European Safety and Reliability Association

Newsletter

http://www.esrahomepage.eu June 2018

Editorial

Terje Aven
ESRA Chairman
University of Stavanger, Norway

Dear ESRA members,

It is time for ESREL 2018 in Trondheim, Norway, and the football World Cup in Russia. They will be two unforgettable events for sure. It is always fun to watch top football matches with colleagues from different countries. Norway has not qualified – disappointing but not surprising. It was, however, a shock that Italy did not gain enough points. We will suffer with Enrico; I am not sure how he will deal with this unusual situation.

Trondheim can be magic in late June, with endless days. In fact, the daylight subsides for barely an hour. I hope you also have time to enjoy this, the city and surroundings when travelling so far. The program is great, with many interesting talks and discussions. Yes, there should be something for all tastes.

This is my last editorial as Chairman of ESRA. I have served the organization for two terms (two plus two years), following a period of four years as Vice-Chairman. It has been a pleasure. I would like to thank the other Officers who have accompanied me: Vice Chairman Radim Bris, Treasurer Piero Baraldi and General Secretary Coen van Gulijk – Roger Flage since 2017. It has been a pleasure to work with you all.

Our focus has been on further developing ESRA for the enhancement of the fields and sciences of safety, reliability and risk assessment and management. I now see a strong group of people committed to ESRA and these fields and sciences. More than 50 people are involved as Chairs of the 27 Technical Committees of ESRA, covering a number of methodological areas and applications. This is impressive and gives hope for the future, as many of these Chairs are young and active professionals. In early June the Management team of ESRA and about half of this group of Chairs met in Sardinia, Italy, for a workshop to discuss the future of ESRA. More information about this workshop will come later, but I would like to say that it was a great event – a lot of enthusiasm, and ideas and plans for how to further develop ESRA and the risk, safety and reliability fields and sciences.

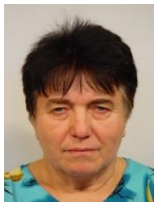
We have developed a new website (esrahomepage.eu), which is reasonably updated on what is happening in ESRA. See for example the collection of newsletters and recorded webinars. I would like to thank Professor Carlos Guedes Soares for his terrific job as editor of our newsletter. I would also like to express my gratitude to postdoc Torbjørn Bjerga for acting as a webmaster and Åge Tjelta Landråk, Proactima, for his support in relation to the webinar series. Excellent work. Thanks also to Enrico Zio for his help regarding the planning of the webinars.

I am proud of ESRA. It is a strong organization. Improvements can always be made, and I am confident that the new Officers will guide and lead ESRA in the right direction in the years to come. I will do my best to support the team.

Terje Aven
Chairman of ESRA

Feature Articles

Risks connected with bridges



Dana Prochazkova
Czech Technical University in Prague
Faculty of Transportation Sciences
Praha, Czech Republic

1. Introduction

Bridges on the roads and railways are critical elements of transport infrastructure that belongs to the critical infrastructure of each territory. From this reason the bridges belong to important public assets and it is necessary to ensure so they may be safe, even in critical situations. The bridge safety is understood as a structured set of anthropogenic measures and activities by which the human ensures both, the human security and the bridge security [1, 2]. To ensure the current human needs, it goes on the integral safety, i.e. on the safety, which includes several protected assets of different nature at a time [2]. Based on current knowledge, the safety is understood as an emergent property of the system, on which the system existence depends; it is the most hierarchical property of the system.

2. Critical infrastructure safety

The aim of the critical infrastructure safety is to ensure the safe territory, safe communities, safe infrastructures and the daily protection of the citizens from the perspective of providing the certain services that people need for life [2]. From findings in [1, 2], it follows that the spots in the technological system (object, the infrastructure, business, territory) are the places, in where happen the basic technological processes and subject to the specific provisions for the safety in normal, abnormal and critical conditions. According to data in [3] such spots on transport infrastructure are also the bridges.

To avoid the economic destabilization of the business units, and other industrial areas, it is necessary to pay special attention to bridges on the roads and railways, which are the critical elements of transport infrastructure. If we want to control the transport system in order to ensure its safety and development, so we need to know the priority aspects, on which depend the achievement of objectives and that we need to focus attention, i.e. measures and activities [2].

3. Data and methods used for research

For research of causes of bridge failures, we compiled in the first the database from 98 world sources; it contains 2035 bridge failures [3]. At data processing directed to identification of sources of risks that caused the bridge collapses, it was used more than 80 information resources, listed in [3, 4].

4. Causes of risks of bridges

The analysis of data in [3] shows that the collapses of bridges with its share of any country. The number of data on the breakdowns of bridges in the individual time periods grows as it expands the number of information sources. E.g., according to [3, 4], it is recorded the following number of breakdowns as follows:

-period 1297-1899: number of failures = 33,
-period 1900-1949: number of failures = 25,
-period 1950-1999: number of failures = 65,
-period 2000-2016: number of failures = 99.

According to the data in [3, 4], it is reality that some concrete and steel bridges collapsed:

-during the construction as a result of bad design or bad construction or bad anchor,
-due to external causes,
-during the renovations or repairs, etc.

The analysis of more than 80 information resources, listed in [3, 4], shows that the causes of the collapse of bridges are:

-natural disaster (earthquake, flood, hurricanes, typhoons, tornadoes, hurricanes, landslides, avalanches, subsoil liquefaction; the power of accumulated ice floes; force accumulated large and bulky items
-large temperature differences and other particularly unfavourable meteorological conditions,
-bump of vehicle to bridges,
-fire of vehicles on the bridge,
-explosion of vehicle on the bridge,
-mechanical damage of the bridge by vehicle,
-traffic accident on the bridge,
-errors in the design of the bridge as: bad load combinations; an underestimation of the size of the potential disasters; underestimation of resonance in the construction; an underestimation of vibration; underestimation of aerodynamic forces; underestimation of geotechnical vulnerabilities in the bedrock, etc.,
-errors in the construction and design such as: poor quality material (often depleted concrete); hidden defects in the material; bad anchors; errors in the joints of the components; poor execution of bridge arches, etc.,
-errors in operation, such as: lack of maintenance; neglected repairs; the absence of timely repairs; frequent congestion; corrosion; the fatigue cracks in the material; an underestimation of the ageing, etc.,
-sabotage and the terrorist attacks.

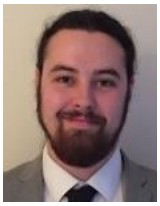
The human factor manifests at both, the errors at individual operations and the errors in the management of traffic on the bridges. Inspections carried out after breakdowns in bridges, often as the cause of the bridge collapse under consideration have identified a combination of several of the above reasons, it is often human error in them, especially in the safety management during the life of the bridge.

5. Tool for management of bridge risks
Because some risks are inherent for each bridge, it is necessary to compile the risk management plan [5]. In this risk management plan of a particular bridge it is necessary to give the method of settlement of failures and the relevant responsibilities in the layers of the safety management system

REFERENCES
[1] PROCHÁZKOVÁ, D. Safety of complex technological facilities. ISBN: 978-3-659-74632-1. Lambert Academic Publishing, Saarbruecken 2015, 244p.
[2] PROCHÁZKOVÁ, D. Strategic management of safety of territory and organisation. ISBN: 978- 80-01-04844-3. Praha: ČVUT 2011, 483p.
[3] ČVUT. Archives of Solved Tasks from Safety Management and Crisis Management. Praha: ČVUT 2017.
[4] ttps://en.wikipedia.org/wiki/List_of_bridge_failures
[5] PROCHÁZKOVÁ, D. Zásady řízení rizik složitých technologických zařízení. e-ISBN: 78-80-01-06182-4. Praha: ČVUT 2017, 364p. http://hdl.handle.net/10467/72582

PhD Degrees Completed

Asset Integrity Case development for normally unattended offshore installations



Sean Loughney
Supervisors:
Prof. Jin Wang
Dr. Ben Matellini
Dr. Trung Thanh Nguyen
Faculty of Engineering and Technology, Liverpool John Moores University, UK

In recent years there has been a marked increase in fires associated with fuel gas leaks with offshore gas turbines. A detailed review of offshore gas turbines incidents conducted in 2005 showed that there were 307 hazardous events over 13 year period, from 1991 to 2004. The review concerned itself with over 550 gas turbine machines. The analysis concluded that the majority of incidents (approximately 40%) occurred during normal operations, with approximately 20% during start-up, another 20% during or after maintenance and the remaining 10% of fuel gas leaks occur during fuel changeover. With the majority of incidents occurring during normal operations, the fuel gas detection is heavily reliant on either turbine fuel detectors and/or fire and gas system detectors. This is due to the modules containing the electrical power generators being almost totally unmanned during normal operation. It was also found that based upon the review conducted on machines in the stated 13 year period, shows that approximately 22% of gas leaks remained undetected. Subsequently, 60% of those undetected leaks were found to have ignited [1] [2].

Given this background, this research [3] proposes the initial stages of the development of a NUI – Asset Integrity Case (Normally Unattended Installation). An NUI – Asset Integrity Case will enable the user to determine the impact of deficiencies in asset integrity on the potential loss of life and demonstrate that integrity is being managed to ensure safe operations. The Integrity Case is an extended Safety Case (SC). Where SCs demonstrate that safety procedures are in place, the Integrity Case shall ensure that the safety procedures are properly implemented. The Integrity Case can be applicable to operations for any large-scale asset, and in the case of this research the large asset for which the Integrity Case shall be developed is an offshore installation [4].

A proposed framework for the development of the NUI-Asset Integrity Case was outlined in order to facilitate accurate development and research outcomes. The framework incorporates two distinct methodologies in a dynamic risk assessment methodology and a decision-making methodology.

An initial Bayesian Network (BN) model was developed, in order to demonstrate the cause and effect relationship of a specific gas turbine component failure. A number of tests were generated to validate the hypotheses of model by applying an outlined BN methodology to a case study. The model demonstrated the effect a possible retaining ring failure would have on the electrical generation system, and surrounding area, of an offshore platform. The levels of fatalities have been omitted from the analysis as the objective of the research is demonstration of dynamic risk assessment for unattended installations. Furthermore, the model can also be applied to high risk areas on manned installations to potentially reduce fatalities as well as property damage. Hence, the Initial BN model presented provides a base to expand the research and the BN model to achieve this goal [5] [6]

The BN model was then expanded demonstrate the effect that several initial failures have on a potential fuel gas release as well as the potential fire and explosion hazards that can occur. These consequences are equally important for offshore platform operators due to the additional HSE regulations within Safety Cases regarding hazards to the environment in any instance. Therefore, if there is a fuel gas leak without ignition, it poses a large issue for operators and duty holders given that the release is undetected. The analysis is presented in the three test cases clearly demonstrates the vital role that the mitigating barriers play in preventing severe consequences due to a gas turbine fuel leak. The BN model also clearly demonstrates that it can provide an effective and applicable method of determining the likelihood of various events under uncertainty, and more importantly show increased uses as a dynamic risk assessment tool.

This is especially applicable in monitoring offshore areas where personnel are not normally present [7].

Finally, this research also investigated the possible configurations and designs of Wireless Sensor Networks (WSNS) that could feasibly operate within an offshore electrical power generator for the purpose of asset integrity monitoring.

A set of qualitative criteria and attributes were outlined to assist with the decision. Similarly, the Evidential Reasoning approach was investigated and utilised for the purpose of determining the most suitable WSN design by aggregating the multiple attributes. A number of WSN configurations were outlined for use in the offshore industry and the most suitable was determined based upon a set of design criteria. The subsequent analysis determined that a multi-hop configuration with a small sensor radius would be the ideal solution for asset integrity monitoring of an offshore electrical generator

[3].Validation was conducted throughout the research through the use of case studies. However, all of analyses conducted were further validated through the use of Sensitivity Analysis.

In the future, this work can be expanded to other systems and industries by applying the developed Asset Integrity Case framework and methodology. The framework outlines the generic steps to develop a dynamic risk assessment model along with MADA for the most suitable remote sensing and detection methods.

REFERENCES

[1] HSE, Fire and explosion hazards in offshore gas turbines, HSE; 2008.

[2] HSE, Offshore Gas Turbines (and Major Driven Equipment) Integrity and Inspection Guidance Notes. ESR Technology Ltd., Oxfordshire. 2006

[3] Loughney, S., Asset integrity case development for normally unattended offshore installations, PhD Thesis, Faculty of Engineering and Technology, Liverpool John Moores University; 2018

[4] RMRI Plc., RMRI's Asset Integrity Case, Manchester; 2011

[5] S. Loughney, J. Wang, D. Lau, D. Minty, Integrity Case Development for Normally Unattended Offshore Installations - Initial Bayesian Network Modelling, Risk, Reliability and Safety: Innovating Theory and Practice – Walls, Revie & Bedford (Eds). 2017 Taylor & Francis Group, London, ISBN 978-1-138-02997-2. Proceedings of the 26th European Safety and Reliability Conference (ESREL). 2017

[6] S. Loughney, J. Wang, Bayesian network modelling of an offshore electrical generation system for applications within an asset integrity case for normally unattended offshore installations, Proc IMechE Part M: J Engineering for the Maritime Environment, 1–19,

DOI: 10.1177/1475090217704787. Online: 2017.

[7] S. Loughney, J. Wang, P. Davies, Bayesian network modelling for offshore installations: Gas turbine fuel gas release with potential fire and explosion consequences, Safety and Reliability. Theory and Applications – Cepin & Bris Hardback (Eds). 2017 Taylor & Francis Group, London, ISBN 978-1-138-62937-0. Proceedings of the 27th European Safety and Reliability Conference (ESREL). 2017.

Safety and verification of advanced maritime vessels: an approach based on systems theory

Børge Rokseth
Supervisors:
Prof. Ingrid Bouwer Utne
Co-Supervisors:
Prof. Jan Erik Vinnem
Prof. Asgeir Johan Sørensen
Prof. Eilif Pedersen
Department of Marine Technology,Norwegian University of Science and Technology (NTNU),Norway

The past few decades have seen rapid technological development in ships and offshore vessels. Advanced electrical power plants and dynamic positioning (DP) systems are now widespread, and the growing demand for greener and smarter multifunctional vessels has resulted in automation of vital vessel functions such as motion control and energy management. Technological developments have made new types of complex operations possible and can be expected to continue to do so in the future. Smarter and more advanced vessels, however, do not necessarily imply increased safety. Increasing complexity and technological change make old methods for hazard identification and verification inadequate. Experience of designing and safely operating previous generations of vessels may not be directly applicable to future vessels.

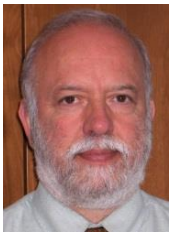
The main objective in this recent PhD thesis, completed at the Norwegian University of Science and Technology (NTNU), has been to improve and advance our current understanding of how to design and verify safe vessels. Although the work focuses primarily on DP vessels, the basic principles and methods developed also apply to other types of advanced marine systems. The research may be relevant to other industries.

Ensuring safe design and operation of an advanced vessel is not trivial. Challenges range from training system operators to be able to handle vessels safely, to ensuring high reliability of their technical systems. Today, such challenges are treated separately. The research in this PhD thesis indicates that these challenges are coupled, and that adopting a holistic perspective that integrates efforts from different engineering disciplines is essential. As an example, high reliability of vessel functions such as motion control, cannot be ensured without considering the complexity that emerges through interactions with human operators and integrated computer control systems. Questions such as whether the operators understand the system adequately well, and whether critical events that occur in the technical system are communicated clearly to the operators through the

system's interfaces, also becomes important for reliable performance of high-level vessel functions.

The thesis reviews current methods and practices for hazard identification and safety verification and investigates how safety can be monitored and understood during operation of these vessels. The research proposes methods and approaches to improve the current state by addressing the identified challenges. The Systems-Theoretic Process Analysis (STPA) is evaluated as a method for hazard identification for DP vessels, as an alternative to the current Failure Mode and Effect Analysis (FMEA) approach. The results show that a complementary approach would be beneficial. As a way of reducing cost related to hazard analysis and enabling safe incorporation of new technology, the STPA approach is adapted into a method for eliciting modular hierarchies of safety requirements. Application of this method as a hazard analysis in the design phase, will enable more reuse of safety requirements and transfer of experience between vessel designs, also during rapid technological change. The thesis further proposes a systemic method for verification management and identification of verification objectives and scenarios. Finally, key requirements and an outline of a framework for dynamic risk models for DP systems has been developed. Online dynamic risk models are necessary to provide feedback on operational safety performance, enhancing situation awareness of operators and other control entities in the system. Applications of proposed methodologies and approaches are demonstrated in the thesis through case studies.

RESS News



Carlos Guedes Soares
Editor-in-Chief RESS
Instituto Superior Técnico,
Universidade de Lisboa

A New Editor

The Journal has continued increasing the number of submissions, increasing thus the pressure on the Editorial Board and on the many faithful reviewers that provide the reviewing and quality control of the Journal. In order to meet this challenge one additional Editor has been nominated, from 1st January 2018, bringing the number of Associate Editors to three now.

I would like to welcome Dr Gregory Levitin to his new Editorial role in RESS. He has been publishing actively in various journals, including RESS and has had editorial experience in various journals, before taking over this task.

He is also Chair of one ESRA Technical Committee and thus he contributes to increase the link that RESS has with ESRA, which is simultaneously one important aspect.

The journal has also continued the policy of gradual rotation of Editorial Board members and thus this year we have welcomed several new members: R.L. Boring, B. Iooss, F.I. Khan, A.K. Parlikad, M. Sujan, L.P. Swiler, P. Weber. I hope they will bring a new impetus to some subject areas.

RESS is continuing an active policy towards having special sections or special issues on specific topics so as to present a more focused view on them.

The special issue of Foundations and Novel Domains for Human Reliability Analysis, with Guest Editors: Luca Podofillini and Ali Mosleh. The submissions to this issue will be closed very shortly.

Other special issues that have been initiated in the meanwhile are:

Advances on Computer Safety and Reliability, with Guest Editors: Stefano Tonetta and Erwin Schoitsch, has started accepting submissions In December 2017 and will be open until July 2018.

The special issue on Quantitative Assessment and Risk Management of Natech Accidents has **Valerio Cozzani** and Nima Khakzad as Guest Editors. Submissions are open since March 2018 to September 2018.

ESRA News

Chairman of ESRA Technical Committee (TC) on Maritime and offshore Technology, Prof Jin Wang has been given two prestigious research awards

Professor Jin Wang, Associate Dean (Research) at the Faculty of Engineering and Technology, Liverpool John Moores University has recently won the following prestigious awards:

- Outstanding Contribution to Marine Safety award for 2017 from the Institute of Marine Engineering, Science and Technology (IMarEST).
- 2017 Royal Institution of Naval Architecture (RINA) – Lloyd's Register Maritime Safety Award for Lifetime Achievement for improvement of the safety of life at sea and the protection of the maritime environment through novel and improved design, construction and operational procedures.

The IMarEST' award recognises the achievement of engineers, scientists and technologists in improving safety at sea. Each year the award is given to a member of the global marine community whose achievements

are judged by a panel of senior IMarEST members and approved by the IMarEST Professional Affairs and Education Committee and, in turn, the IMarEST Board of Trustees.
Professor Wang received his award in IMarEST's 115th Dinner at London Guildhall on the 16th March 2018.

Fig.1 - Prof. Jin Wang received his award from Cdr Rob Dorey, the 116th President of the IMarEST.

The Maritime Safety Award for Lifetime Achievement was presented to Professor Wang, by RINA in association with Lloyd's Register, to recognise his significant technological contribution to improving maritime safety or the protection of the maritime environment.

Fig. 2 - Prof. Jin Wang received his award from Trevor Blakeley, Chief Executive of the Royal Institution of Naval Architects

Such contribution has been made either by a specific activity or over a period of time. Each year one award is given to a member of the global maritime community whose achievements are judged by a panel of members of RINA and Lloyd's Register.
Prof. Jin Wang has recently been appointed as a sub-panel (criteria phase, Unit of Assessment 12 Engineering) member in the Research Excellence Framework (REF) 2021 following his service as a sub-panel member in REF 2014. His appointment is a successful nomination from ESRA.

Life Extension Maintenance of a Nuclear Power Plant

Through the Advanced Nuclear Research Centre (ANRC) at the University of Strathclyde, Management Science researchers, Emma Comrie, Euan Barlow, Matthew Revie, Lesley Walls and Tim Bedford, have been working closely with the Outage and Maintenance Services team of the Canadian nuclear power company, Bruce Power. This collaborative effort supports ongoing life extension maintenance activities at a Bruce Power plant, with the aim of minimising the time taken to perform key tasks and thus reducing operating costs.
The work concerns a design element of CANDU reactors, namely the role of four loose-fitting garter spring spacers used to prevent the touching of the Pressure Tube (carrying the fuel) and the Calandria Tube (containing an insulating annulus gas preventing heat loss). These spacers are not fixed in location and through normal operation of the reactor these spacers move resulting in the Pressure Tube being unequally supported. A key maintenance activity is the relocation of the spacers such that a gap is maintained between the Pressure Tube and the Calandria Tube, ensuring the safe use of the channel until scheduled replacement. Relocating spacers is difficult as the physical profile of the gap between the tubes is unknown, therefore users rely on standardised procedures and experiential knowledge. However, over time, through use, deformation has occurred to the Pressure Tubes, for example elongation, sagging and diametrical expansion and this has resulted in non-standard approached being required. A decision support tool is being developed that can be used to support a user in a changing environment when making decisions on how to relocate the spacers, specifically key inputs into the tool available for this activity.
Using a blended mix of problem structuring, data analyses and knowledge elicitation, a comprehensive, interactive and versatile decision support system has been developed. This tool provides users a mix of visual modelling, predictive modelling, and knowledge management that can be used to support understanding of the potential current environment and provide recommendations for actions. A sppecial focus has been made to the nature of the way information regarding the underlying analyses is communicated to users; simple visualisations summarising the

information have been developed to transfer knowledge efficiently. This approach works towards ensuring the adoption and integration of the tool into current practices and seeks to ensure that users understand and can make informed decisions based on review of the outputs of the tool.
The decision support tool has been trialled during a recent outage. Feedback has been positive with the tool regularly used by engineers. Further life extension activities are planned on other units and as per the request of the industry partner, the tool has been updated with the flexibility to allow upload of new data to be used in future maintenance activities on different units. An extensive training documentation has also been compiled to support new users.

Past Safety and Reliability Events

3rd International "Computational Reliability Engineering (CRE)" Symposium

University of Liverpool
19 October – 20 December 2017
Author: Marcin Hinz

The "Computational Reliability Engineering in Product Development and Manufacturing (CRE)" Symposium was organized by the chair for reliability engineering and risk analytics of Univ.-Prof. Dr.-Ing. Stefan Bracke already for the third time. In order to extend the international character of the symposium, especially regarding the event location, for the first time it took place outside Germany. Due to the cooperation with the University of Liverpool, the event took place in the historical buildings of the London campus of the University of Liverpool in England. The CRE symposium was supported by Meiji University in Tokyo, the European Safety and Reliability Association (ESRA), the University of Wuppertal in Germany, the University of Liverpool as well as the Institute for Analytics and Prognostics of technical complex systems (IAP) from Cologne in Germany. The guests from the industry and academic world discussed, as usual, the current topics related to the product reliability and risk analysis. Academics were represented by attendees from Meiji University (Tokio, Japan), the University of Electro-Communications (Tokio, Japan), the University of Liverpool (GB), Technical University Delft (Netherlands), the University of Huddersfield (GB), University Paderborn (Germany), Leibniz University Hannover (Germany), University Siegen (Germany), the Technical University of Cologne (Germany), and the University of Wuppertal(Germany).

The industrial attendees came from Valeo S.S (France), Carl Zeiss SMT GmbH (Germany), Brockmann & Büchner GmbH (Germany), and diondo GmbH (Germany).

On the first day of the symposium (19th of October) all attendees were participating the meeting in the campus of the University of Liverpool in the London City. Topics of the discussions were focused on the product and process reliability, risk analytics, uncertainty analysis, testing of technical products, sustainability engineering, and physics of failure. The Meiji University presented a new method for the calculations of uncertainties based on robust design. The University of Liverpool discussed the topic of uncertainties from the simulation perspective along the product development process whereas the University of Electro-Communications showed the challenges of reliability of sustainable products in the era of Trump and Brexit. University Paderborn presented the development of reliable and intelligent systems and the University of Wuppertal showed the development of new mathematical approaches for the optimization of product reliability. diondo GmbH was discussing new possibilities of reliability growth by means of the usage of computer tomography. Finally, Valeo S.A. concluded the presentation day with a talk about low-cycle fatigue of engine cooling radiators.

On the second day of the symposium (20th of October) the excursion to the Greenwich Royal Observatory museum took place. The observatory was set as a reference for the zero meridian (sometimes also called the Greenwich meridian) and used for the measurement of the longitudes. Primarily, clocks and astronomy as well navigation instruments were developed in the observatory, according to which the Greenwich Mean Time (GMT), a standardised time specification, was introduced. Many technical discussions regarding the technological development and practicability of the time measurement were conducted with the attendees of the symposium and the employees of the observatory. Hence, the excursion provided the chance to discuss about the history of the development of navigation tools as well as the theory and practice of high precision manufacturing of measurement systems.

The fourth CRE symposium with the University of Wuppertal as organiser will be held in September 2018 in Danzig, Poland in cooperation with the Gdynia Maritime University from Poland.

The organisers would like to thank the sponsors, the European Safety and Reliability Association (ESRA), Meiji University in Tokyo, the University of Wuppertal in Germany, the University of Liverpool as well as the Institute for Analytics and Prognostics of technical complex systems (IAP GmbH) from Cologne in Germany, which supported this annual symposium.

For further information please contact:

Prof. Dr.-Ing. Stefan Bracke
Chair of Reliability Engineering and Risk Analytics
Faculty of Mechanical and Safety Engineering
University of Wuppertal, Germany.

Workshop:"Computational Challenges in the Reliability Assessment of Engineering Structures"

24 January 2018
Delft, The Netherlands

Structural reliability and remaining service life assessment of engineering structures can be a daunting task. The main issue is that these assessments often involve computationally expensive physical models (e.g. NL-FE models) combined with a large number of random variables (e.g. due to random fields) and concern small failure probabilities (1e-3 to 1e-6). Practical examples of such conditions can be found in many fields, e.g. civil engineering, aerospace, or automotive engineering.

To face this challenge and come up with workable solutions, the Department of Structural Reliability at TNO has organized a workshop on this topic. The aim of the workshop was to bring together researchers, practitioners, and software developers from all over the world to share experience, learn from each other, and to jointly find ways of solving these challenges.

The workshop day

The workshop was held on the 24 January in Delft, The Netherlands. With about 50 participants, the interest in the workshop has far exceeded our initial expectations. The participants were practitioners and researchers from various branches of engineering. They came from 10 different countries and affiliated with 22 different institutes/companies.

11 lectures were presented during the workshop, many of these by leading researchers in the field.

The first part of lectures dealt with state-of-the-art reliability methods (advanced subset simulations, hyper-spherical importance sampling, etc.). The second part focused on the latest developments and challenges in engineering practice.

Each of the lectures was recorded and along the lecture slides made publicly available on a designated website: www.reliabilitytno.com.

The outcomes

During the entire workshop there were lively discussions on the presented methods and future challenges. In the final discussion session this yielded to a clear agreement that a comparison of these methods is needed on the basis of carefully selected benchmark studies that are representative of realistic engineering problems. This can give insight to the performance and limitations of these methods.

Call

The methods are intended to be compared, measured against each other via a competition. TNO will take the lead in this by drafting the first proposal and facilitating the process. The proposal will include the guiding principles for the competition, as well as the practical and scientific requirements to the selected benchmark problems.

We invite all interested parties to assist TNO in the facilitation of the process.

For further information, please contact arpad.rozsas@tno.nl.

Website: www.reliabilitytno.com

Calendar of Safety and Reliability Events

10th IMA International Conference on Modelling in Industrial Maintenance and Reliability

Manchester,UK
13 – 15 June 2018

The 10th International Conference on Modelling in Industrial Maintenance and Reliability (MIMAR) will take place in Manchester, UK from 13 – 15 June 2018. This event is the premier maintenance and reliability modelling conference in the UK and builds upon a very successful series of previous conferences. It is an excellent international forum for disseminating information on the state-of-the-art research, theories and practices in maintenance and reliability modelling and offers a platform for connecting researchers and practitioners from around the world.

We hope you can attend and we will provide a warm welcome in Manchester in 2018.

Key Dates:

- Abstract deadline: April 3, 2018
- Paper submission: May 15, 2018

•Final deadline for acceptance for conference proceedings: May 15, 2018

Organising Committee

Philip Scarf - Chair (University of Salford, UK)
Phuc Do - Co-Chair (University of Lorraine, France)
Shaomin Wu - Co-Chair (University of Kent, UK)

Further information

Details of publication and conference fees will be announced shortly.

Scientific enquiries to Prof. Philip Scarf (Salford Business School, University of Salford)
Email: p.a.scarf@salford.ac.uk

Conference Website:
https://ima.org.uk/6619/mimar2018/

Welcome to ESREL 2018

Trondheim, Norway
17-21 June 2018

The annual European Safety and Reliability Conference ESREL is an international conference under the auspices of the European Safety and Reliability Association (ESRA).

The topic for ESREL 2018 is "Safe Societies in a Changing World" and our ambition for the conference is to advance in the understanding, modeling, and management of the complexity of the risk, safety and reliability fields characterizing our world, now and in the future. We aim at setting up a multidisciplinary platform to address the technological, societal and financial aspects of these fields. With the support of NTNU, we engage in broadening the scope of risk, safety and reliability from the technical to natural, financial and social aspects, focusing on Inter-dependencies of functions and cascade of failures in complex systems.

Conference General Chairman:

Prof. Stein Haugen – NTNU

Conference Co-Chairs:

Prof. Jan Erik Vinnem– NTNU
Prof. Trond Kongsvik– NTNU
Prof. Anne Barros – NTNU

Conference Website:

https://www.ntnu.edu/web/esrel2018/home

37th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2018)
Symposium on Structures, Safety and Reliability

Madrid, Spain
17-22 June 2018

The annual OMAE conference is an international assembly of engineers, researchers, and students in the fields of ocean, offshore and arctic engineering. The conference is organized by thematic area in 9 traditional Symposia, one of which deals with topics of Safety and Reliability as applied to this industrial domain. This Symposium typically has around 120 papers and thus is an interesting venue for reliability specialists that want to develop applications in this industrial sector.

Conference Chairs:
Dr. Antonio Souto-Iglesias– UPM (Spain)
Dr. Raúl Guanche García– UC (Spain)
Dr. Francisco Huera-Huarte– URV (Spain)

Technical Program Chair
Dr. Solomon C. Yim – OSU (USA)

Specific questions can be addressed to the **Symposium Coordinator** at:
c.guedes.soares@centec.tecnico.ulisboa.pt

Conference Website: http://www.omae2018.com

Save the Date for ESREL 2019 – 29th European Safety and Reliability Conference

Leibniz Universität Hannover,
Hannover, Germany
22 - 26 September 2019

The 29th edition of the European Safety and Reliability Conference (ESREL) will be held on 22 - 26 September 2019 at the iconic Welfenschloss, the heart xfsubmission system will open shortly after the ESREL 2018 conference in Trondheim. **The abstract deadline is fixed to October 31, 2018.**

We are looking forward to welcoming you in Hannover.

Sincerely,

Michael Beer (Conference General Chair)
Enrico Zio (Conference General Co-Chair)

Conference Website: https://esrel2019.org/#/

ESRA Information

1. ESRA Membership

1.1 National Chapters

- French Chapter
- German Chapter
- Italian Chapter
- Polish Chapter
- Portuguese Chapter
- Spanish Chapter
- UK Chapter

1.2 Professional Associations

- The Safety and Reliability Society, UK
- Danish Society of Risk Assessment, Denmark
- SRE Scandinavia Reliability Engineers, Denmark
- ESReDA, France
- French Institute for Mastering Risk (IMdR-SdF), France
- VDI-Verein Deutscher Ingenieure (ESRA Germany), Germany
- The Netherlands Society for Risk Analysis and Reliability (NVRB), The Netherlands
- Polish Safety & Reliability Association, Poland
- Asociación Española para la Calidad, Spain

1.3 Companies

- TAMROCK Voest Alpine, Austria
- IDA Kobenhavn, Denmark
- VTT Industrial Systems, Finland
- Bureau Veritas, France
- INRS, France
- Total, France
- Commissariat á l'Energie Atomique, France
- DNV, France
- Eurocopter Deutschland GMbH, Germany
- GRS, Germany
- SICURO, Greece
- VEIKI Inst. Electric Power Res. Co., Hungary
- Autostrade, S.p.A, Italy
- D'Appolonia, S.p.A, Italy
- IB Informatica, Italy
- RINA, Italy
- TECSA, SpA, Italy
- TNO Defence Research, The Netherlands
- Dovre Safetec Nordic AS, Norway
- PRIO, Norway
- SINTEF Industrial Management, Norway
- Central Mining Institute, Poland
- Adubos de Portugal, Portugal
- Transgás - Sociedade Portuguesa de Gás Natural, Portugal
- Cia. Portuguesa de Producção Electrica, Portugal
- Siemens SA Power, Portugal
- ESM Res. Inst. Safety & Human Factors, Spain
- IDEKO Technology Centre, Spain
- TECNUN, Spain
- TEKNIKER, Spain
- CSIC, Spain
- HSE - Health & Safety Executive, UK
- Atkins Rails, UK
- W.S. Atkins, UK
- Railway Safety, UK
- Vega Systems, UK

1.4 Educational and Research Institutions

- University of Innsbruck, Austria
- University of Natural Resources & Applied Life Sciences, Austria
- AIT Austrian Institute of Techn. GmbH, Austria
- Université Libre de Bruxelles, Belgium
- University of Mining and Geology, Bulgaria
- Czech Technical Univ. in Prague, Czech Republic
- Technical University of Ostrava, Czech Republic
- University of Defence, Czech Republic
- Tallin Technical University, Estonia
- Helsinki University of Technology, Finland
- École de Mines de Nantes, France
- Université Henri Poincaré (UHP), France
- Laboratoire d'Analyse et d'Architecture des Systèmes (LAAS), France
- Université de Bordeaux, France
- Université de Technologie de Troyes, France
- Université de Marne-la-Vallée, France
- INERIS, France
- Fern University, Germany
- Technische Universität Muenchen, Germany
- Technische Universität Wuppertal, Germany
- University of Kassel, Germany
- TU Braunschweig, Germany
- Institute of Nuclear Technology Radiation Protection, Greece
- University of the Aegean, Greece
- Universita di Bologna (DICMA), Italy
- Politecnico di Milano, Italy
- Politecnico di Torino, Italy
- Universita Degli Studi di Pavia, Italy
- Universita Degli Studi di Pisa, Italy
- Technical University of Delft, The Netherlands
- Institute for Energy Technology, Norway
- Norwegian Univ. Science & Technology, Norway
- University of Stavanger, Norway
- Technical University of Gdansk, Poland
- Gdynia Maritime Academy, Poland
- Institute of Fundamental Techn. Research, Poland
- Technical University of Wroclaw, Poland
- Instituto Superior Técnico, Portugal
- Universidade de Coimbra, Portugal
- Universidade Nova de Lisboa - FCT, Portugal
- Universidade de Minho, Portugal
- Universidade do Porto, Portugal
- University Politechnica of Bucharest, Romania
- University of Iasi, Romania
- Slovak Academy of Sciences, Slovakia
- University of Trencin, Slovakia
- University of Ljubljana,, Slovenia
- Asociación Española para la Calidad, Spain
- PMM Institute for Learning, Spain
- Universidad D. Carlos III de Madrid, Spain
- Universidad de Extremadura, Spain
- Univ. de Las Palmas de Gran Canaria, Spain
- Universidad Politecnica de Madrid, Spain
- Universidad Politecnica de Valencia, Spain
- Institute de Matematica y Fisica Fundamental (IMAFF), Spain
- University of Castilla-La Mancha, Spain
- Luleå University, Sweden
- World Maritime University, Sweden
- Institut f. Energietechnik (ETH), Switzerland

- Paul Scherrer Institut, Switzerland
- City University London, UK
- Liverpool John Moores University, UK
- University of Aberdeen, UK
- University of Bradford, UK
- University of Salford, UK
- University of Strathclyde, Scotland, UK

1.5 Associate Members

- Federal University of Pernambuco, Brazil
- Fluminense Federal University, Brazil
- Pontifícia Universidade Católica, Brazil
- European Commission - DR TREN (Transport and Energy), in Luxembourg
- Vestel Electronics Co., Turkey

2. ESRA Officers

Chairman
Terje Aven (terje.aven@uis.no)
University of Stavanger, Norway

Vice-Chairman
Radim Bris (radim.bris@vsb.cz)
Technical University of Ostrava, Czech Republic

General Secretary
Coen van Gulijk (C.VanGulijk@hud.ac.uk)
University of Huddersfield, UK

Treasurer
Piero Baraldi (Piero.baraldi@polimi.it)
Politecnico di Milano, Italy

Past Chairman
Enrico Zio (enrico.zio@polimi.it)
Politecnico di Milano, Italy

Chairmen of the Standing Committees
Antoine Grall, University of Technology of Troyes, France
C. Guedes Soares, Instituto Superior Técnico, Portugal

3. Standing Committees

3.1 Conference Standing Committee

Chairman: A. Grall, University of Tech. of Troyes, France
The aim of this committee is to establish the general policy and format for the ESREL Conferences, building on the experience of past conferences, and to support the preparation of ongoing conferences. The members are one leading organiser in each of the ESREL Conferences.

3.2 Publications Standing Committee

Chairman: C. Guedes Soares, Instituto Sup. Técnico, Portugal
This committee has the responsibility of interfacing with Publishers for the publication of Conference and Workshop proceedings, of interfacing with Reliability Engineering and System Safety, the ESRA Technical Journal, and of producing the ESRA Newsletter.

4. Technical Committees

Methodologies

4.1 Accident and Incident modelling

Chairman: Stig Johnsen, Norway & Nicola Paltrinieri, Norway
E-mail: Stig.O.Johnsen@sintef.no; nicola.paltrinieri@ntnu.no

4.2 Economic Analysis in Risk Management

Chairman: Eirik B. Abrahamsen, Norway
E-mail: eirik.b.abrahamsen@uis.no

4.3 Foundational Issues in Risk Assessment and Management

Chairman: Terje Aven, Norway & Enrico Zio, France
E-mail: terje.aven@uis.no; enrico.zio@ecp.fr

4.4 Human Factors and Human Reliability

Chairman: Luca Podofillini, Switzerland & Chiara Leva, Ireland
E-mail: luca.podofillini@psi.ch; levac@tcd.ie

4.5 Maintenance Modelling and Applications

Chairman: Christophe Bérenguer, France & Mitra Fouladirad, France
E-mail: christophe.berenguer@grenoble-inp.fr; mitra.fouladirad@utt.fr

4.6 Mathematical Methods in Reliability and Safety

Chairman: John Andrews, UK & Nicolae Brinzei, France
E-mail: John.Andrews@nottingham.ac.uk; nicolae.brinzei@univ-lorraine.fr

4.7 Prognostics and System Health Management

Chairman: Piero Baraldi, Italy & Enrico Zio, France
E-mail: piero.baraldi@polimi.it; enrico.zio@ecp.fr

4.8 Resilience Engineering

Chairman: Ivonne Herrera, Norway & Eric Rigaud, France
E-mail: Ivonne.A.Herrera@sintef.no; eric.rigaud@mines-paristech.fr

4.9 Risk assessment

Chairman: Marko Cepin, Slovenia & Henrik Hassel, Sweden
E-mail: marko.cepin@fe.uni-lj.si; henrik.hassel@risk.lth.se

4.10 Risk Management

Chairman: Lesley Walls, UK & David Valis, Czech Republic & Marcelo Hazin, Brazil
E-mail: lesley@mansci.strath.ac.uk; david.valis@unob.cz; marcelohazin@gmail.com

4.11 Simulation for Safety and Reliability Analysis

Chairman: Nicola Pedroni, France & Edoardo Patelli, UK
E-mail: nicola.pedroni@ecp.fr; edoardo.patelli@liverpool.ac.uk

4.12 Structural Reliability

Chairman: Jana Markova, Czech Republic & Martin Krejsa, Czech Republic
E-mail: jana.markova@klok.cvut.cz; martin.krejsa@vsb.cz

4.13 System Reliability

Chairman: Gregory Levitin, Israel & Serkan Eryilmaz, Turkey
E-mail: gregory.levitin@iec.co.il; serkan.eryilmaz@atilim.edu.tr

4.14 Uncertainty analysis

Chairman: Emanuele Borgonovo, Italy & Roger Flage , Norway
E-mail: emanuele.borgonovo@unibocconi.it; roger.flage@uis.no

Application Areas - Technological Sectors

4.15 Aeronautics and Aerospace

Chairman: Darren Prescott, UK
E-mail: darren.prescott@nottingham.ac.uk

4.16 Chemical and Process Industry

Chairman: Valerio Cozzani, Italy & Gabriele Landucci, Italy & Nima Khakzad, The Netherlands
E-mail: valerio.cozzani@unibo.it; gabriele.landucci@unipi.it; nkhakzad@gmail.com

4.17 Civil Engineering

Chairman: Raphael Steenbergen, The Netherlands
E-mail: raphael.steenbergen@tno.nl

4.18 Critical Infrastructures
Chairman: Giovanni Sansavini, Switzerland & Enrico Zio, France
E-mail: sansavig@ethz.ch; enrico.zio@ecp.fr

4.19 Energy
Chairman: Michalis Christou, Belgium & Mahmood Shafiee, UK
E-mail: Michalis.Christou@ec.europa.eu; m.shafiee@cranfield.ac.uk

4.20 Information Technology and Telecommunications
Chairman: Elena Zaitseva, Slovakia & Ralf Mock, Switzerland
E-mail: elena.zaitseva@fri.uniza.sk; ralf.mock@zhaw.ch

4.21 Land Transportation
Chairman: Olga Fink, Switzerland & Bob Huisman, The Netherlands
E-mail: olga.fink@ivt.baug.ethz.ch; b.huisman@nedtrain.nl

4.22 Manufacturing
Chairman: Benoit Iung, France & François Peres, France
E-mail: benoit.iung@univ-lorraine.fr; francois.peres@enit.fr

4.23 Maritime and Offshore technology
Chairman: Jin Wang, UK & Ingrid B. Utne, Norway & Mario Brito, UK
E-mail: j.wang@ljmu.ac.uk; ingrid.b.utne@ntnu.no; M.P.Brito@soton.ac.uk

4.24 Natural Hazards
Chairman: Pieter van Gelder, The Netherlands & Bas Kolen, The Netherlands
E-mail: p.h.a.j.m.vangelder@tudelft.nl; B.Kolen@tudelft.nl

4.25 Nuclear Industry
Chairman: Sebastian Martorell, Spain & Francesco Di Maio, Italy
E-mail: smartore@iqn.upv.es; francesco.dimaio@polimi.it

4.26 Occupational Safety
Chairman: Ben Ale, The Netherlands & Reniers Genserik, Belgium
E-mail: ben.ale@xs4all.nl; genserik.reniers@uantwerpen.be

4.27 Security
Chairman: Sissel H. Jore, Norway & Zdenek Vintr, Czech Republic & Genserik Reniers, Belgium
E-mail: sissel.h.jore@uis.no; zdenek.vintr@unob.cz; genserik.reniers@uantwerpen.b

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 Coen van Gulijk E-mail: c.vangulijk@hud.ac.uk.
Please submit information to the ESRA Newsletter to any member of the Editorial Board:

Editor: **Carlos Guedes Soares –** c.guedes.soares@tecnico.ulisboa.pt
Instituto Superior Técnico, Lisbon

Editorial Board:
Ângelo Teixeira – angelo.teixeira@tecnico.ulisboa.pt
Instituto Superior Técnico, Portugal
Mitra Fouladirad – mitra.fouladirad@utt.fr
University of Technology of Troyes**,** France
Dirk Proske – dirk.proske@boku.ac.at
University of Natural Resources and Applied Life Sciences, Austria
Francesco Di Maio - francesco.dimaio@polimi.it
Politecnico di Milano, Italy
Igor Kozine – igko@dtu.dk
Technical University of Denmark, Denmark
Sylwia Werbinska – sylwia.werbinska@pwr.wroc.pl
Wroclaw University of Technology, Poland
Eirik Albrechtsen – eirik.albrechtsen@iot.ntnu.no
Norwegian University of Science Technology, Norway
Luca Podofillini – luca.podofillini@psi.ch
Paul Scherrer Institut, Switzerland
Marko Cepin - marko.cepin@fe.uni-lj.si
University of Ljubljana, Slovenia
Jana Markova – jana.Markova@cvut.cz
Czech Technical University in Prague, Czech Republic
Sofía Carlos - scarlos@iqn.upv.es
Universidad Politécnica de Valencia, Spain
Joël Luyk - j.luyk@delta-pi.nl
Soc. for Risk Analysis & Reliability, The Netherlands
Uday Kumar - uday.kumar@ltu.se
Luleå University of Technology, Sweden
Zoe Nivolianitou – zoe@ipta.demokritos.gr
Demokritos Institute, Greece
Elena Zaitseva - elena.zaitseva@fri.uniza.sk
University of Žilina , Slovakia
Matthew Revie - matthew.j.revie@strath.ac.uk
University of Strathclyde, United Kingdom