European Safety and Reliability Association

Newsletter

http://www.esrahomepage.eu December 2021

Editorial

Stefan Bracke, Chair of Reliability Engineering and Risk Analytics (LZR), University of Wuppertal,Germany

At the beginning of the year, on behalf of the ESRA Board, I would like to wish all readers of the ESRA Newsletter best wishes for the year 2022, explicitly with regard to health and personal and professional success. The Corona pandemic continues to affect our daily interaction, our work and our social life:

Since December 2019, the world is confronted with the COVID-19 pandemic, caused by the Coronavirus SARS-CoV-2. The pandemic with its incredible speed of spread shows the vulnerability of a globalized and networked world. The first two years of the pandemic were characterized by heavy burden on health systems and severe restrictions on public life.

Also on us as ESRA as well as the platform ESREL the pandemic has a huge influence. First, the ESREL 2020 PSAM 15 conference (Venice, Italy) had to be postponed first and finally conducted digitally. The digital way was the only possible way to ensure the scientific exchange in our community, which succeeded excellently. In 2021, the pandemic situation seemed to relax as the infection incidence was at a comparably lower level in summer and autumn. The ESREL 2021 (Angers, France) was conducted in a hybrid format. But also, here, the organizing team around Bruno Castanier successfully met the challenges: ESREL 2021 was also a great success.

Unfortunately, we have to note that the Corona pandemic is characterized by massive waves of infection in most countries, the characteristics of which are influenced by seasons, geographic conditions, containment measures, vaccination strategies, etc. Thus, many countries are already in the fourth or fifth wave of Corona pandemic. It is to be feared that many activities of the year 2022 will also be affected by restrictions due to the Corona pandemic. However, the pandemic also shows that methods and systems of safety and science, reliability engineering and risk analytics are still in demand and can make a contribution in the context of pandemic control. Contributions and special sessions within the ESREL 2021 conference have shown this.

We hope that the situation will ease and that ESREL 2022 (Dublin, Ireland) can be held again under largely normal conditions. The team around Simon Wilson and Maria Chiara Leva plans the ESREL 2022 under the motto "Understanding and Managing Risk and Reliability for a Sustainable Future" as a hybrid conference in order to be able to react accordingly in the dynamic situation.

From an organizational perspective, 2022 will also be a year of change. After our new Secretary General Myrto Konstantinidou (Institute for Nuclear and Radiological Sciences, Energy, Technology and Safety (INRASTES); NCSR Demokritos) has already successfully started her work in the last quarter of the year 2021, further elections regarding the ESRA Board are pending this year. In September 2022, after two two-year terms, elections will be held for Chair, Vice-Chair and Treasurer.

I wish the Safety and Reliability Community a successful start into the new year!

ESRA Treasurer,
Stefan Bracke

Feature Articles

Mental Workload Analysis for Seafarers via Ship Bridge Simulation

Shiqi Fan
Liverpool John Moores University,
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Introduction

75-96% of marine accidents are caused by human errors [1]. The primary purpose of this research is to investigate how mental workload influences neurophysiological activation and decision making of experienced and inexperienced seafarers. The research findings reveal the levels of neurophysiological activation of deck officers in tacking ship collision risks, which generates insights for seafarers' safety training and certification.

Experiment

An experimental study was conducted in the ship bridge simulator with functional Near-Infrared Spectroscopy (fNIRS) to measure prefrontal cortex (PFC) activity, seen in Figure 1. The Task Load Index (TLX) was used to assess subjective levels of perceived workload. Two groups of 40 participants were allocated to 1) experienced and 2) inexperienced groups, depending on their nautical qualifications.

Figure 1 View of the participant in the ship bridge simulator

Both groups underwent the scenario with watchkeeping and decision-making phrase. However, it was presented in 1) non-distraction condition or 2) distraction condition. The distraction condition was demonstrated by reporting missions at the same intervals while watch-keeping and decision-making.

Then symmetric correlation matrices were obtained from partial correlation coefficients of all pairwise combinations of the 15 channels (fNIRS, Figure 2) for each group or segment. The connection density and local clustering coefficient were calculated [2].

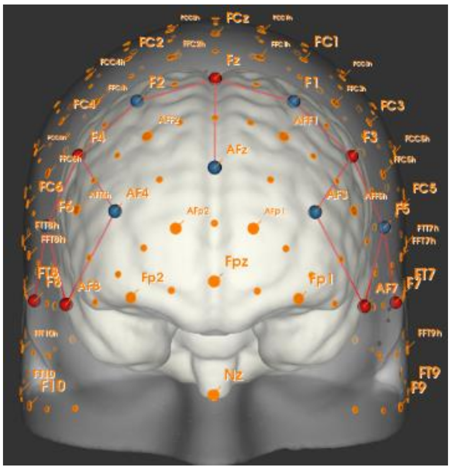

Figure 2 fNIRS probe placement - 3D montage

Analysis and results

The functional connectivity analysis shows that density falls at decision-making when participants prepare to make the manoeuvre[3]. It explains that the network becomes more efficient during decision-making. Besides, there is a decrease of clustering (which refers to connections between neighbouring nodes) during end of watchkeeping, which may indicate boredom. This is followed by a sudden increase when cognitive decision making begins. However, the pattern described before only occurs for non-distracted participants. Distracted participants do not show a decline of clustering during watchkeeping, possibly because they are alerted by multiple tasks. They also do not show a substantial increase at decision making, possibly because they are distracted. Then, two linear regression models were constructed to predict distance from the target vessel when it was spotted and when participants performed an evasive manoeuvre. It revealed that density and local clustering were positively associated with distance to the target vessel when spotted; however, this relationship was strongest for connection density. By contrast, there was an inverse relationship between connection density and the safety margin, i.e., reduced density was associated with greater distance to target vessel when the evasive manoeuvre was performed.

Conclusions

The work applies fNIRS to explore the role of PFC and functional connectivity in watchkeeping and collision avoidance. It demonstrates the process of seafarers' decision-making, which is beneficial for maritime safety training and maritime risk assessment. It also raises a new research direction on human reliability analysis by incorporating neuroscience into human reliability engineering.

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HMRT – Holistic Management of Road Tunnels

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Tunnels are considered safe road infrastructures. Since they are thoroughly inspected and monitored, drivers are more careful when passing through them, and are unaffected by open road weather conditions. From this perspective, the tunnels are generally considered safer than the open road network, in terms of accident rates. Nevertheless, when an accident occurs inside a tunnel it can maximize its impact and casualties due to its constrained space of occurring events. When such accidents occur, due to the closed environment of the tunnels, adverse effects can be caused, especially in terms of human losses and damage to equipment and infrastructure of the tunnel (Kirytopoulos et al., 2017).

Undoubtedly, fire accident events are the greatest threat to road tunnel systems. Destructive experiences such as the Mont Blanc fire in France (1999) or the fire in Yanhou, China (2014) are only indicative of the severity of such incidents. Three academic partners in collaboration with Egnatia Motorway S.A. and Tekmon P.C., have launched a research project that deals with fire management in tunnels. This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE.

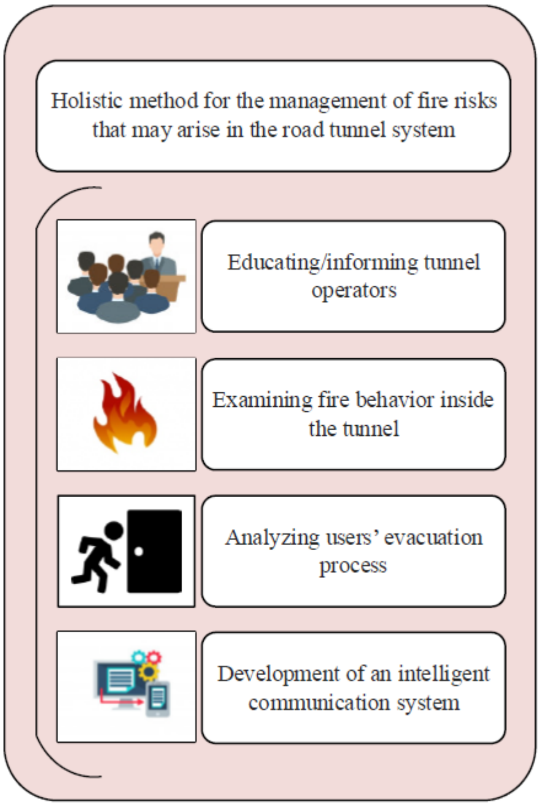

Figure 1. Central research objectives for the development of a comprehensive intelligent communication and holistic risk management system.

The main goal of project ODOS (HMRT – Holistic Management of Road Tunnels) is the development of an intelligent communication system for managing fire risks in tunnels. Fire risks may include a fire inside the tunnel caused by vehicles carrying dangerous and/or non-dangerous goods, the presence of high levels of carbon monoxide and other toxic gases, the release of flammable volatile liquids or gases on the road inside the tunnel etc. The developed application aims to support control room operators of road tunnels and first responders to response adequately in case of potential incidents, ensuring in this way a higher level of safety for these critical infrastructures. The proposed intelligent communication system pursues to fulfil the following central objectives (see Figure 1):

- Development of a holistic method for the management of fire risks that may arise in the road tunnel system.
- Educating tunnel operators that have the primary and central role in the management of risks about the potential behaviour of users participating in the accident as well as

informing tunnel operators about the avail-ability of system's resources.
- Examining fire behaviour inside the tunnel and analyzing users' evacuation process.
- Development of an intelligent communication system based on new and innovative technical installations together with advanced human-related methods.

For more information please visit the webpage of the project ODOS - HMRT: http://odos.simor.ntua.gr/
The publications of the project offer more details on the tools developed.

Publications list

Kirytopoulos, K. Kazaras, K., Papapavlou, K. Ntzeremes, P. and Tatsiopoulos, I. (2017). Exploring driving habits and safety critical behavioural intentions among road tunnel users: A questionnaire survey in Greece. *Tunnelling and Underground Space Technology*.

Kirytopoulos K., Dermitzakis E., Ntzeremes P. and Chatzistelios G., (2020). Holistic Management of risks for Road Tunnels in Proceedings of the 13th International Conference on Modeling, Optimization and Simulation - MOSIM'20 – Agadir – Morocco. *New advances and challenges for sustainable and smart industries*.

Kirytopoulos K., Ntzeremes P., Chatzistelios G., Saramourtsis A., Tsantsanoglou A., Konstantinidou M., (2020). How much do Greek Drivers Know about Safety when Driving Through Road Tunnels? *30th European Safety and Reliability Conference*, ESREL 2020 and *15th Probabilistic Safety Assessment and Management Conference*, PSAM 2020.

Kirytopoulos K., Mourelatos, A., Chatzistelios G., Ntzeremes P., Konstantinidou M., (2021). Employing serious games to increase safety in driving through road tunnels. Proceedings of the *31st European Safety and Reliability Conference* ESREL 2021.

Konstandinidou M., Sisias G., Kontogiannis S. (2021). Development of a Proactive Tool for Dangerous Goods Management in Tunnels. Proceedings of the *31st European Safety and Reliability Conference* ESREL 2021.

Konstandinidou M., Kazaras K., Kirytopoulos K. (2020). Human, Organizational Factors and Mental Workload for Tunnel Operators in Emergency Situations. *4th International Symposium on Human Mental Workload: Models and Applications,* H-WORKLOAD 2020.

Kontogiannis, S., Asiminidis, C., (2021). Proposed Management System and Response Estimation Algorithm for Motorway Incidents. Energies, 14*(10)*.

Ntzeremes, P. and Kirytopoulos, K. (2019). Evaluating the role of risk assessment for road tunnel fire safety: A comparative review within the EU. *Journal of Traffic and Transportation Engineering, 6(3*): 282–296.

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Sisias G., Kontogiannis, S., Konstantinidou, M., and Dossis, M. (2020). Preliminary results of a proposed CNN framework for use in motorway applicable detection systems, *Proc. of the 5th South-East Europe Design Automation, Computer Engineering, Computer Networks and Social Media,* IEEE.

Project partners

Sector of Industrial Management and Operational Research of the National Technical University of Athens (http://simor.mech.ntua.gr/).

Systems Reliability and Industrial Safety Laboratory, National Centre of Scientific Research "Demokritos" (https://inrastes.demokritos.gr/laboratories/systems-reliability-and-industrial-safety-laboratory/).

Department of Mathematics of the University of Ioannina (https://www.uoi.gr/ekpaideysi/sxoles-kai-tmimata/tmima-mathimatikon/)

Egnatia Motorway S.A. (https://egnatia.eu/)

Tekmon P.C. (https://tekmon.com/)

Reliability assessment of existing prestressed concrete structures

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1 Introduction

The corrosion of prestressing reinforcement in concrete structures is an important issue, also due to the sudden collapses of several existing buildings and bridges, in some cases unpredictable and uncontrollable. The recent collapse of the Morandi Bridge in Genoa and two residential buildings in Marseille in 2018 year are particularly well known. The seriousness of the issue can also be illustrated by the collapse of some concrete bridges in Slovakia during 2015-2020 years. One of the most famous recent case of the prestressed concrete footbridge collapse happened in the Czech Republic in 2017 year, see Fig. 1. In these cases, the collapse of the structure was directly related to the significant corrosion damage to the prestressing reinforcement. Bridges are commonly the most visible examples of the problem with reinforcement corrosion.

However, there are other types of structures as industrial halls and stadiums where significant failures have been recently identified, with respect to corrosion damage of prestressing reinforcement. A comprehensive diagnostic of the roof of sports stadium revealed corrosion damage to the prestressed cables of one of the largest suspended structures in central Europe.

Figure 1 – Collapse of Prague footbridge and total damage of its prestressing reinforcement

2 Prestressed concrete roof trusses of industrial halls

Subsequently prestressed roof trusses exist in many industrial halls in the Czech Republic and also in the Slovakia, built in 60^{th} of the past century. Several cases are known in which these roof trusses collapsed due to the rupture of corroded prestressing reinforcement. Damage of the roof trusses occurs suddenly (fragile failure) without any warning signs.

Trusses in the industrial hall in the western Bohemia collapsed in 2010 year, firstly assumed to be due to extreme wind. The second accident in the same hall in 2018 year revealed to be an example of a fragile fracture without the presence of other factors such as snow or wind. Significant corrosion of prestressed reinforcement was found out in both industrial halls.

So far, the accidents occurred without loss of human life. However, this situation may change, as the total documented extent of similar dangerous industrial halls with roofs, where a system of prestressed roof trusses were used, is about 521 000 m^2 in the Czech Republic. According to available data, up to 20 000 people could work under this type of construction without heaving some information. Some owners or operators of these halls may not even know what type of dangerous structures are present in their halls and that they may collapse suddenly without any warning.

Figure 2 – Failure of roof trusses in industrial hall

Similar lattice trusses can be found in a number of different industrial halls in the Czech Republic. They were built mainly in the seventies of the last century. These trusses suffer from systemic defects and lack of technological discipline during grouting of cable ducts with prestressing reinforcement. As a result, the prestressing reinforcement is not sufficiently protected against corrosion. Especially in cases where it leaks into the structure for a long time due to bad insulation, or water condenses on the structure, there is a serious risk of corrosion damage to the prestressing reinforcement.

The huge number of industrial halls and poor condition of the structures has become a significant problem - from the safety of working people, through the economic impact of production interruptions, to a significant environmental footprint in the case of a complete roof replacement of the production hall.

The roof of the industrial hall is supported by thin-walled cassette reinforced concrete roof panels, placed on additionally prestressed lattice trusses having a span of 18 m and at mutual axial distances of 6 m, which were originally produced of three parts for transport reasons and additionally fastened by prestressing cables and then the ducts were poorly injected, see Fig. 3.

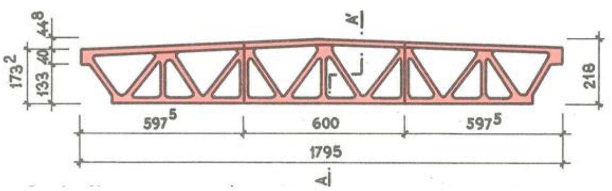
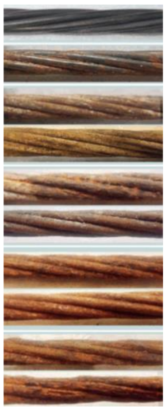


Figure 3 – Illustration of prestressed truss, in m.

An inspection of these trusses revealed that at least half of cable ducts was without grouting grout. The degree of corrosion of the prestressing reinforcement, evaluated during the construction technical survey, could be roughly classified according to the Figure 4 [4], which provides categorisation of the steel corrosion. In most cases the corroded reinforcement found in the trusses was classified into corrosion grades 3 to 5.



1 - without corrosion

2 - localised light surface corrosion

3 – pitting (mass loss 1%)

4 – heavy pitting (3 % mass loss)

5 – significant loss (8% mass loss)

6 – fracture danger (up to 21 % mass loss)

Figure 4 - Illustration of grades of reinforcement corrosion

3 Reliability assessment

Reliability assessment of prestressed trusses with the presence of noninjected channels and with different degrees of prestressing reinforcement corrosion is a demanding task. In some cases, it is even more complicated due to the location of existing industrial halls in some places of the Czech Republic were there has been an enormous increase in snow load requirements in the past based on newly statistical data evaluation by the Czech Hydrometeorological Institute leading to updating the snow map in nationally implemented Eurocodes for structural design [3].

Some unexperienced designers also try to make reliability assessment of an existing industrial hall using ISO 13822 [2], Chapter 8 - Evaluation of the structure on the basis of its previous satisfactory behaviour. This method of assessment is based (with some simplification) on the assumption that if the structure has no visible signs of overloading, static failure, defects or excessive degradation, and if we do not adversely affect such a structure (weaken it or increase its loads) and the structure is used without failure for a sufficiently long time, it can be considered to have satisfactory behaviour and to be reliable enough. However, this method of evaluating the reliability of the structure cannot be used in this case with regard to the already revealed weakening of the prestressing reinforcement by hidden corrosion.

In addition, it should be considered that only a limited number of randomly selected places of the trusses were verified by the construction survey and that the actual total damage of some cross-sections may be bigger.
Another important fact is the mode of possible failure of the structure, which can have the character of a brittle failure and can occur suddenly, without prior warning, e.g. previous increase in deflection or concrete cracking.

4 Risk management system

It is important to introduce measures that, with the most caution and awareness of the increased risk, will allow further operation of the industrial hall for the necessary time before the final proposal for rehabilitation of the hall roof or also for potential decision of its replacement based on project. We could consider a period of months, but commonly no longer than one year, to be a necessary time. This proposal for the risk management regime should be discussed with the owner of the industrial hall.

The proposal for the temporary operation of the hall in the risk management mode could be based on recommendations given in ISO 13822 [2] including three basic measures.

- Additional truss surveys aimed at reduction of uncertainties in the extent of corrosion damage to the prestressing reinforcement.
- Limiting the roof load as much as possible, providing snow control in winter.
- Reducing the risk of structural failure by continuous monitoring the response of the structure to loads and by regular or extraordinary inspections of the structure.

5 Monitoring of structural response

The behaviour of the hall should be checked by inspections. Regular inspections once a week should be performed by an instructed authorized employee of the owner or user of the hall. A professional inspection at half year intervals should be performed by a specialist in the field of structural engineering with appropriate experience. In addition, a technical inspection will be carried out whenever the climatic load limits are reached or exceeded, or in case where there is any doubt about the structural behaviour.

Each inspection will be recorded in a site diary, which will be available on the construction site for these purposes. Written reports from regular and professional inspections should be evaluated by an authorized structural engineer and the owner should be informed about the results.

The response of the roof trusses of the industrial hall to the actual load should be continuously monitored till the final strengthening of the structural system.

5 Concluding remarks

Many existing constructions works including industrial halls with prestressed reinforced roof trusses have been affected by significant degradation in the Czech Republic and also in the Slovakia. They are commonly beyond the service life of the Eurocodes, which is expected to be about 50 years. They can be found in a critical state, which may lead to a sudden unexpected collapse of one or more prestressed concrete roof trusses affected by heavy hidden corrosion.

Well proposed safety measures including continuous monitoring can reduce risks in industrial halls before preparation of strengthening of the structural system on the basis of the developed project documentation or before the transfer of factory production to other building.

If the long-term use of the existing hall is planned (about new 40-50 years), then it is probably a more appropriate solution to remove the heavy existing deteriorated concrete roof structure and replace it with a new lighter construction system designed according to the requirements of the new Eurocodes. However, such a decision should be made in co-operation of designer and hall owner considering social, economic and ecological aspects.

References

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[2] ISO 13822 Bases for design of structures - Assessment of existing structures, 2014

[3] EN 1990 Basis of structural design, 2002

[4] Kolisko J. et al., Properties of prestressed reinforcement structures under corrosion, Journal Concrete, 06/2019

ESRA News

The contribution of

Ioannis A. Papazoglou

to the development of QRA in the nuclear and process industry

Ioannis Papazoglou, (1949 – 2021), born in Athens, obtained his diploma from the School of Electrical & Mechanical Engineering of the National Technical University of Athens 1972) and his Masters and PhD degree from the Department of Nuclear Engineering of MIT in the field of Reliability and Risk Assessment (1974, 1977). Between 1980 and 1984 he was leader of the Risk Evaluation Group of the Department of Nuclear Energy at the Brookhaven National Laboratory, USA. He returned to Greece in 1985 and joined the National Center for Scientific Research DEMOKRITOS, where he became Director of the Institute of Nuclear Technology - Radiation Protection and member of the Board of Directors for ten years.

In 1988 he organized, within the NCSR Demokritos, the Laboratory of Systems Reliability and Industrial Safety (SRISL), which consisted of six PhD researchers performing Research & Development in the areas of risk assessment & management, decision analysis and uncertainty quantification mainly applied in chemical installations and systems. He is considered one of the pioneers in Quantitative Risk Assessment both in the nuclear and chemical industry. While in the US he performed probabilistic safety analysis and reliability of nuclear power plants, review and evaluation of risk studies, probabilistic analysis of specific safety issues, generic reliability issues, development of NRC probabilistic safety analysis guide and audit manual and application of multi-objective decision analysis on the disaggregation of global safety objectives to system reliability requirements. As the Head of SRISL his major contribution was the development of a methodology for Quantitative Risk Assessment for the chemical industry handling toxic, flammable and explosive substances. This methodology has been applied to various industries, such as ammonia, LNG, LPG, refineries and explosive plants. He was also in charge of the development of a methodology for the evaluation of safety reports of industrial installations subject to the SEVESO-II Directive, applied to all major hazard industrial plants in Greece. In addition, he contributed in the development of dynamic reliability of complex systems, decision analysis under uncertainty, multi-objective techniques useful to determine the land use around hazardous chemical installations and methods for emergency response planning. He elaborated the development of the Occupational Risk Model for quantifying the risk of the working population in various professions.

Dr. Ioannis Papazoglou has been active in the European scene of risk assessment & management through various positions in European organizations and committees. He has been a Visiting Professor at Delft Technical University, in the faculty of Technology Policy and Management-Safety Science Group, organizing and teaching a course in "Quantification Techniques for Risk Analysis and Management" between 2006 and 2007. As head of SRISL he has supervised several PhD theses in the fields of dynamic reliability and emergency planning. He has published over three hundred scientific publications comprising articles in scientific peer reviewed journals, papers in peer reviewed conference proceedings, technical reports and book chapters. He served at the editorial board of the "Journal of Hazardous Materials", "Reliability Engineering and System Safety" and the "International Journal of Risk Assessment and Management". He has served as Guest Editor in special issues of the "Journal of Hazardous Materials", "Reliability Engineering and System Safety" and "Safety Science". He was the Chairman of the European Safety and Reliability Association (ESRA) from 2005 to 2009, and President of the Standing Committee on Conferences from 2000 to 2005. He has been the General Chairman of ESREL'96–PSAMIII and of ESREL 2010 conferences both organized in Greece, and member of the Technical Committee of almost all ESREL conferences to date. He was the President of the International Association for Probabilistic Safety Assessment and Management (IAPSAM) Board of Directors, from 1994 to 1996 and Member of the Board of Directors from 1996 to 2002. He has also served at the Executive Committee of the Society for Risk Analysis-Europe from 1998 to 2002.

Calendar of Safety and Reliability Events

41st International Conference on Ocean, Offshore and Arctic Engineering (OMAE 2022) - Symposium on Structures, Safety and Reliability

Conference: 5-10 June, 2022
Exhibition: 6-9 June, 2022
Hamburg, Germany

Following the tradition of excellence of previous OMAE conferences, the OMAE 2022 will be held at the Congress Centre Hamburg, in Hamburg, Germany on 5-10 June, alongside an Exhibition on 6-9 June, 2022.

The OMAE 2022 Congress will be composed of 12 Symposia, 11 of which dealing with specific topics, and this year the Symposium 12 will be an Honorary Symposium for Professor Günther F. Clauss on Hydrodynamics and Ocean Engineering.

The Structures, Safety and Reliability Symposium, as the name suggests, deals with offshore structures safety and reliability, having typically between 100-150 papers. Typical sessions include Probabilistic and Spectral Wave Models, Probabilistic Response Modelling, Reliability of Marine Structures, Fatigue Reliability, Reliability of Mooring and Risers, Reliability Renewable Energy Devices, Risk based Maintenance planning and Risk Analysis & Safety Management.

Safety and Reliability Symposium Coordinator
Professor Carlos Guedes Soares, Instituto Superior Técnico Universidade de Lisboa, Portugal.
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Conference Website: https://event.asme.org/OMAE

32nd European Safety and Reliability Reliability Conference (ESREL 2022)

Conference: 28 Aug. - 1 Sept., 2022
Dublin, Ireland

We are delighted to announce that the 32nd European Safety and Reliability Conference (ESREL 2022) will be held in Dublin, Ireland from 28th August - 1st September 2022, under the auspices of the European Safety and Reliability Association (ESRA).
For many of us, ESREL is not only a place of scientific excellence but also an occasion for our community of safety and reliability specialists to meet in a spirit of conviviality in the broadest sense. We hope to continue this tradition in Ireland, providing a sample of our famous Irish hospitality, as we are conscious that the real value of the event will come from our guests, invited speakers and contributors alike.
This year the conference will have a special focus on: “Understanding and Managing Risk and Reliability for a Sustainable Future”. We therefore invite all of you to submit your contribution keeping this overarching theme in mind.
Authors are invited to submit a short abstract by 15 February. Accepted abstracts will be invited to submit a full paper or an extended abreact within Special Sessions or regular session that will be peer reviewed. Full paper will be also published in open access conference proceedings by Research Publishing Services, Singapore, and be indexed.
We have received over 600 abstracts to date and 33 Special Sessions on very interesting topics and the event this year will also have some joint events such as:

- 6th International Symposium on Human Mental Workload. H-Workload
- International Workshop on Autonomous System Safety: IWASS
- Joint ESReDA - ESRA Session on Advancements in Resilience Engineering of Critical Infrastructures

These joint sessions will complement the regular sessions and application areas. You will find full details of the topic areas and further information about submitting a contribution for the event at the website, www.esrel2022.com.

Key dates:

- Abstract submission: 15 February 2022
- Full paper/extended abstract submission: 30 March 2022
- Final Revised Papers: 15 June 2022
- Early Bird Registration: 15 July 2022

We hope to have as many presenters in a face to face setting and to share a Guinness with many of you for real and not only virtually!
The organising committee includes the General Chairs:

- Simon Wilson. President of the Irish statistics Association. Simon is Professor In statistics at Trinity College Dublin and lead of the Insight Centre for Data Analytics.
- Maria Chiara Leva, Environmental Health Sustainability Institute TU Dublin, Ireland co-Chair of the HRA and HF committee in ESRA

General Co-Chairs:

- Terje Aven, Center for Risk Management and Societal Safety, University of Stavanger, Norway
- Enrico Zio, Dipartimento di Energia, Politecnico di Milano, Italy / Laboratoire Genie Industriel, Ecole Centrale Supelec.
- Cepin Marko, Chair of ESRA, University of Ljubljana.

While the Technical Program Committee Chairs are:

- Edoardo Patelli, Head of the Centre for Intelligent Infrastructures University of Strathclyde, UK
- Luca Podofillini, Vice-chairman of ESRA, senior scientist Paul Scherrer Institute Switzerland

Full details of the event and information about submitting an abstract can be found at the website: www.ESREL2022.com

Looking forward to welcoming you to Dublin!

Continuing Education Courses

RAM&PHM 4.0:

Advanced methods for Reliability, Availability, Maintainability, Prognostics and Health Management of industrial equipment

The 2021 professional one-week training course organized by Politecnico di Milano (Milan, Italy), titled "RAM&PHM 4.0: Advanced methods for Reliability, Availability, Maintainability, Prognostics and Health Management of industrial equipment" took place (online, due to COVID restrictions) from January 19 to February 9, 2021. The course was the XXIII edition of the series. Its goal has been to provide the 38 participants (20 from university/research center and 18 from industry) with advanced methodological competences, analytical skills and computational tools necessary to effectively operate in the areas of reliability, availability, maintainability, diagnostics and prognostics of industrial equipment. The course presents advanced analytics to improve safety, increase efficiency, manage equipment aging and obsolescence, set up condition-based and predictive maintenance.

Since the beginning, the course has been officially supported by ESRA and since 2005 official scholarships have been offered. The 2021 edition of the course has been supported by ESRA with two scholarships covering the registration fee. The 2021 scholarships have been offered to two PhD students, one of Università di Genova (Genova, Italy) and the other of the Universidad Nacional de Cuyo (Mendoza, Argentina).

The first part of the course has been devoted to the presentation of advanced methods for the availability, reliability and maintainability analysis of complex systems and for the development of Prognostics and Health Management (PHM) and Condition-Based Maintenance (CBM) approaches. In this respect, the basics of Monte Carlo Simulation, nonlinear regression and filter models (Artificial Neural Networks, Principal Component Analysis, Auto-Associative Kernel Regression, Ensemble Systems, Hilbert Huang and Wavelet transforms) and evolutionary optimization methods (Genetic Algorithms) have been illustrated. In the second part of the course, exercise sessions on Monte Carlo simulation, Artificial Neural Networks and Genetic Algorithms provided the participants with the opportunity of directly applying the methods to practical case studies. Finally, in the last part of the course, real applications of the advanced methods have been illustrated. The applications range from the evaluation of maintenance costs taking into account the reliability and availability of equipment, to the application of Monte Carlo Simulation for system availability analysis and condition-based maintenance management, to the use of regression and classification techniques for fault detection, classification and prognosis in industrial equipment.

The last day of the course a roundtable session has organized aimed at sharing the course participants practical experience on methods and applications of RAM analysis, fault detection, diagnostics and prognostics.

The next edition of the course fill take place at Politecnico di Milano, Milan (Italy) on December 2021.

Professional Training Course: **ADVANCED QUANTITATIVE RISK AND RESILIENCE ASSESSMENT**

The first edition of the professional training course: "Advanced Quantitative Risk and Resilience Assessment" will be held ONLINE from 12/10/2021 to 18/11/2021 (each Tuesday and Thursday from 14:00 to 18:00 (Rome time).

The course is mainly dedicated to risk analysts and engineers, resilience engineers, technical designers of industrial plants, safety and maintenance managers, asset managers, technicians and operators of surveillance, protection and control of the safety of a facility, researchers and PhD students in the area of Reliability Analysis and Risk Assessment.

The course is stimulated by the evidence that systems are increasingly exposed to hazards of disruptive events, such as unexpected system failures, climate change and natural disasters, and malicious terrorism attacks. In practice, risk assessment is applied to inform risk management on how to protect from the potential losses caused by the disruptive events. Nowadays, the focus is on the accident scenarios, their possible consequences and likelihoods, and the uncertainties therein. The post-accident recovery process is not considered. Yet, given that the sources of hazard leading to disruptive events are extremely uncertain and, thus, difficult to describe and model quantitatively, and that the systems are highly connected to each other so that the impact of the disruption extends beyond the boundary of the individual systems, an extension of the framework of assessment is necessary, calling for an integrated risk and resilience assessment framework that incorporates aspects beyond those of prevention, typical of risk assessment, in order to allow accounting for pre- and post-accident scenarios analysis.

In this sense, the course intends to present the methodologies that allow the integrated assessment of risk and resilience. In particular, the course intends to offer adequate technical-scientific knowledge on advanced risk and resilience assessment methods and provide the most recent methodological tools for their rigorous treatment.

The first part of the course is devoted to the presentation of the classical Monte Carlo simulation methods for risk and resilience assessment and management, and advanced concepts on uncertainty (probabilistic, fuzzy, interval) and sensitivity analysis (variance- and distribution-based). In the second part of the course, advanced methods for risk and resilience assessment will be illustrated, including Bayesian Networks and Dynamic Bayesian Networks, Artificial intelligence and Evolutionary algorithms, complex systems and Human factors modelling. Hands-on sessions provide the participants with the opportunity of directly applying the methods to practical case studies (some of these will be held using MATLAB). Finally, in the last part of the course, participants will also be given the opportunity to discuss their experience and technical problems, related to methods and applications.

The European Safety and Reliability Association (ESRA)) supports the course with two scholarships to be awarded to PhD students. Scholarships will be assigned considering the affinity of the research to the topics of the course, the quality of the CV and the number and impact of publications in the field.

Course directors:
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To register:
https://www.corsoriskassessment.energia.polimi.it/

ESRA Information

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- ESRA Norway

Professional Associations

- DBI - The Danish Institute of Fire and Security Technology, Denmark
- ESReDA, France
- IDA Risk – Technical Network for Risk Assessment under the Danish Society of Engineers, Denmark
- KAERI (Korea Atomic Energy Research Institute), Korea
- Machinery Reliability Institute (MRI), USA
- NVRB, The Netherlands
- Polish Safety & Reliability Association, Poland
- SINTEF AS, Norway
- The Safety and Reliability Society, UK
- VDI - Society Product and Process Design, Germany
- VTT, Finland

Companies

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ESRA is a non-profit international organization for the advance and application of safety and reliability technology in all areas of human endeavour. It is an "umbrella" organization with a membership consisting of national societies, industrial organizations and higher education institutions. The common interest is safety and reliability.
For more information about ESRA, visit our web page at http://www.esrahomepage.eu

For application for membership of ESRA, please contact the general secretary Myrto Konstantinidou (myrto@ipta.demokritos.gr)

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