take a bus between the Postojna Cave and Predjama Castle to see both landmarks.

**Knight tournaments and medieval days**
Every summer, Predjama Castle is the location of Erazem's Knight Tournament, in which knights, archers, swordsmen, and horsemen show their fighting abilities and the historic way of life at a knight's encampment. Medieval days, markets, and camps are also organised by many other Slovenian towns with castles. **https://www.postojnska-jama.eu/en/come-and-visit-us/predjama-castle/**

**LIPICA**
The world-famous riding school of the Lipizzaners, the gracious »four-legged aristocrats«, lies in a green oasis in the middle of the Karst region. It was founded in 1580. Today, Lipica proudly continues the 400-year old tradition of breeding the famous white horses. Visit with local guide.
**https://www.slovenia.info/en/places-to-go/attractions/lipica**
**http://www.lipica.org/en/what-to-do/visit-to-the-stud-farm**

**FISH PICNIC**
Imagine cruising on a boat along the coast on a nice day. Admiring the beautiful Slovenian coast with pearls and stop in Koper and Izola. Lunch on the boat.

**PIRAN, THE DREAM CITY**
One of the most photogenic cities in the Mediterranean, Piran has preserved its unsurpassed charm. Enter the picturesque Piran, get to know its rich history and culture, and listen to the stories of our people. The proximity to the sea and the rich history, which is mirrored in the architecture, draw magical scenes. In Piran, you will feel as though you have stepped right into a picture postcard. You will be charmed by the narrow streets within the old town wall. In the main square, you will be greeted by the statue of the most famous man in Piran, the well-known Giuseppe Tartini, composer and virtuoso violinist who was born in a house just steps from the square. On the pier, you can catch sight of fisherman unravelling a fishing net.

A market woman from Piran will have just delivered vegetables, fresh from her garden, to the market. Locals sitting by the sea, chatting and listening to sounds of the sea, greet you with a nod.
**http://www.portoroz.si/en/portoroz-and-piran/1803**

**TASTE OF COUNTRYSIDE (SALT AND OIL AND WINE)**
Images keep flowing in: hilly countryside, stonewalled pastures, green valleys, small towns, vineyards and olive plantations, old stone houses, pine-trees, and friendly people. »Tonina hiša« - the museum exhibits old items and objects illustrating the life of inhabitants of Istria in ancient times. Visit a wine

cellar and make a toast with a glass of the regional wine. »Salt pans« - this 700-year old story speaks about the salt production.
**http://www.pomorskimuzej.si/en/tonas-house**

**THE SALT PANS IN SLOVENIA NOWADAYS**
Nowadays, the salt pans exist only in Strunjan and Sečovlje. In addition to these, Strunjan lagoons (Stjuža and Pretočna), both of the Fiesa lakes, the Škocjan marshes and the delta of the Rižana River are also considered to be a part of the coastal marsh wetlands. All Slovenian coastal wetlands are thus the work of human endeavour, but still coexist with nature.

Today, the Sečovlje salt pans are the largest of the coastal marsh wetlands (650 hectares), and at the same time, the most important Slovenian locality from the ornithological point of view. The variety of bird species in this area, from the aspect of nesting and wintering, is much larger than in any other comparable locality of its kind.
**http://www.portoroz.si/en/experience/natural-attractions/secovlje-salt-pans**

**ŠKOCJAN CAVES – UNESCO WORLD HERITAGE**
The Škocjan Caves were entered on UNESCO's list of world heritage sites on 28 November 1986. The Škocjan Caves are, above all, a natural phenomenon of global significance, ranking side by side with the Grand Canyon, the Great Barrier Reef, the Galapagos Islands, Mount Everest and others.
**http://www.unesco.org**

**The Škocjan Caves meet the scientific criteria for world heritage sites in the field of nature:**

- the largest known underground canyon in the world (UNESCO criteria a-i, a-iii);
- an example of contact karst;
- Velika and Mala dolina, part of the caves with sink holes and the underground canyon are examples of extraordinary natural beauty with great aesthetic value (UNESCO criteria a-iii);
- an extraordinary ecosystem
- Campanula justiniana which grows only in the South-Western part of Slovenia (an endemic species) while bats and the subterranean cave fauna are the most significant endangered animal species (UNESCO criteria a-iv);
- the area also has great cultural and historical significance as it has been inhabited since the Mesolithic period. **http://www.park-skocjanske-jame.si/en/information/certifications**

**Contact the reception of Grand hotel Bernardin for further information.**

# PARALLEL SESSIONS – EUROPA, EMERALD

## 19. 6. PARALLEL SESSIONS, MONDAY MORNING, 4 PAPERS PER SESSION

| 11:10-12:30 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Fundamental Issues in Risk Analysis and Management 1** | **Advanced Safety Assessment ASAMPSA_E 1** | **Accident Modelling 1** | **Maintenance Modelling and Applications 1** | **Resilience in critical infrastructures 1** |
| | **Terje Aven** | **Emmanuel Raimond** | **Peter Burgherr** | **Christophe Bérenguer** | **Giovanni Sansavini** |
| **11:10-11:30** | J. Zhou, K. Hänninen, K. Lundqvist, L. Provenzano | A. Prošek, A. Wielenberg, H. Löffler, E. Raimond | Laura Savoldi, Roberto Bonifetto, Roberto Zanino | Huadong Mo, Giovanni Sansavini | Stian Antonsen, Lars Bodsberg, Jacob Kringen |
| | An Ontological Interpretation of the Hazard Concept for Safety-Critical Systems | Methodology for Selecting Initiating Events and Hazards for Consideration in an Extended PSA | Analysis of a loss-of-flow accident (LOFA) in a tokamak superconducting Toroidal Field Coil | Performance-based maintenance of degraded control systems | User needs for resilience indicators in interconnected critical infrastructures |
| **11:30-11:50** | A. Hafver, S. Eldevik, O. V. Drugan, I. Jakopanec, F. B. Pedersen, R. Flage, T. Aven | Y. Guigueno, E. Raimond, M. Nitoi, P. Brac, D. Vasseur, G. Hultqvist | Mohamed Zahran, Pu Xue, Moustafa Esa, B. C. Y. Bai, G. L. Su | Nuria C. Caballe, Inma T. Castro | Maren Maal, Kjersti Brattekås, Kjell Olav Nystuen, Ronny Windvik |
| | Risk-based- versus control-based safety philosophy in the context of complex systems | Summary of PSA End-Users views on extended PSA concept in the project ASAMPSA_E | On design of stiffened 3D-multi-cell for enhancing the vehicle crashworthiness and occupant safety | Performance measures for a system subject to degradation and sudden shocks | How to assess future security threats to critical infrastructure systems? Lessons learnt and best practices from a security risk assessment of the ERTMS in Norway |
| **11:50-12:10** | Simen Eldevik, Andreas Hafver, Irena Jakopanec, Frank Børre Pedersen | E. Raimond, M. Kumar, H. Loeffler, A. Wielenberg | P. Skjetne, E. J. Davies, J. Er.Olsen, F. Leirvik, D. F. Krause, G. Eidnes | T. Grubessich, P. Viveros, R. Stegmaier, F. Kristjanpoller | David Rehak, Simona Slivkova, Veronika Brabcova |
| | Risk, Uncertainty, and "What if?" – A practical view on uncertainty and risk in the knowledge- and physical domain. | Objectives, challenges and development of multi-unit PSA – considerations from the ASAMPSA_E project | Comparison of Meso Scale Subsea gas Release With Multiphase Eulerian-Lagrangian CFD Model | Design of indicators of workshop utilization for a railway company of passengers transport | Evaluation the resilience of critical infrastructure subsystems |
| **12:10-12:30** | | Kurt Decker, Hans Brinkman, Emmanuel Raimond | Zanino, Froio, Bertinetti, Savoldi, Cismondi, Ciattaglia | | Aleksandar Jovanovic, Flor Angela Quintero, Amrita Choudhary |
| | | Hazards and hazard combinations to be considered in extended Probabilistic Safety Assessment (PSA) | Benchmark of the GETTHEM Vacuum Vessel Pressure Suppression System (VVPSS) model for a helium-cooled EU DEMO blanket | | Use of safety-related indicators in resilience assessment of Smart Critical Infrastructures (SCIs) |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 19. 6. PARALLEL SESSIONS, MONDAY MORNING, 4 PAPERS PER SESSION

| 11:10-12:30 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Assessment of Natural Hazards** | **Reliability in Land Transportation** | **Uncertainty Analysis 1** | **Prognostics and System Health Management 1** | **Wind Power Reliability** |
| | **Pieter van Gelder** | **Coen van Gulijk** | **Sebastian Martorell** | **Piero Baraldi** | **Enrico Zio** |
| **11:10-11:30** | C. Vivalda, V. Verda, A. Carpignano, Dell'Erba, D. Cagliero, E. Guelpa | Datian Zhou, A.G. Hessami, X. Yao | Luis G. Crespo, Sean P. Kenny, Daniel P. Giesy | C. Modarres, A. Coburger, E. Droguett, M. Fuge | Maik Reder, Julio J. Melero |
| | Forest Fire Risk Analysis Methods and Simulation Tools | Model based approach to Identifying Hazards for Modern Train Control System | On the calculation and shaping of staircase random variables | Computer Vision for Damage Recognition and Location Identification: A Deep Learning Based Approach | Time Series Data Mining for Analysing the Effects of Wind Speed on Wind Turbine Reliability |
| **11:30-11:50** | Reidar Staupe-Delgado, Michael H. Glantz | J. Zurek, M. Zieja, J. Ziolkowski, A. Borucka | Luis G. Crespo, Daniel Giesy, Sean Kenny | Moath Kassim, Gyunyoung Heo | Jinrui Ma, Antoine Grall, Mitra Fouladirad |
| | Identifying Commonalities between Individual El Niño Events | Research of automotive vehicles operation process by using the Markov model | Random predictor models with a nonparametric staircase structure | A Benchmarking Study on Online Cross Calibration Techniques for Redundant Sensors | Deterioration modelling on wind turbine pitch control system |
| **11:50-12:10** | Katerina Sikorova, Ales Bernatik | L.S.Liu, Xiaojian Yi, Peng Hou, Yue-hua Lai, Jian Shi | S. Martorell, F. Sánchez-Saez, S. Carlos, J. F. Villanueva, A. I. Sánchez | Matteo Davide Lorenzo Dalla Vedova, Pier Carlo Berri, Paolo Maggiore | Nurseda Yildirim Yurusen, Maik Reder, Julio J. Melero |
| | Fire water: management system in Czech Republic | A New Reliability Analysis Method for Vehicle Control Systems with Three-State Electronic Units Based on Goal Oriented Methodology | A comparison of performance between order statistics and metamodeling in safety margins uncertainty quantification | On-board electromechanical servomechanisms affected by progressive faults: proposal of a smart GA model-based prognostic approach | Failure Event Definitions & their Effects on Survival and Risk Analysis of Wind Turbines |
| **12:10-12:30** | Jana Markova | T. Alves Silva, J. B. Camargo, J. K. Naufal, L. Flávio Vismari, R. Inam, C. R. Belo Azevedo | | Genta Kikuchi, Makoto Sato, Kohei Maruchi, Masanori Yabuki | Bruno Castanier, Belgacem Bettayeb, Wenjin Zhu |
| | Analysis of climate changes for evolution of Eurocodes | A preliminary analysis of impacts of Vehicular Ad Hoc Networks on traffic safety | | Failure Classification on Residential Fuel Cells based on Multi-Sensor Data | An adaptive condition-based maintenance planning approach: An offshore wind turbine case study |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Risk Management 1** | **Reliability in Industry** | **Accident Modelling 2** | **Nuclear Safety - PSA 1** | **Resilience Engineering 1** |
| | **A. Blokus-Roszkowska** | **Andrej Senegačnik** | **Sónia Marques** | **Tunc Aldemir** | **Elena Zaitseva** |
| 14:00-14:20 | Salvador Ávila Filho, Dauton Menezes | J. Leigh, H. Lugo-Sanudo, L. Jackson, S. Dunnett, A. West, R. Sharpe, A. Neal | Anastacio Pinto Goncalves Filho, Gyuchan Thomas Jun, Patrick Waterson | J. Wood, D. Helton, A. Kuritzky, J. Lane, C. Leggett, M. Li, G. Wang | Gasser, Lustenberger, Sun, Kim, Spada, Burgherr, Hirschberg, Stojadinovic |
| | Control of systemic failure through design criteria, RISKDyn | Modelling Manufacturing Processes using Markov Chains | Four Studies, Two Methods, One Accident – Another Look at the Reliability and Validity of Accimap and STAMP for Systemic Accident Analysis | A Compendium of Risk Assessment Studies by US Nuclear Regulatory Commission Office of Nuclear Regulatory Research | Security of electricity supply indicators in a resilience context |
| 14:20-14:40 | G. Baldissone, M. Demichela, M. Gerbec, M. Chiara Leva | Christina Latsou, Sarah J. Dunnett, Lisa M. Jackson | Salvador Ávila Filho, Jairan Dionizio | Picoco, Aldemir, Rychkov, Alfonsi, Mandelli, Rabiti | Allison Reilly, Chengwei Zhai, Seth Guikema |
| | Risk-based optimization of operational procedures | Automated generation of a Petri Net Model: application to an end of life manufacturing process | Systemic Fault Analysis to calculate the approximation of the top event: NEMESYS | Coupling of RAVEN and MAAP5 for the Dynamic Event Tree analysis of Nuclear Power Plants | Strengths and limitations of Bayesian learning processes in agent-based models |
| 14:40-15:00 | Alexandre Oliveira Tavares, Pedro Pinto Santos, José Lopes, Jorge Brito | Zhong Zhang, Xiaojian Yi, Yue-hua Lai, Peng Hou, Balbir. S. Dhillon | Jan Mrazek, Lucia Duricova, Martin Hromada | Davide Mercurio, Vince Andersen, KC Wagner | Ali Azadeh, Seyed Mohammad Asadzadeh, Mehrab Tanhaeean |
| | Intermunicipal risk management: addressing territorial and local expectations | A New Reliability Modeling of Mechanical Systems Considering Failure Correlation | The Proposal of Evaluation Criteria for Recoverability of Road Transport | Integrated Level 1 - Level 2 Decommissioning Probabilistic Safety Assessment Methodology for Boiling Water Reactors | A consensus-based AHP for improved assessment of resilience engineering in maintenance organizations |
| 15:00-15:20 | Xiuzhu Gu, Huchen Liu, Kenji Itoh | J. Gröber, F. Müller, W. Gauchel, P. Zeiler, B. Bertsche | Floris Goerlandt | S. Martorell, P. Martorell, I. Marton, S. Carlos, A. Sanchez, R. Mullor | Seyed Mohammad Asadzadeh, Mehrab Tanhaeean, N. Abdi |
| | Patient handoff quality and safety in China: Health care providers' views | Extended reliability analysis of mechatronic systems based on information obtained by design of experiments | A Probabilistic Model for Navigational Accident Scenarios in the Northern Baltic Sea | An overview of optimization criteria in the context of advanced surveillance requirements | Exploring the similarity of Resilience Engineering approach to EFQM approach to ensure safety in a hospital |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Risk Modelling of Natural Events** | **Risk Assessment of Liquefied Natural Gas Facilities** | **Uncertainty Analysis 2** | **Prognostics and System Health Management 2** | **Human Factors in Transport** |
| | **Pieter van Gelder** | **Zoe Nivolianitou** | **Martina Kloos** | **Piero Baraldi** | **Chiara Leva** |
| 14:00-14:20 | C. Vivalda, M. A. Musci, N. Grasso, E. Guelpa, V. Verda, M. Piras | Goran Stanković, Stojan Petelin, Peter Vidmar, Marko Perkovič | Yan Li, Junming Hu, Yonghui Xie | Darius V. Roman, Ross W. Dickie, David Flynn, Valentin Robu | Eleonora Bressan, Pietro Carlo Cacciabue, Gabrio Ludovico Mauri |
| | Forest wildfire risk mapping and the influence of the weather and geo-morphological input data | Effectiveness of a technologically advanced evacuation model in case of LNG spillage from LNG carrier | Uncertainty quantification of microwave resonator cavity for space borne hydrogen atomic clock | A Review of the Role of Prognostics in Predicting the Remaining Useful Life of Assets | Dynamic communication of hazards to cyclist by merging risk assessment and risk exposure |
| 14:20-14:40 | Albert Lunde, Ove Njå | Olga Aneziris | Yunhui Hou, Siqi Qiu, Mohamed Sallak | Gauthier, Cadet, Rosini, Gérard, Heiries, Bérenguer | S. Rangra, M. Sallak, W. Schön, F. Vanderhaegen |
| | A systems thinking approach to safety in Norwegian avalanche rescue operations. | Validation and sensitivity analysis of the dispersion model "SLAB" in case of LNG release | Estimation of system availability using Markov modeling and random set theory | Model-based fault detection using analytical redundancy for automotive proton exchange membrane fuel | Obtaining empirical data from experimentation on railway operational simulator for human reliability modelling |
| 14:40-15:00 | Krzysztof Lewandowski | Lustenberger, Sun, Gasser, Kim, Burgherr, Spada, Hirschberg, Stojadinovic | Vera Deeva, Stepan Slobodyan | Jingjing He | Alaide Bayma, Marcelo R. Martins |
| | Hazard from increasing the risk of the numbers of earthquakes for the European Economy Growth in next 50 years | Potential impacts of selected natural hazards and technical failures on the natural gas transmission network in Europe | Entropy estimation of a dynamical system via a contact interaction | Assessment of Reliability Performance of Fatigue Crack Detection by Intelligent Coating Monitoring and PZT Sensors | Human Reliability Analysis in the Emergency Evacuation from an Aircraft |
| 15:00-15:20 | Olga Sokolova, Prof. Victor Popov | Hamza Zerrouki, Hacene Smadi | Claudia Vivalda, Giovanni Boe | Xiaowei Duan, Junyou Shi, Yawei Zhao | Aud Marit Wahl, Trond Kongsvik |
| | Critical infrastructure exposure to severe solar storms. Case of Russia | Risk management of a Liquefied Natural Gas process facility using Bow tie and Bayesian Networks | Addressing cost uncertainties when planning and implementing a monitoring programme for a Carbon Storage site | Research on the health prediction of system Based on Relevance Vector Machine and Ant Colony Algorithm | Leadership@sea: essential non-technical skills |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Maritime and Offshore Risk Assessment** | **Vulnerability Assessment** | **Process Reliability** | **Maintenance Modelling and Applications 2** | **Resilience in critical infrastructures 2** |
| | **Stojan Petelin** | **Andrija Volkanovski** | **Andrej Senegačnik** | **Christophe Bérenguer** | **Giovanni Sansavini** |
| **15:40-16:00** | Tito Livio Cardoso, Adriana Miralles Schleder, Marcelo Ramos Martins | Alexander Cedergren, Henrik Hassel | Bostjan Jurjevcic, Andrej Senegacnik, Igor Kustrin | Chris Rijsdijk, Tiedo Tinga | D. Lange, D. Honfi, M. Theocharidou, G. Giannopoulos, N. K. Reitan, K. Storesund |
| | A preliminary hazards identification of a ship hybrid power system | An action research approach to developing, implementing and evaluating methods for risk and vulnerability assessment | A statistical control of direct-firing system using intrusive electrostatic sensors | Predicting mission success from operating conditions | Incorporation of resilience analysis methods in Critical Infrastructure risk assessment frameworks |
| **16:00-16:20** | J. Uzoma Okoroma, F. Ganci, A. Caprignano, R. Gerboni | Rui Mota, Alexandre Oliveira Tavares, Pedro Pinto Santos | Jacek Ryczyński, Tomasz Smal | P. Martorell, I. Martón, S. Martorell, A. I. Sánchez, S. Carlos | Gonçalo Cadete, Miguel Mira da Silva, Marianthi Theocharidou |
| | The role of subsea activities in the framework of the new EU Directive 30/2013 on Oil and Gas safety for offshore installations | Urban vulnerability to fires and the efficiency of hydrants. Improving resource positioning and institutional response | Influence of length storing of fuel on intensity of wear selected components of internal combustion engines | Unreliability model for demand caused failures of safety components addressing degradation by demand stress and maintenance effectiveness | A Conceptual Framework for Assessing the Resilience of Critical Infrastructure |
| **16:20-16:40** | Espen Bergland, Abbas Barabadi, Yonas Zewdu Ayele | Eivind Halvard Okstad, Tor Olav Grøtan, Nicola Paltrinieri | Lexiao Li, W. Zhang, B. Sun | A. Erguido, A. Crespo Márquez, E. Castellano, J. F. Gómez Fernández | David Rehak, Martin Hromada, Jozef Ristvej |
| | Application of unmanned aerial vehicles (UAV) for inspection of Arctic Windmill and Arctic offshore | An empirical case design and stress test addressing hidden, dynamic and emergent vulnerabilities of society | Physics-of-Failure-based method of reliability modeling for LED driver with failure correlation | A novel dynamic opportunistic maintenance modelling approach | Indication of Critical Infrastructure Resilience Failure |
| **16:40-17:00** | Sunghee Kim, Gyusung Kim, Ki-il Nam | Lucia Duricova, Martin Hromada, Jan Mrazek | Tao Wang, Youcai Yao, Yang Li, Ning Wang, Liwen Wang, Lingchao Qin | Viveros, Nikulin, Bustamante, Grubessich, Kristanpoller, Crespo, Gonzalez-Prida, Parra, Stegmaier | B. Rød, A. Barabadi, Y. Z. Ayele, D. Lange, D. Honfi, E. López Droguett |
| | Fire and explosion risk analysis at the machinery spaces of the offshore facilities | The Comparison Security Coefficient between University and Shopping Center | Performance Analysis of Co-based Alloy Coating by Laser Cladding | Enhancing Maintenance Scheduling and Control Process by using SMED and TRIZ Theory | Probabilistic metric of infrastructure resilience considering time-dependent and time-independent covariates |
| **17:00-17:20** | Myrto Konstandinidou, Stefania Contini, Shlomo Wald | Nima Khakzad, Pieter van Gelder | Wei Zhang, Wei Wang, Weijia Feng, Wenqiang Zhou | Isaac Animah, Mahmood Shafiee | M. Bugeza, D. Kopše, Z. Košnjek, I. Prezelj, F. Križanič, V. Kolšek |
| | De-codifying the requirements of the Directive 2013/30/EU on safety of offshore oil and gas operations; risk management and Reports on Major Hazards | Vulnerability assessment of chemical facilities under the impact of floods | Research on the reliability of the spraying process based on the design of experiment | A risk based maintenance (RBM) interval decision making model to support life extension of subsea oil and gas facilities | Critical Infrastructure and Redundancy in Slovenian Electric Power System |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Fault Tree Analysis** | **System Reliability 1** | **Uncertainty Analysis 3** | **Prognostics and System Health Management 3** | **Safety Related to Socio-Technical Systems** |
| | **François Pérès** | **Anne Barros** | **Peter Burgherr** | **Piero Baraldi** | **Katerina Sikorova** |
| 15:40-16:00 | Yizhak Bot, Amir Segal | Yun Wang, Shou Song Qing, Hai Long Cheng, Peng Wei Hu, Hang Wu | Brian Cohn, Jieun Hur, Richard Denning, Tunc Aldemir, Halil Sezen | F. Cannarile, P. Baraldi, M. Compare, D. Borghi, L. Capelli, M. Cocconcelli, A. Lahrach, E. Zio | David Brooks, Michael Coole |
| | Fault Tree Analysis: how accurate is it? | An Inventory Model For Repairable Spare Parts With Lateral Transshipments | Implementation of Surrogate Models within RAVEN to Support SPRA Uncertainty Analysis | An unsupervised clustering method for assessing the degradation state of cutting tools used in the packaging industry | Codifying knowledge in the development of the discipline of Security Science: Knowledge to diagnose, infer and treat the security problem |
| 16:00-16:20 | Marc Zeller, Kai Hoefig | Y. Seo, K. Kang, H. Noh, J. Jung, D. Chang, S. Han, S. Park | Tianpei ZU, Meilin Wen, Rui Kang, Qingyuan Zhang | Hui Zhang, Jun Yao, Yurong Zhu | Reidar Staupe-Delgado, Bjørn Ivar Kruke |
| | SpeCTRA: automated Synchronization of Component fault TRee and model-based FME(D)A | Availability Estimation of Utility Module in Offshore Plant Depending on System Configuration | An Uncertainty Evaluating Model for Uncertain Metrics in Reliability | Research on bearing life evaluation method based on EMD | Developing a Typology of Crisis Preparedness |
| 16:20-16:40 | Ales Filip | Everton Lima, Marcelo Ramos Martins | Houssein Abdo, Jean-Marie Flaus, François Masse | Wenzhe Li, Junyou Shi, Xiaowei Duan, Xuhao | Salvador Ávila Filho, Clessio Dias |
| | Benefits of aviation specific risk for GNSS-based railway signalling | The selection of generic data for a reliability study in the design of an offshore system | Fuzzy semi-quantitative approach for probability evaluation using Bow-Tie analysis | A test point selection method based on recognition of typical topology structure of complex networks | Reliability research to design barriers of sociotechnical failure |
| 16:40-17:00 | Lei Jiang, Xiaomin Wang, Yiliu Liu | Zihui Wang, Min Huang | Martina Kloos | Victor Krymsky | Michaela Vašková, Jiří Barta |
| | Reliability assessment of CTCS-3 onboard system with a fuzzy fault tree | Airborne miniature aircraft: Program, Design and Optimization | Tolerance limit in a more realistic best-estimate plus uncertainty analysis | Software failure prognostics: application of interval-valued probabilities to assessment of reliability under imperfect debugging | Training of the Critical Infrastructure Employees |
| 17:00-17:20 | Luke T. Herbert, Zaza N. L. Hansen | Jasper Behrensdorf, Matteo Broggi, Michael Beer, Sebastian Brandt | Anna Kalinina, Matteo Spada, Peter Burgherr | Yawei Zhao, Junyou Shi, Weiwei Cui, Wenzhe Li | Ki Sang Son |
| | UML Statechart Fault Tree Generation By Model Checking | Numerically efficient reliability analysis of interdependent networks | Uncertainty of the outflow hydrograph resulting from the break of a concrete dam | Research on false alarm identification method considering BIT test threshold | Investigating Safety Consciousness Level of the University Students |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 20. 6. PARALLEL SESSIONS, TUESDAY MORNING, 3 PAPERS PER SESSION, PANEL DISCUSSION: INDUSTRIAL CHALLENGES IN LAND TRANSPORTATION

| 10:00-11:00 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Panel Discussion: Industrial Challenges in Land Transportation** | **Nuclear Safety - PSA 2** | **Accident Modelling 3** | **Uncertainty Analysis 4** | **Resilience in critical infrastructures 3** |
| | **Bob Huisman, Pierre Dersin** | **Andrija Volkanovski** | **Stig Ole Johnsen** | **Tunc Aldemir** | **Ivonne Herrera** |
| 10:00-10:20 | Bob Huisman | Spencer Wheatley, Wolfgang Kröger, Didier Sornette | Behnaz Hosseinnia, Nima Khakzad, Genserik Reniers | Marek Stawowy, Krzysztof Perlicki, Marek Sumiła | I. Žutautaitė, R. Krikštolaitis, L. Martišauskas, J. Augutis |
| | Implementing predictive maintenance task scheduling for existing industrial capital assets | Comprehensive Nuclear Events Database: Safety & Cost Perspectives | A multi-plant emergency response plan for tackling major fire accidents in chemical clusters | Comparation of Uncertainty Multilevel Models for Ensure the ITS Services | Risk assessment for critical energy infrastructure considering criticality of its elements |
| 10:20-10:40 | Pierre Dersin | Andrija Volkanovski, Vaidas Matuzas | Alena Oulehlová, Hana Malachová | Marek Stawowy, Krzysztof Perlicki, Tomasz Mrozek | Ivonne Herrera, Rogier Woltjer, Matthieu Branlat, Björn Nevhage |
| | Fleet Maintenance as a Dynamic Decision Process | Qualitative importance measures and nuclear safety | Analysis of the Gas Distribution System Operator's Activities on Declaring the State of Emergency | Application and Simulations of Uncertainty Multilevel Models for Estimation of number of Space of Car Parks of Motorway. | Dealing with crises in critical infrastructures: risk and resilience as complementary management approaches |
| 10:40-11:00 | | | Alena Oulehlová, Pavel Kincl, Hana Malachová | Tianxi Liang | Jiří F. Urbánek, Jiří Barta, Jiří J. Urbánek |
| | | | Training of the Members of Crisis Management: the Scenario of the Forest Fire | System Reliability Assessment Based on QMU | Crisis Situation Investigation at Process Models of Critical Infrastructure Subject |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 20. 6. PARALLEL SESSIONS, TUESDAY MORNING, 3 PAPERS PER SESSION, PANEL DISCUSSION: INDUSTRIAL CHALLENGES IN LAND TRANSPORTATION

| 10:00-11:00 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Reliability and Structures** | **Human Factors and Human Reliability** | **Food Safety** | **Model-Based Reliability and Safety Engineering** | **Workshop**<br><br>**The integration of reliability & durability within HBM Prenscia software**<br><br>**Presentation (15 minutes) is continued with software workshop** |
| | **Daniel Straub** | **Luca Podofillini** | **Sebastian Martorell** | **Sónia Marques** | |
| 10:00-10:20 | Miroslav Sykora, Dimitris Diamantidis, Karel Jung, Milan Holicky | Kjartan Bjørnsen, Terje Aven | Eva Doménech, Sebastián Martorell | F. Möhrle, K. Bizik, M. Zeller, K. Höfig, M. Rothfelder, P. Liggesmeyer | |
| | Target reliability for railway civil engineering structures | Utilizing HRA input in risk assessments – a new method for strengthening the risk characterization by highlighting the qualitative insights from the HRA | Safety margins of exposition to organophosphorus chemicals in food | A Formal Approach for Automating Compositional Safety Analysis Using Flow Type Annotations In Component Fault Trees | |
| 10:20-10:40 | Zhaojun Hao, Min Huang | Raphael Moura, Caroline Morais, Edoardo Patelli, Michael Beer, John Lewis | Eva Doménech, Sebastián Martorell | Rasmus Adler, Daniel Schneider, Kai Höfig | |
| | The applications of DOE and computer simulation technology to the improving process reliability of turbine blades of aircraft engines | Human factors influencing decision-making: tendencies from first-line management decisions and implications to reduce major accidents | Assessment of safety margins in relation to Acceptable Daily Intake (ADI) and Maximum Residue Limits (MLR) with application to OPs in peaches | Evolution of fault trees – From hardware safety analysis to the integrated safety analysis of software-intensive control systems | |
| 10:40-11:00 | C. Rosebrock, M. Hinz, F. Reinecke, S. Bracke | W. Steijn, J. Groeneweg, D. van der Beek, J. van Kampen, P. van Gelder | | B. Kaiser, B. Monajemi, D. Kusche, H. Schulte | |
| | Modelling the reliability of lead anodes in the electrowinning process of non-ferrous metals using machine learning | An integration of human factors into Quantitative Risk Analysis: A proof of principle | | Systematic Design and Validation of Degradation Cascades for Safety-Relevant Systems | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 20. 6. PARALLEL SESSIONS, TUESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Fundamental Issues in Risk Analysis and Management 2** | **Advanced Safety Assessment ASAMPSA_E 2** | **System Reliability 2** | **Maintenance Modelling and Applications 3** | **Simulation for Safety and Reliability Analysis 1** |
| | **Roger Flage** | **Emmanuel Raimond** | **Nicolae Brinzei** | **Anne Barros** | **Daniel Straub** |
| **11:20-11:40** | I. Jakopanec, A. Hafver, S. Eldevik, F. B. Pedersen | Ma. Kumar, J. Vitazkova, H. Loeffler, E. Raimond | R. Kassan, E. Chatelet, B. El Hassan, J. Soukieh | M. Zieja, P. Barszcz, M. Wesolowski, K. Blacha | J. Heinrich, F. Plinke, J. Hauschild |
| | Risk communication: the link between understanding and managing risk | Implementation of external hazards in Level 1 and Level 2 PSA: considerations from the ASAMPSA_E project | Reliability Assessment of Wireless Sensor Networks Equipped with Photovoltaic Cells for the Detection of Changing Environmental Conditions | The evaluation method of degradation degree of runway pavement surfaces constructed from cement concrete | State-based safety and availability analysis of automated driving functions using Monte Carlo Simulation |
| **11:40-12:00** | Tony Rosqvist | Slawomir Potempski, Hans Brinkman | Andrey Vasilyev, John Andrews, Lisa Jackson, Sarah Dunnett | Wenqiang Zhou, Dong Zhou, Long Xue, Wei Zhang | A. Basti, D. Franciotti, G. Bucciarelli, G. Panella |
| | Information and confidence levels in risk results-can both be obtained? | Man-made hazards modelling and implementation in extended PSA | Reliability Modelling of PEM Fuel Cells with Hybrid Petri Nets | A Method For Parallel Relative System Maintenance Decision-making Based on Product Health | Evaluation of different hypothetical accident scenarios for improving people evacuation in the Gran Sasso National Laboratory |
| **12:00-12:20** | Jennifer E. Lynette | N. Rahni, E. Raimond, H. Löffler, G. Hultqvist | E. Zaitseva, V. Levashenko, M. Kvassay | O. Duran, A. Crespo, V. González-Prida, A. Guillén | F. Müller, J. Gröber, T. Rieker, P. Zeiler, B. Bertsche |
| | A Comparative Analysis of Risk and Quality | Verification and improvement of SAM strategies with L2 PSA | Induction of structure function of Multi-State System based on uncertain data | Throughput-Centered Physical Assets Priorization Technique | Development-based reliability modelling and analysis with Petri nets considering interactions |
| **12:20-12:40** | | Pavlin Groudev, Emil Kichev, Petya Petrova | Xiaojian Yi, Peng Hou, Balbir. S. Dhillon, Jian Shi, Zhong Zhang, H. N. Mu | M. I. Suassuna da Fonte, M. Losada Agudelo, M. H. Alencar, A. Teixeira de Almeida | Masoud Naseri |
| | | Areas of verification and improvement of SAM strategies with Level 2 PSA: Preliminary analyse for possible options for WWER-1000 | A New Reliability Assessment Method for Complex Systems Based on Goal Oriented Methodology | Multidimensional analysis of failure consequences in the RCM approach: contributions to the decision-making process | Component availability analysis considering time-dependency of parameters influencing transition rates |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 20. 6. PARALLEL SESSIONS, TUESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Security Assessment 1** | **Critical Infrastructure Safety 1** | **Reliability Data and Testing 1** | **Risk Assessment in Land Transport** | **Workshop**<br><br>**The integration of reliability & durability within HBM Prenscia software** |
| | **Sissel H. Jore** | **Krzysztof Kołowrocki** | **Xiaoyang Li** | **Bob Huisman** | |
| **11:20-11:40** | Per Gustafson | Krzysztof Kolowrocki, Joanna Soszynska-Budny | P. Ojala, J. P. Hietala, J. Miettinen, P. Julkunen, I. Nieminen | R. Setola, M. C. De Maggio, G. Natale, M. Tesei, E. Zio | |
| | Evaluating an Indicator Matrix for Early Detection of Smuggling Equipment for Dual-Use | An overall approach to modelling operation threats and extreme weather hazards impact on critical infrastructure safety | Modelling of seep through of humidity to electric connector with stochastic processes | An Analytic Hierarchy Process Approach for the Security Assessment of High Speed Railway Construction Sites | |
| **11:40-12:00** | Lucia Duricova, Martin Hromada, Jan Mrazek | Agnieszka Blokus-Roszkowska, Krzysztof Kołowrocki | Zeljana Beslic, Shuang Yan, Bernd Bertsche | Agnieszka Tubis, Sylwia Werbińska-Wojciechowska | |
| | The Analytical Software Support for Evaluation to a Security and Safety Situation in the Soft Targets | Modeling dependencies in critical infrastructure networks | Method for planning optimal degradation tests in consideration of budget and statistic accuracy applied on pitting tests on gear wheels | Operational risk assessment in road passenger transport companies performing at Polish market | |
| **12:00-12:20** | H. Abdo, M. Kaouk, J. M. Flaus, F. Masse | Przemyslaw Dziula, Krzysztof Kolowrocki | Xiaolu Fu, Jun Yang, Songhua Hao | Ingrid Time, Ove Njå | |
| | Towards a better industrial risk analysis: a new approach that combines security within safety | Modelling the operation process of Global Baltic Network of Critical Infrastructure Networks | Optimal Design of Step Stress Accelerated Degradation Test Plan for Solid-State Lasers | Approaching tunnel safety from a system safety perspective | |
| **12:20-12:40** | Mirosław Siergiejczyk, Jacek Paś, Ewa Dudek | Sambor Guze, Krzysztof Kołowrocki | | M. López-Campos, C. Nikulin, R. González-Ramírez, L. Ascencio | |
| | Reliability analysis of aerodrome's electronic safety systems taking into account electromagnetic interferences | Safety Modeling of Port, Shipping and Ship Traffic and Port Operation Information Critical Infrastructure Join Network related to Its Operation Process | | Integrated methodology for decision making: study of the main routes carrying dangerous cargoes in the Valparaiso region | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Risk Assessment 1** | **Nuclear Safety - PSA Applications 1** | **Air Traffic Safety** | **Maintenance Modelling 1** | **Risk Assessment of Chemical Facilities 1** |
| | **Stein Haugen** | **Andrej Prošek** | **Elena Zaitseva** | **Antoine Grall** | **Francesca Milazzo** |
| **14:00-14:20** | Lorenzo Fedele, Lucilla Monteleone | Moath Kassim, Gyunyoung Heo | Jacek Skorupski | T. Tinga, W. Tiddens, F. Amoiralis, M. Politis | M. Spada, P. Boutinard Rouelle, P. Burgherr, D. Giardini |
| | Safety, maintenance and nanotechnologies: an introductory state of art about the risk assessment methodologies and the potentialities | Detection and Classification of NPP Accidents Scenarios based on Residual Sign Matrices (RSMs) | On the nature of serious incidents in air traffic | Predictive maintenance of maritime systems: models and challenges | Comparative risk assessment of hydrogen accidents in Europe |
| **14:20-14:40** | M. Bucelli, E. Okstad, N. Paltrinieri, V. Cozzani | S. Kamyab, A. Pirouzmand, K. Karimi, F. Yousefpour | Jacek Skorupski, Piotr Uchroński | M. Redondin, L. Bouillaut, D. Daucher, N. Faul | Cristina P. Medeiros, Marcelo H. Alencar, Adiel T. de Almeida |
| | Advanced methods for risk analysis with integrated perspective | Evaluating Technical Specification for Emergency Diesel Generator from the CDF Point of View in a typical NPP | Walk-through metal detector assessment as a part of airport security management | Temporal clustering of retroreflective marking | Information visualisation supporting a decision-making process in the management of multidimensional risk in gas pipeline |
| **14:40-15:00** | Sandra Hogenboom, Jan Erik Vinnem, Ingrid Bouwer Utne | Kilyoo Kim, Dae Il Kang | I. Herrera, M. Branlat, A. Vennesland, M. Ragosta, A. Pasquini | Z. Nivolianitou, N. Defteraios, I. Ziomas, C. Caroni, O. Aneziris | Cristina P. Medeiros, Marcelo H. Alencar, Adiel T. de Almeida |
| | Towards an Online Risk Model for DP Operations: Decision-making and Risk Information | A Study on Initiating Event Models Induced by Fire in a Fire PRA | A Modelling Framework for Resilience Management: Practical benefits in real Air Traffic Management cases | RBIM in Refineries, case study: predicting H2 corrosion | Uncertainty sensitivity analysis prior to making a final recommendation to the Decision Maker in a multidimensional risk of gas pipelines |
| **15:00-15:20** | Silvia Ansaldi, Patrizia Agnello, Paolo Bragatto | Sanghee Kang, Han Gon Kim, Hyun Gook Kang | Max Butter | Katarzyna Pietrucha-Urbanik, David Valis, Zdenek Vintr | Deshai Botheju, Kumuduni Abeysinghe |
| | Technological Readiness and Effectiveness of "Smart Systems" for the Control of Major Accident Hazard | Evaluation of Operation Strategy to Enhance the Safety using High Pressure Emergency Makeup System during SBLOCA | Evaluation of the risk of runway overrun using flight data monitoring | Water Network Condition Assessment Using Analytic Hierarchy Process | New directions in Safety & Environmental Management and Policy: A Brief Update on Petroleum Industry |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Qualitative Reliability Methods** | **Critical Infrastructure Safety 2** | **Reliability Data and Testing 2** | **Transport Risk Management** | **Workshop**<br><br>**BQR - Reliability & Maintenance"** |
| | **Franck Schoefs** | **Krzysztof Kołowrocki** | **Xiaoyang Li** | **Bob Huisman** | |
| **14:00-14:20** | Q. Mahboob, B. Altmann, S. Zenglein | E. Kuligowska, K. Kołowrocki, J. Soszyńska-Budny | Jon Tømmerås Selvik, Eric Patrick Ford | Max Mendel, Pieter van Gelder | |
| | IFF-MECA: Combined handling of interfaces, functions and components based failure analysis | Safety of maritime ferry related to its operation process | Maintenance data collection for subsea systems: A critical look at terms and information used for prediction of downtime | Inversive Distance as a Measure of Collision Risk | |
| **14:20-14:40** | Bruno Vidal Silva, Cléssio Dias, Salvador Ávila Filho | Ewa Kuligowska, Krzysztof Kołowrocki, Joanna Soszyńska-Budny | Nika Nowizki, Peter Zeiler, Bernd Bertsche, Heinrich Moedden | G. Gongora Svartzman, J. Emmanuel Ramirez-Marquez | |
| | Reliability research in rotary for acidic systems in the dimensions of management, technology and human factors | Integrated model of maritime ferry safety related to its operation process including operating environment threats | Field Data Analysis of Multi Spindle Lathes for a Proven-In-Use Assessment | Commuting Time Variations and Reliability of Subway Systems in the Presence of Disruptions. The Case Study of New York City | |
| **14:40-15:00** | C. Nikulin, C. Acuña, M. Lopez-Campos, R. Madrid, C. Fernandez | Krzysztof Kołowrocki, Joanna Soszyńska-Budny, Mateusz Torbicki | JiPeng Wu, Xiaoyang Li, Rui Kang | A. Lein Aalberg, E. Hansson Blix, N. J. Edwin, R. J. Bye, V. Berntsen | |
| | A creative Root Cause Analysis integrated with Problem Solving approach to better drives maintenance's strategies. | Critical infrastructure integrated safety model related to climate-weather change process applied to port oil piping transportation system operating at land Baltic seaside area | The reliability tests for biomedical devices: a review | A quantitative indicator-based model to support risk-based supervision in the Norwegian Maritime Authority | |
| **15:00-15:20** | P. Dersin, B. Lamoureux, A. Alessi, O. Fink, M. Brahimi | K. Kołowrocki, J. Soszyńska-Budny, M. Torbicki | Hongwei Cheng, Jin'e Huang, Dong Xu | Olga Becherova, S. Hoskova-Mayerova | |
| | Prognostics and Health Management in Railways | Safety of maritime ferry operating at Baltic sea open waters related to climate-weather change process including extreme weather hazards | Research on the Parameters Relationship of Reliability Verification Test | Rail infrastructure as part of the critical infrastructure | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 20. 6. PARALLEL SESSIONS, TUESDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Risk Assessment 2** | **Nuclear Safety - PSA Applications 2** | **TRUSS - Structural Safety 1** | **Security Assessment 2** | **Resilience Engineering 2** |
| | **Matteo Spada** | **Andrej Prošek** | **Arturo González** | **Sissel H. Jore** | **Ralf Mock** |
| **15:40-16:00** | Zhiguo Zeng, Enrico Zio | Gueorgui Petkov, Ivan Petkov | Guang Zou, Kian Banisoleiman, Arturo González | Donya Fakhravar, Nima Khakzad , Genserik Reniers, Valerio Cozzani | Tor Stålhane, Stig Ole Johnsen |
| | Interval-valued importance measures for business continuity management | Dynamic human performance context comparison for severe accident management during long term station blackout in light water reactors | Reliability-based inspection planning in view of both crack initiation and propagation | Security Risk Assessment of Gas Pipelines Using Bayesian Networks | Resilience Engineering and safety in Agile Development (through SafeScrum) |
| **16:00-16:20** | Henrik Hassel, Alexander Cedergren | Chao Zhang, Yanqin Su, Hongxing Lu | Matteo Vagnoli, Rasa Remenyte-Prescott, John Andrews | Eleonora Pilone, Micaela Demichela, Gianfranco Camuncoli | Ralf Mock, Christian Zipper |
| | A method for combined risk and continuity management in a municipal context | Discussion on Reliability Assurance Program for Safety Related System in Digital I&C System of NPP | A Bayesian Belief Network approach for railway bridge condition monitoring and fault detection | A local semi-quantitative methodology to evaluate the main territorial risks and their interactions | Embedding Resilience Assessment into Risk Management |
| **16:20-16:40** | D. Lichte, K.-Dietrich Wolf, N. Schlüter, S. Marchlewitz | Jaemin Yang, Jonghyun Kim, Namcheol Kim | A. Barrias, J. Ramon Casas, S. Villalba, G. Rodriguez | G. Landucci, F. Argenti, G. Reniers, V. Cozzani | B. Rød, C. H. Pursiainen, N. Reitan, K. Storesund, D. Lange, M. Mira da Silva |
| | An Approach to Holistic Safety and Security Risk Assessment Considering Contradictory Requirements under Uncertainty | Analysis of Errors of Commission for the Low Power and Shutdown Operation of APR1400 by Using CESA and MDTA Methods | UPC - BarcelonaTech experience on the use of Rayleigh based distributed optical fiber sensors for SHM of concrete structures | Quantitative performance assessment of physical security barriers for chemical facilities | Evaluation of resilience assessment methodologies |
| **16:40-17:00** | Siqi Qiu, Yijian Zheng, Xin Guo Ming, Yunhui Hou, Mohamed Sallak | Quentin Baudard, Pierre Le Bot | Federico Perrotta, Tony Parry, Luis C. Neves | Sissel Haugdal Jore | Häring, Scheidereiter, Ebenhöch, Schott, Reindl, Köhler, Schindelhauer, Bordoy, Scheithauer, Kaufmann |
| | Evaluation of the occurrence probability of a railway accident with parametric uncertainties and failure dependencies using Binary Decision Diagram | Modelling human operations during a nuclear accident: the Fukushima Daiichi accident, in light of the MONACOS method. | Using truck sensors for road pavement performance investigation | The Risk and Value Nexus in Security Risk Management | Analytical engineering process to identify, assess and improve technical resilience capabilities |
| **17:00-17:20** | | S. Dias Costa, L. Teixeira Marcos, C. Marcelo , J. Borges Araújo | Abdollah Malekjafarian, Daniel Martinez Otero, Eugene O'Brien | Petra Beňová, Michaela Vašková | Roshanak Nateghi, Allison C. Reilly |
| | | Safety Electronic systems reliability monitoring program in nuclear power plant - Reactor Protection System Follow up | Pavement Condition Measurement at High Velocity using a TSD | Ensuring the security of selected soft targets | Holistic Approaches to Infrastructure Risk Reduction: Effective Investments Through Pluralism |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 20. 6. PARALLEL SESSIONS, TUESDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Structural Reliability 1** | **Software Risk Assessment** | **Reliability Data and Testing 3** | **Organisational Factors** | **Workshop** |
| | **Duško Kančev** | **Antoine Rauzy** | **Stein Haugen** | **Claudia Vivalda** | **BQR - Reliability & Maintenance** |
| **15:40-16:00** | Mitja Franko, Branislav Panič, Marko Nagode | Antti Pakonen, Kim Björkman | S. Håbrekke, S. Hauge, M. A. Lundteigen, Å. Snilstveit Hoem, L. Xie | G. Kleijn van Willigen, F. Mohrmann, A. Roelen, H. van Meerveld | |
| | Damage based reliability prediction of dynamically loaded components | Model checking as a protective method against spurious actuation of industrial control systems | Modified generic failure rates for safety instrumented systems based on operational experience from the oil and gas industry | Implementing Risk Based Asset Management | |
| **16:00-16:20** | Mahmood Shafiee, Ebitimitula Etebu | Aida Omerovic, Marit Kjøsnes Natvig, Isabelle Catherine Rebecca Tardy | S. Hoskova-Mayerova, S. Bekesiene, M. Hubacek, M. Bures | Marja Ylönen | |
| | Contributions of Structural Health Monitoring to the Reliability of an Offshore Fixed Platform | Privacy Scorecard – Refined Design and Results of a Trial on a Mobility as a Service Example | Vehicle movement modelling possibilities for defense and crisis management | Licensee's relationship with the suppliers - simple rules, lessons learned | |
| **16:20-16:40** | C. Mennuti, G. Augugliaro, P. Lenzuni, F. Brini, P. Quaresima, P. Bragatto | Haitao Zhao | Yue Shao, Xiaohui Wang, Wenhao Xing, Liwei Sun, Zhiqiang Li | Lillian Katarina Stene | |
| | Assessment of structural damage to civil and industrial structures with Acoustic Emission | Assessment of soft error effect on satellites | Research on Establishment Method of Natural Environmental Spectrum and Accelerated Test Environmental Spectrum | "Unity of effort" in the new wars | |
| **16:40-17:00** | J.-P. Hietala, P. Ojala, P. Multanen, J. Miettinen, P. i Saarenrinne | Marek Pawlik | Fuqiang Sun, Ning Wang, Ye Fan, Tongmin Jiang | Yanming Xiong, Ying Liu, Youjian Zhang | |
| | Fatigue Lifetime Estimation of Machine Component Using Accelerated Testing | Railway Global System for Mobile Communication, safety of the possible enhanced services | An imputation method for missing degradation data based on regression analysis and RBF neural network | Surety engineering and its applications in high consequence systems | |
| **17:00-17:20** | Marek Sokolski, Piotr Sokolski | Zhaowu Xu, Jing Wang, Jinming Chen, Yong Jiang, Ziming Wang | Marcin Hinz, Annika Mueller, Bianca Backes, Stefan Bracke | Asbjørn Lein Aalberg, Rolf Johan Bye | |
| | Assessment of safety of large size ring girders in bucket wheel excavators – a case study | Failure Mode and Effect Analysis of Large Space Environment Simulator | Simulation driven optimization of testing conditions of dental implants. | Violation enhancing conditions - a study of Norwegian car ferry workers' compliance of safety-related procedures | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 21. 6. PARALLEL SESSIONS, WEDNESDAY MORNING EARLY, 3 PAPERS PER SESSION

| 10:00-11:00 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Maintenance Optimisation** | **Reliability and Gamma Process** | **Autonomous Vehicles** | **Cyber security** | **Risk Assessment of Chemical Facilities 2** |
| | **Pierre-Etienne Labeau** | **Inga Žutautaitė** | **Mario Brito** | **Ralf Mock** | **Paolo Bragatto** |
| 10:00-10:20 | Radim Briš, Nuong Thi Thuy Tran | Mestapha Oumouni, Franck Schoefs, Bruno Castanier | Mario Brito | Birgit Milius, Po-Chi Huang | Giuseppa Ancione, Isaak Kavasidis, Maria Francesca Milazzo |
| | Optimization of maintenance policies for complex and highly reliable multi-unit systems | Spatio-Temporal modelling of degradation processes through stochastic Gamma and Gaussian processes | Towards Building a Safety Case for Autonomous Surface Vehicles: A Bayesian Perspective | A roadmap to a safer railway: How the IT security threat will influence the way we handle railway operations in the future | Improving safety of crane-related operations in chemical industry by the support of a real-time computer-aided visual guidance system |
| 10:20-10:40 | Vasiliki Klonari, Tuan Phong Nguyen, Pierre-Etienne Labeau, Stefaan Verstraeten | Massimiliano Giorgio, Agostino Mele, Gianpaolo Pulcini | Bianca, Molina,Rojas González, Camargo, de Almeida, Vismari, Naufal,Inam, Azevedo | Marek Pawlik | Willy Røed, Torbjørn Bjerga |
| | Optimisation of offshore wind farm maintenance strategy considering the variability of the efficiency of imperfect maintenance interventions | A perturbed gamma process with non-gaussian state-dependent errors | A Comparison of Two Simulators to Support Safety Analysis in Autonomous Vehicles | Safety, security and cybersecurity in railway operation | Holistic understanding and structure of environmental safety barriers in the oil and gas industry |
| 10:40-11:00 | E. Pascale, L. Bouillaut, T. Freneaux, R. Sista, P. Sannino, P. Marmo | Xinlei Zhao, Xiaohong Wang, Lizhi Wang, Dawei Lu, Tongmin Jiang | P.Lakomicki, B. C.astanier, A. Grall, P. Schimmerling, T. Cembrzynski, O. Cayol | Denise Tellbach, Yan-Fu Li | Atsuko Nakai, Kazuhiko Suzuki |
| | Application of the Weibull distribution for the optimization of maintenance policies of an electronic railway signaling system | A reliability evaluation method based on Gamma process with ADT | How to assess the reliability in case of a scalable random environment: application on the autonomous vehicle | A Survey on the Cyber-Security of Distributed Generation Systems | Accident simulator for risk assessment of non-steady work of chemical plant |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 21. 6. PARALLEL SESSIONS, WEDNESDAY MORNING EARLY, 3 PAPERS PER SESSION

| 10:00-11:00 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Resilience Engineering 3** | **Common Cause Failures** | **Tunnel Safety** | **Human Factors 1** | **Reliability in Geotechnics** |
| | **Matteo Spada** | **Nicolae Brinzei** | **Stojan Petelin** | **Zdenek Vintr** | **Franck Schoefs** |
| 10:00-10:20 | Armando López-Cuevas, Jose Emmanuel Ramirez-Marquez | Mengfei Fan, Zhiguo Zeng, Enrico Zio, Rui Kang, Ying Chen | Blaž Luin, Stojan Petelin | Claudia Morsut, Bjørn Ivar Kruke | Sónia Marques |
| | Characterizing Community Resilience through Mood Novelty | Modeling common-cause failures using stochastic hybrid systems | Road tunnel operator training on computer simulators | Human factors in crisis governance: the L'Aquila case. | Design Point Simulation in the Context of Evaluation of Probability Bounds in Geotechnics |
| 10:20-10:40 | Beatrice Cassottana, Shen Lijuan, Tang Loon Ching | Christian Tanguy | Mona Svela, Ove Njå | C. Parra, V. González-Prida, A. Crespo, J. F. Gómez, P. Viveros, F. Kristjanpoller, A. Guillén | Sónia Marques |
| | A data-driven graphical approach to quantify learning capability for systems resilience: A case study on the U.S. electric power grid | Influence of disk common-cause failures on the data unavailability in Cloud storage systems | Systems engineering to address learning of road tunnel fire safety | Audit Proposal for Maintenance, Reliability and Warranty Management Process | Effects of Correlation in the Context of Evaluation of Probability Bounds in Geotechnics |
| 10:40-11:00 | A. B. Skjerve, K. Viitanen, C. Axelsson, R. Bisio, H. Koskinen, M. Liinasuo | Huan Wu, Jian Jiao, Tingdi Zhao | Natalia Vatsvåg, Espen Olsen | | Sónia Marques |
| | Learning from Successes in Nuclear Operations – A Guideline | A combined modeling and analysis method for probabilistic common cause failures in phased-mission system | A study of determinants of perceived tunnel safety among Norwegian road users | | Classification of Failure Modes by Fitting and Pattern Recognition Tools in the Context of Evaluation of Probability Bounds in Geotechnics |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 21. 6. PARALLEL SESSIONS, WEDNESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Bayesian Methods** | **Probabilistic Methods Applied to Power Systems 1** | **Nuclear Safety - PSA Applications 3** | **Risk Assessment 3** | **Software Modelling and Analysis** |
| | **A. Blokus-Roszkowska** | **Pierre-Etienne Labeau** | **Vytis Kopustinskas** | **Valerio Cozzani** | **Lixuan Lu** |
| 11:20-11:40 | Jack Reeves, Rasa Remenyte-Prescott, John Andrews | Hiba Baroud, E.D. Wollega, V. Winckler | S. C. Kim, J. S. Park, B. S. Kim, N. C. Cho, D. J. Jang, J. W. Bae, Y. H. Lee | Stig Johnsen, Tor Stålhane | Lixuan Lu, Phillip McNelles |
| | A sensor selection method for fault diagnostics | Renewable Energy Supply Risk Modeling and Analysis | A methodology of the threat assessment for LOLA due to malicious aircraft crash onto NPP | Safety, security and resilience of digital ecosystems. | Analysis of fault tolerant design methods for single event effects in field programmable gate array-based systems using the dynamic flowgraph methodology |
| 11:40-12:00 | Xinrui Ma, Zili Wang, Dongming Fan, Yi Ren | Roberto Rocchetta, Edoardo Patelli | Myung Ro Kim, JaeGab Kim | Stefan Bracke, Fabian Reinecke, Roland Goertz | Insaf Sassi, Alexia Gouin, Jean-Marc Thiriet |
| | An Enhanced GO Methodology with Multiple Signal Transmission Types based on Bayesian Network | An Efficient Framework for Reliability Assessment of Power Networks Installing Renewable Generators and Subject to Parametric P-box Uncertainty | The analysis method of initiating events (IEs) for Low Power Shutdown Level 1 PRA | Risk Scenarios, Reliability Challenges and Safety Concept Approach for Second Life Lithium-Ion Battery Systems out of Automotive Technologies | Diagnosis Architecture Reconfiguration for a Networked Mobile Robot |
| 12:00-12:20 | Sean Loughney, Jin Wang, Paul Davies | G. Dogan, P.-E. Labeau, J.-Cl. Maun, J. Sprooten, C. Bastiaensen, K. Sleurs | Jaegab Kim, MyungRo Kim | Heinrich Moedden | Miha Pielick, Miha Mraz |
| | Bayesian network modelling for offshore installations: Gas turbine fuel gas release with potential fire and explosion consequences | The 'discrete forecast error scenarios' method for grid reliability assessment in short-term planning: application to the Belgian grid | The effect to Core Damage Frequency for Low Power Shutdown PSA in the change of period of scheduled outage | Probabilities in safety of machinery – a real risk reduction has to replace the prevention paradox which is focussing merely on hypothetical risk estimations | Suitability of FRAM method for hazard analysis of ATM functional system of Slovenia Control Ltd. |
| 12:20-12:40 | Presentation only: M. Berk, O. Schubert, H.-M. Kroll, B. Buschardt, D. Straub | Shijia Du, Rui Kang, Zhiguo Zeng, Enrico Zio | Moosung Jae, Jintae, Goon-Cherl Park | Paolo Bragatto, Gaetano Gorrino, Paola Castellano | F. Postiglione, M. Di Mauro, G. Galatro, M. Longo, M. Tambasco |
| | Bayesian self-referencing reliability assessment of sensor systems: Theory and application to automotive environment sensing | Time-dependent reliability assessment of a distributed generation system based on multi-valued decision diagrams and Markov processes | Reliability Assessment of A Decay Heat Removal System in A SFR Using Reliability Physics Model | Reliability of fixed and mobile systems for artificial avalanche detachment | Availability evaluation of a Virtualized IP Multimedia Subsystem for 5G network architectures |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 21. 6. PARALLEL SESSIONS, WEDNESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Structural Reliability 2** | **Aircraft Safety** | **Infrastructure Reliability Modelling** | **Economic Analysis in Risk Management 1** | **Human Factors 2** |
| | **Bernt Leira** | **Mario Brito** | **Henrik Hassel** | **Eirik B. Abrahamsen** | **Chiara Leva** |
| 11:20-11:40 | Arne Bang Huseby, Erik Vanem, Karoline Eskeland | L. Drees, J. Siegel, P. Koppitz, F. Holzapfel | Caroline Johnson, Roger Flage, Seth Guikema | Wieger Tiddens, Olaf Brouwer, Jan Braaksma, Tiedo Tinga | Birgit Milius |
| | Evaluating properties of environmental contours | Quantifying probabilities of exceeding the maximum Mach number in cruise flight using operational flight data | Review of Network-Theoretic Approaches to Characterise Interdependencies in Critical Infrastructure | The business case for condition-based maintenance: a hybrid (non-) financial approach | Human factors and their application in railways |
| 11:40-12:00 | Seong-Yeob Lee, Daejun Chang, Choonghee Jo | Mariusz Zieja, Michal Jasztal, Slawomir Stepien, Mariusz Wazny | Jan Prochazka, Dana Prochazkova | Yaqian Wang, Yufeng. Sun | Oddveig Reiersdal Aaberg, Siri Wiig |
| | An approach to determine component reliabilities of pile-guided floater based on economic evaluation | The reliability analysis of on-board storage batteries during the operation of aircrafts | Drinking Water Supply Failure | Costs model for Two-Dimensional Lifetime Warranty Policies based on Combined Repairs | Interprofessional Team training in Hospital Wards - a Literature Review |
| 12:00-12:20 | Zhanpeng Shen, Xueqian Chen, Xinen Liu | Marta Woch, Mariusz Zieja, Norbert Grzesik | Presentation only: A. Scherb, D. Straub, L. Garrè | Lubos Kotek, Lukas Jirka, Zdenek Tuma | Kristýna Binková, Andrea Brichová |
| | Reliability Analysis of Polymer Bonder Explosive Based upon Aleatory and Epistemic Uncertainties | A method to assess the reliability of the aircraft airframe on the basis of operational data | Component importance in power grids subject to natural hazards and cascading failure events | Risk based spare part management for machines in decommissioning | Competency to leads others as a tool of crisis management in active and second career |
| 12:20-12:40 | Shufeng Zhang, Dong Xu, Li Zhang, Yuanxiang Jiang, Xun Chen, Jiang Yu | Hongli Wang, Deming Zhong, Tingdi Zhao | | Presentation only: Mostafa Seraj, Ali Hadi, Davood Shahsavani | |
| | Reliability analysis of composite structures considering the statistical correlation between ply mechanical properties | Aircraft system safety analysis based on failure propagation model | | Estimate sustainability and durability accounts for liquidity risk of liability side analysis | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 21. 6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **System Reliability and Manufacturing** | **Probabilistic Methods Applied to Power Systems 2** | **TRUSS - Structural Safety 2** | **Mathematical Methods in Reliability and Safety 1** | **Risk Management and Accidents Analysis** |
| | **Zdenek Vintr** | **Andrija Volkanovski** | **Arturo González** | **Mario Brito** | **Marcelo Hazin Alencar** |
| **14:00-14:20** | Evenye Monono Enjema, Mahmood Shafiee, Athanasios Kolios | Gorazd Bone, Rafael Mihalič | John Moughty, Joan Ramon Casas | Luiz Fernando Oliveira, Joaquim Domingues, Frank Borre Pedersen, Andreas Hafver | P. Burgherr, M. Spada, A. Kalinina, S. Hirschberg, W. Kim, P. Gasser, P. Lustenberger |
| | A Study on the Reliability of BlowOut Preventer (BOP) Systems in Deepwater Erratic Conditions | Probabilistic Power Flow Analysis of a Power System Containing FACTS devices | Evaluation of the Hilbert Huang Transformation of Transient Signals for Bridge Condition Assessment | Combining Time-Dependent Reliability and Bayesian Networks for Risk Monitoring of Subsea Wells | The Energy-related Severe Accident Database (ENSAD) for comparative risk assessment of accidents in the energy sector |
| **14:20-14:40** | S. Lee, M. A. Lundteigen, N. Paltrinieri, Y. Liu, M. Rød, J. Dale | Jerneja Bogovic, Rafael Mihalic | B. Heitner, E. J. OBrien, F. Schoefs, T. Yalamas, C. Leahy | Jozef Zurek, Jaroslaw Ziolkowski, Anna Borucka | S. Hogenboom, J. Erik Vinnem, I. Bouwer Utne |
| | A new design concept of blowout preventers for decision support | Probabilistic load flow in Slovenian power system | Comparative study on Bayesian updating of bridge safety model | A method for determination of combat vehicles availability by means of statistic and econometric analysis | Organizational risk indicators for dynamic positioning operations – Learnings from 20 years of FPSO – shuttle tanker incidents and accidents |
| **14:40-15:00** | S. Miro, M. Broggi, M. Beer, T. Willeke, J. Seume | Blaž Kirn, Marko Čepin, Marko Topič | Giulia Milana, Kian Banisoleiman, Arturo Gonzalez | Marcela Rabasová, Zygmunt Korban, Ondřej Pavlík | Tomáš Kertis, Dana Procházková, Jan Procházka |
| | Survival signature approach for the reliability analysis of an axial compressor | Effective load carrying capability of solar photovoltaic power plants – case study for Slovenia | Field Characterization of Location-specific Dynamic Amplification Factors towards Fatigue Calculations in Ship Unloaders | A comparison of safety and efficiency of protection systems in carotid artery stenting | Railway accidents in the Czech Republic, causes of risks and their mitigation |
| **15:00-15:20** | Andrzej Surowiecki, Jacek Ryczyński | Cheng Yu, Fu Guicui, Jiang Maogong, Qiu Yao | Sofia Antonopoulou, Ciaran McNally | Yahui Li | Shenae Lee, Yiliu Liu, Nicola Paltrinieri |
| | State of strain of physical model road embankment stabilized retaining wall composed of gabion's elements | Lifetime estimation for IGBT modules in power converter under power fluctuation condition | Reliability assessment of braided BFRP reinforcement for concrete structures | A Novel Strategy for Fault Propagation Study of Complicated Gear System Based on Network Theory | Modelling hazardous event scenarios for decision support |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 21. 6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Structural Reliability 3** | **Occupational Safety 1** | **Organizational Factors** | **Economic Analysis in Risk Management 2** | **Human Reliability in Nuclear Facilities** |
| | **Bernt Leira** | **Claudia Vivalda** | **Yanfu Li** | **Eirik B. Abrahamsen** | **Marcelo Ramos Martins** |
| 14:00-14:20 | Bernt Leira, Sebastian Thøns | Kristiane M. F. Lindland, Anne Mette Lind Hermansen, Hege Moberg | Christian Henrik Alexander Kuran, Ove Njå | Rui Du, Min Huang | Moosung Jae, Seunghyun Jang |
| | System reliability of concrete structures subjected to chloride ingress | Securing employees against hazardous clients in challenging contexts | Using ethnographic methodology in the study of safety in complex sociotechnical systems | Economic Design of CUSUM Control Charts Under Preventive Maintenance and Loss Functions | A Computer Code to Calculate Human Error Probabilities During Implementing Severe Accident Mitigating Strategies |
| 14:20-14:40 | Zhengwei Fan, Yu Jiang, Shufeng Zhang, Xun Chen | Maria Therese Jensen, Espen Olsen | Birgit Milius, Heinz-Peter Berg, Stephan Griebel | Vytis Kopustinskas, Pavel Praks | Luca Podofillini, Vinh N. Dang |
| | Research on Vibration Characteristics of Composite Cantilevered Plate with Delamination Damage | Health Risk and Risk of Job Insecurity during Organizational Change: The Influence of Learning Demands and Role Ambiguity | Managing change of safety-critical infrastructure via STAMP | Effect of investments to security of gas supply: a probabilistic cost-benefit case study | First results from an analysis of recent operational events involving errors of commissions |
| 14:40-15:00 | Yanlei Wang, Hongwei Cheng | L. Comberti, G. Baldissone, M. Demichela, M. Patrucco, L. Maida | T. M. Stene, A. Ekambaram, M. Hermundsgård, A. Johansen | L. Inge K. Sørskår, E. B. Abrahamsen, H. B. Abrahamsen | D. Pandya, L. Podofillini, F. Emert, A. J. Lomax, V.N. Dang, G. Sansavini |
| | A study on the statistical properties of the fatigue damage of Gaussian random loadings | Investigation on the impact of National regulations on the occupational safety | Start-up processes in large construction projects – a requirement for a happy end? | On the use of economic analyses when evaluating new technology in helicopter emergency medical services | Quantification of human failure probabilities for radiotherapy: relevance of THERP's values |
| 15:00-15:20 | Wei Zhang, Yijia Song | S. Martorell, V. Gallego, A. I. Sánchez | Maria Grazia Gnoni, Joseph Homer Saleh | Olivier Nusbaumer | S. Y. Choi, W. Jung, Y. Kim, J. Park, S. Kim |
| | An equivalent method considering interaction on fatigue reliability analysis | Trend analysis in time series of occupational health indicators in Spain from 1995 to 2015 | How Near Miss Management systems and System Safety Principles could contribute to support High Reliability Organizations | Exact parametrization of ARMA models using the EM-algorithm | Application of qualitative unsafe act analysis under simulated emergency |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 21. 6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON LATE, 6 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | **Mathematical Methods in Reliability and Safety 2** | **Airport Security** | **TRUSS - Structural Safety 3** | **Maintenance Modelling 2** | **Risk Management 2** |
| | **Enrique Lopez Droguett** | **Antoine Rauzy** | **Arturo González** | **Antoine Grall** | **Henrik Hassel** |
| **15:40-16:00** | Nima Khakzad, Genserik Reniers, Pieter van Gelder | Mirosław Siergiejczyk, Karolina Krzykowska, Adam Rosiński | R. Teixeira, A. O'Connor, M. Nogal, J. Nichols, M. Spring | Anne Barros, Nicolas Lefebvre, Michel Roussignol | Maria Chiara Leva, Brian McAleer, Michael Rocke, Donal Brogan |
| | On the application of analytic network process to security risk assessment of chemical facilities | Reliability-exploitation analysis of electronic power systems used for airport security | Structural probabilistic assessment of Offshore Wind Turbine operation based on Kriging response interpolation | Modeling Weibull lifetime law and inspection based maintenance for Safety Instrumented Systems | Risk Register and Risk intelligence: the challenge of operational risks in the energy sector |
| **16:00-16:20** | Jacek Malinowski | Michaela Vašková, Jitka Johanidesová | Yan Xu, Farhad Huseynov, James M. W. Brownjohn, Eugene J. O'Brien, David Hester | Long Xue, DongZhou, BiaoQiu, Wenqiang Zhou | Håvard Fridheim, Tonje Grunnan, Stein Malerud |
| | A fast algorithm finding minimal cut-sets in a network for the purpose of computing an upper bound on its reliability | The Security of Air Transport Infrastructure | Tracking deflection in the field using optical system: a case study | Research on measurement method of on-orbit maintenance time | How to develop fit for purpose scenarios for crisis management exercises |
| **16:20-16:40** | Pierre Dersin, Cristian Maiorano | Pietro Carlo Cacciabue, Italo Oddone, Ivan Rizzolo | Siyuan Chen, Debra F. Laefer, Jonathan Byrne, Atteyeh S. Natanzi | Yong Yang, Zhijun Cheng, Bo Guo | Lech Bukowski, Jerzy Feliks |
| | Reliability Demonstration Tests: Decision Rules and Associated Risks | Risk methods for the assessment of security of large structures: the case of an international airport | The effect of angles and distance on image-based, three-dimensional reconstructions | A conditional based maintenance model for long storage products with imperfect repair actions | Imperfect Knowledge Based Prediction of Disruption Risk in Large Scale Complex Systems |
| **16:40-17:00** | Alessandro Mancuso, Michele Compare, Ahti Salo, Enrico Zio | Daniel Lichte, Kai-Dietrich Wolf | Md Shah Nur Alam Sourav, Salam Al-Sabah, C. McNally | Jianxing Lu, Xiaohong Wang, Lizhi Wang, Tongmin Jiang | Eirik Bjorheim Abrahamsen, Willy Røed |
| | Risk-informed decision making under incomplete information: portfolio decision analysis and credal networks | Quantitative Multiple-Scenario Vulnerability Assessment Applied to a Civil Airport Infrastructure | Post-installed concrete screws for in-situ assessment of mortar strength | Imperfect preventive maintenance model study based on product degradation process considering cost and availability | The safety of major hazard sites – evaluation of third party risk |
| **17:00-17:20** | Fei Long, Peter Zeiler, Bernd Bertsche | Dana Prochazkova, Jan Prochazka | Alberto Gonzalez Merino, Luis Costas de la Peña, Arturo González | A. J. Guillén, G. Turconi, G. Ventola, V. González-Prida, J. Gómez, A. Crespo | Thor Myklebust, Tor Stålhane, Robert Bains, Geir K. Hanssen |
| | Modelling the interaction in redundant production systems for analysing their productivity and availability with high-level Petri nets | Causes of accidents in civilian aircraft operation and tools for management of selected risks | Sensitivity analysis of a finite element model for the seismic analysis of free-standing spent fuel racks | Maintenance 4.0. Review of Maintenance role in the Industry 4.0 revolution. | The Agile Hazard Log approach |
| **17:20-17:40** | Presentation only: J. Baumgartner, Z. Süle, J. Abonyi | | | | José Sobral, C. Guedes Soares |
| | Process quality improvement using sequence of survival models | | | | Physical safety barriers behaviour based on RAM analysis using DEMATEL method |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 21. 6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON LATE, 6 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Structural Reliability 4** | **Failure Mode And Effects Analysis** | **Organizational Factors in Transport** | **Risk Assessment and Accident Modelling** | **System Reliability 3** |
| | **Martin Krejsa** | **Marcelo Hazin Alencar** | **Yanfu Li** | **Marko Gerbec** | **Vytis Kopustinskas** |
| **15:40-16:00** | Eva Lantsoght, Cor van der Veen, Dick Hordijk, Ane de Boer | Cléssio Dias, Bruno Vidal, Salvador Ávila Filho | R. Rosness, S. S. Kilskar, R. K. Tinmannsvik, K. Wasilkiewicz | Sebastian Sochacki, Stefan Bracke | Zdenek Vintr, Michal Vintr |
| | Reliability index after proof load testing: viaduct De Beek | Implementation Proposal of Industrial Equipment Maintenance Plan Evaluation Offshore: an Application Case Practical Tool Failure Mode and Effects Analysis – FMEA | Safety impacts of internationalisation in the Norwegian railway sector | The comparison of the estimation and prognosis of failure behaviour in product fleets by the RAPP method with state-of-the-art risk prognosis models within the usage phase | Tools for Components Reliability Prediction |
| **16:00-16:20** | Martin Krejsa, Jiri Brozovsky, David Mikolasek | Anis Baklouti, Faida Mhenni, Nga Nguyen, Jean-Yves Choley, Abdelfattah Mlika | Trine Marie Stene, Ragnhild Wahl, Reidun Svarava, Jan Alexander Langlo | Axel Berres | Lele Qi, Zhiqiang Li, Lei Li |
| | Probabilistic reliability assessment of steel elements exposed to fatigue using Bayesian approach | Improved System Architecture and Behavior Based on FMEA Recommendations | Digitalization of the Rail Network – Challenging the Traffic Management | Trade-off analysis for different architectures of safety-critical systems | Research of reliable life assessment for cemented carbide cutting tool |
| **16:20-16:40** | Mariusz Zieja, Michal Jasztal, Slawomir Stepien, Mariusz Wazny | Vladimíra Osadská, Lukáš Pospíšil, Aleš Bernatík | Tor Erik Evjemo, Åsa S. Hoem | Lars Ole Grottenberg, Ove Njå | Jozef Zurek, Jaroslaw Ziolkowski, Anna Borucka |
| | The analysis of the fatigue crack growth rate in pipeline elements in two-dimensional depiction | Combination of FMEA and Stochastic DEA for risk analysis | Aviation in the context of globalization: Characteristics and potential safety challenges from the perspective of a full-service carrier | Assessing the use of GIS in the Norwegian emergency management domain | Application of Markov processes to the method for analysis of combat vehicle operation in the aspect of their availability and readiness |
| **16:40-17:00** | Yang Chen, Yi Yang, Jinsong Yang, Jingjing He | Jiangsheng Zhu, Kuichao Ma, Mohsen Soltani, Zhe Chen | Bjørn-Morten Batalden, Are Kristoffer Sydnes | Alexey Leksin, Uli Barth, Damir Adeulov, Ralf Mock | Min An, Yao Chen |
| | Quantitative assessment of crack size based on Lamb wave method | Failure Mode and Effect Analysis for Wind Turbine Systems in China | What causes 'very serious' maritime accidents? | Comparison of Dutch and Russian standards for calculating the risks of a vapour cloud explosion | Fuzzy Reasoning Approach and Fuzzy Analytical Hierarchy Process for Expert Judgment Capture and Process in Risk Analysis |
| **17:00-17:20** | Liu Huawei, Liu Yuqiang, Tan Chunlin, Liu Yongjian, Zhang Jianguo, Yang Lechang | Jacek Kalowski | Malin Knutsen Glette | Ingunn Marie Holmen, Ingrid Bouwer Utne, Stein Haugen, Ingeborg Ratvik | Jaime Santos-Reyes, Galdino Santos-Reyes, Tatiana Gouzeva |
| | Reliability analysis of the space mechanism considering the performance degradation and dynamic time-variant characteristics | Design requirements driven approach to highly automated Failure Mode Effects Analysis | General practitioners decision-making in questions of hospital admissions– a review of the literature | The status of risk assessments in Norwegian fish farming | Preliminary results on historical data on homelessness and post-earthquake disaster emergency shelter |
| **17:20-17:40** | A. Komorek, J. Godzimirski, A. Krzyżak | | Kristine Størkersen | | |
| | The selected aspects of the research into impact loading of adhesive joints in block samples - the influence of the sample geometry | | Coastal cargo work: How can safety shout instead of whisper when money talks? | | |

# PARALLEL SESSIONS – EUROPA, EMERALD

## 22.6. PARALLEL SESSIONS, THURSDAY MORNING, 4 PAPERS PER SESSION

| 10:00-11:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | | | | **Organisational Factors in Risk Management** | **Simulation for Safety and Reliability Analysis 2** |
| | | | | **Marko Gerbec** | **Zoe Nivolianitou** |
| 10:00-10:20 | | | | Marko Gerbec | Gabriele Montecchiari, Paolo Gallina, Gabriele Bulian |
| | | | | Management of technical and organizational changes | An experiment using immersive virtual reality and a haptic interface to study human behaviour in evacuation |
| 10:20-10:40 | | | | David Levovnik, Marko Gerbec | Daniel Gaspar, José Silva, Luis Andrade Ferreira |
| | | | | Auditing operational readiness of Management of Change | The algorithm construction for randomness with censored data in simulation studies in reliability |
| 10:40-11:00 | | | | Yuling Li, Frank W. Guldenmund | Alexander David, Giovanni Sansavini |
| | | | | Managing competence for lifting risk | Identification and mitigation of critical states in power systems by limit state surface reconstruction |
| 11:00-11:20 | | | | Dana Prochazkova, Jan Prochazka | Arnold Yuan, Adetola Adegbola |
| | | | | Concept of safety of complex technological facilities and tools for facility safety management | Karhunen-Loève Expansion for Extreme Values of a Homogeneous Copula-Based Gamma Field |

# PARALLEL SESSIONS – MEDITERANEA, ADRIA, PHAROS

## 22.6. PARALLEL SESSIONS, THURSDAY MORNING, 4 PAPERS PER SESSION

| 10:00-11:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | **Structural Reliability 5** | **Mathematical Methods in Reliability and Safety 3** | **Nuclear Safety - PSA Applications 4** | **Occupational Safety 2** | **RAMS in Railways** |
| | **Martin Krejsa** | **Enrique Lopez Droguett** | **Duško Kančev** | **Inga Žutautaitė** | **Qamar Mahboob** |
| 10:00-10:20 | L. Landi, H. Moedden, F. Pera, E. Uhlmann, F. Meister | Hendrik Schaebe | Jinduo Xing, Zhiguo Zeng, Enrico Zio | Fiorenza Misale | T. Myklebust, N. Lyngby, G. K. Hanssen |
| | Probabilities in safety of machinery - risk reduction through fixed and moveable guards by standardized impact tests, part 1: applications and consideration of random effects | Trapped with Availability | An integrated framework for condition-informed probabilistic risk assessment | The new frontier of smart working: the importance of health and safety at work | A survey of the software and safety case development practice in the railway signalling sector |
| 10:20-10:40 | L. Landi, F. Pera, E. Uhlmann, F. Meister, H. Moedden | Jamal Krini, Josef Börcsök | Rainer Kaulbarsch, Dusko Kancev, Jens-Uwe Kluegel | Jaime Santos-Reyes, Daniel Velazquez-Martinez | Hendrik Schaebe |
| | Probabilities in safety of machinery – risk reduction through fixed and moveable guards by standardized impact tests, part 2: possible improvements with FE impact simulations | PFD average calculation through a MooN Architecture System | Development of a safety enhancement program for long term operation at NPP Gösgen (CH) under deterministic and probabilistic aspects | Preliminary results of an assessment of the working environment of healthcare centres in Mexico | SIL apportionment and SIL allocation |
| 10:40-11:00 | A. D. García-Soto, J. G. Valdés-Vázquez, A. Hernández-Martínez, F. L. Gay-Alanís | David Valis, Kamila Hasilova, Zdenek Vintr, Aneta Krzyzak | Diego Mandelli, Daniel Maljovec, Carlo Parisi, Andrea Alfonsi, Curtis Smith, Cristian Rabiti | Poster: Zygmunt Korban, Marcela Rabasová | Matthew Newall, Coen Van Gulijk |
| | Reliability Analysis of Reinforced Concrete Beams Strengthened with FRP using a Combined Method | Non-parametric reliability assessment of composite items | An Overview of Methods to Analyze Dynamic PRA Data | Assessment of the management quality of the occupational health and safety at the extraction department of the coal mine, current condition and forecasts – case study | Efficient Computer Use for Automated Safety Text Analysis |
| 11:00-11:20 | Milan Holicky | David Valis, Kamila Hasilova, Zdenek Vintr, Libor Zak | N. Berner, M. Utschick, G. Gänssmantel, M.Röwekamp | Poster: Zygmunt Korban, Marcela Rabasová | Marek Młyńczak, Karol Andrzejczak, Jaroslaw Selech |
| | Risk based reliability required in construction | Mathematical modelling of soot particles in oil | Systematic Integration of Hydrological Hazards by Automatically Extending PSA Models | Assessment of management quality of occupational health and safety as a result of the multi-criteria task | Assessment model of operational effectiveness related to newly operated public means of transport |

# PROGRAM SUMMARY – EUROPA, EMERALD

## 19. 6. PARALLEL SESSIONS, MONDAY MORNING, 4 PAPERS PER SESSION

| 11:10-12:30 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Fundamental Issues in Risk Analysis and Management 1 | Advanced Safety Assessment ASAMPSA_E 1 | Accident Modelling 1 | Maintenance Modelling and Applications 1 | Resilience in critical infrastructures 1 |
| | Terje Aven | Emmanuel Raimond | Peter Burgherr | Christophe Bérenguer | Giovanni Sansavini |

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Risk Management 1 | Reliability in Industry | Accident Modelling 2 | Nuclear Safety - PSA 1 | Resilience Engineering 1 |
| | Agnieszka Blokus-Roszkowska | Andrej Senegačnik | Sónia Marques | Tunc Aldemir | Elena Zaitseva |

## 19. 6. PARALLEL SESSIONS, MONDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Maritime and Offshore Risk Assessment | Vulnerability Assessment | Process Reliability | Maintenance Modelling and Applications 2 | Resilience in critical infrastructures 2 |
| | Stojan Petelin | Andrija Volkanovski | Andrej Senegačnik | Christophe Bérenguer | Giovanni Sansavini |

## 20.6. PARALLEL SESSIONS, TUESDAY MORNING, 3 PAPERS PER SESSION, PANEL DISCUSSION

| 10:00-11:00 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Panel Discussion: Industrial Challenges in Land Transportation | Nuclear Safety - PSA 2 | Accident Modelling 3 | Uncertainty Analysis 4 | Resilience in critical infrastructures 3 |
| | Bob Huisman, Pierre Dersin | Andrija Volkanovski | Stig Ole Johnsen | Tunc Aldemir | Ivonne Herrera |

## 20.6. PARALLEL SESSIONS, TUESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Fundamental Issues in Risk Analysis and Management 2 | Advanced Safety Assessment ASAMPSA_E 2 | System Reliability 2 | Maintenance Modelling and Applications 3 | Simulation for Safety and Reliability Analysis 1 |
| | Roger Flage | Emmanuel Raimond | Nicolae Brinzei | Anne Barros | Daniel Straub |

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Risk Assessment 1 | Nuclear Safety - PSA Applications 1 | Air Traffic Safety | Maintenance Modelling 1 | Risk Assessment of Chemical Facilities 1 |
| | Stein Haugen | Andrej Prošek | Elena Zaitseva | Antoine Grall | Francesca Milazzo |

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Risk Assessment 2 | Nuclear Safety - PSA Applications 2 | TRUSS - Structural Safety 1 | Security Assessment 2 | Resilience Engineering 2 |
| | Matteo Spada | Andrej Prošek | Arturo González | Sissel H. Jore | Ralf Mock |

# PROGRAM SUMMARY – MEDITERANEA, ADRIA, PHAROS

## 19.6. PARALLEL SESSIONS, MONDAY MORNING, 4 PAPERS PER SESSION

| 11:10-12:30 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Assessment of Natural Hazards | Reliability in Land Transportation | Uncertainty Analysis 1 | Prognostics and System Health Management 1 | Wind Power Reliability |
| | Pieter van Gelder | Coen van Gulijk | Sebastian Martorell | Piero Baraldi | Enrico Zio |

## 19.6. PARALLEL SESSIONS, MONDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Risk Modelling of Natural Events | Risk Assessment of Liquefied Natural Gas Facilities | Uncertainty Analysis 2 | Prognostics and System Health Management 2 | Human Factors in Transport |
| | Pieter van Gelder | Zoe Nivolianitou | Martina Kloos | Piero Baraldi | Chiara Leva |

## 19.6. PARALLEL SESSIONS, MONDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Fault Tree Analysis | System Reliability 1 | Uncertainty Analysis 3 | Prognostics and System Health Management 3 | Safety Related to Socio-Technical Systems |
| | François Pérès | Anne Barros | Peter Burgherr | Piero Baraldi | Katerina Sikorova |

## 20.6. PARALLEL SESSIONS, TUESDAY MORNING, 3 PAPERS PER SESSION, PANEL DISCUSSION:

| 10:00-11:00 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Reliability and Structures | Human Factors and Human Reliability | Food Safety | Model-Based Reliability and Safety Engineering | Workshop: The integration of reliability & durability within HBM Prenscia software |
| | Daniel Straub | Luca Podofillini | Sebastian Martorell | Sónia Marques | |

## 20.6. PARALLEL SESSIONS, TUESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Security Assessment 1 | Critical Infrastructure Safety 1 | Reliability Data and Testing 1 | Risk Assessment in Land Transport | Workshoop The integration of reliability & durability within HBM Prenscia software |
| | Sissel H. Jore | Krzysztof Kołowrocki | Xiaoyang Li | Bob Huisman | |

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Qualitative Reliability Methods | Critical Infrastructure Safety 2 | Reliability Data and Testing 2 | Transport Risk Management | Workshop - BQR - Reliability & Maintenance |
| | Franck Schoefs | Krzysztof Kołowrocki | Xiaoyang Li | Bob Huisman | |

## 20.6. PARALLEL SESSIONS, TUESDAY AFTERNOON LATE, 5 PAPERS PER SESSION

| 15:40-17:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Structural Reliability 1 | Software Risk Assessment | Reliability Data and Testing 3 | Organisational Factors | Workshop - BQR - Reliability & Maintenance |
| | Duško Kančev | Antoine Rauzy | Stein Haugen | Claudia Vivalda | |

# PROGRAM SUMMARY – EUROPA, EMERALD

## 21.6. PARALLEL SESSIONS, WEDNESDAY MORNING EARLY, 3 PAPERS PER SESSION

| 10:00-11:00 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Maintenance Optimisation | Reliability and Gamma Process | Autonomous Vehicles | Cyber security | Risk Assessment of Chemical Facilities 2 |
| | Pierre-Etienne Labeau | Inga Žutautaitė | Mario Brito | Ralf Mock | Paolo Bragatto |

## 21.6. PARALLEL SESSIONS, WEDNESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Bayesian Methods | Probabilistic Methods Applied to Power Systems 2 | Nuclear Safety - PSA Applications 3 | Risk Assessment 3 | Software Modelling and Analysis |
| | Agnieszka Blokus-Roszkowska | Pierre-Etienne Labeau | Vytis Kopustinskas | Valerio Cozzani | Lixuan Lu |

## 21.6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | System Reliability and Manufacturing | Probabilistic Methods Applied to Power Systems 2 | TRUSS - Structural Safety 2 | Mathematical Methods in Reliability and Safety 1 | Risk Management and Accidents Analysis |
| | Zdenek Vintr | Andrija Volkanovski | Arturo González | Mario Brito | Marcelo Hazin Alencar |

## 21.6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON LATE, 6 PAPERS PER SESSION

| 15:40-17:40 | Room Europa A+B | Room Europa C | Room Europa D | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | Mathematical Methods in Reliability and Safety 2 | Airport Security | TRUSS - Structural Safety 3 | Maintenance Modelling 2 | Risk Management 2 |
| | Enrique López Droguett | Antoine Rauzy | Arturo González | Antoine Grall | Henrik Hassel |

## 22.6. PARALLEL SESSIONS, THURSDAY MORNING, 4 PAPERS PER SESSION

| 10:00-11:20 | | | | Room Emerald 1 | Room Emerald 2 |
|---|---|---|---|---|---|
| | | | | Organisational Factors in Risk Management | Simulation for Safety and Reliability Analysis 2 |
| | | | | Marko Gerbec | Zoe Nivolianitou |

# PROGRAM SUMMARY – MEDITERANEA, ADRIA, PHAROS

## 21.6. PARALLEL SESSIONS, WEDNESDAY MORNING EARLY, 3 PAPERS PER SESSION

| 10:00-11:00 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Resilience Engineering 3 | Common Cause Failures | Tunnel Safety | Human Factors 1 | Reliability in Geotechnics |
| | Matteo Spada | Nicolae Brinzei | Stojan Petelin | Zdenek Vintr | Franck Schoefs |

## 21.6. PARALLEL SESSIONS, WEDNESDAY MORNING LATE, 4 PAPERS PER SESSION

| 11:20-12:40 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Structural Reliability 2 | Aircraft Safety | Infrastructure Reliability Modelling | Economic Analysis in Risk Management 1 | Human Factors 2 |
| | Bernt Leira | Mario Brito | Henrik Hassel | Eirik B. Abrahamsen | Chiara Leva |

## 21.6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON EARLY, 4 PAPERS PER SESSION

| 14:00-15:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Structural Reliability 3 | Occupational Safety 1 | Organizational Factors | Economic Analysis in Risk Management 2 | Human Reliability in Nuclear Facilities |
| | Bernt Leira | Claudia Vivalda | Yanfu Li | Eirik B. Abrahamsen | Marcelo Ramos Martins |

## 21.6. PARALLEL SESSIONS, WEDNESDAY AFTERNOON LATE, 6 PAPERS PER SESSION

| 15:40-17:40 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Structural Reliability 4 | Failure Mode And Effects Analysis | Organizational Factors in Transport | Risk Assessment and Accident Modelling | System Reliability 3 |
| | Martin Krejsa | Marcelo Hazin Alencar | Yanfu Li | Marko Gerbec | Vytis Kopustinskas |

## 22.6. PARALLEL SESSIONS, THURSDAY MORNING, 4 PAPERS PER SESSION

| 10:00-11:20 | Room Mediteranea 1 | Room Mediteranea 2 | Room Adria 1 | Room Adria 2 | Room Pharos |
|---|---|---|---|---|---|
| | Structural Reliability 5 | Mathematical Methods in Reliability and Safety 3 | Nuclear Safety - PSA Applications 4 | Occupational Safety 2 | RAMS in Railways |
| | Martin Krejsa | Enrique López Droguett | Duško Kančev | Inga Žutautaitė | Qamar Mahboob |


Production: **Agencija 101 d. o. o.** and **Faculty of Electrical Engineering, University of Ljubljana**