European Safety and Reliability Association

Newsletter

http://www.esrahomepage.org

Sept-Dec 2016

Editorial

Terje Aven
ESRA Chairman
University of Stavanger, Norway

Dear ESRA Colleagues,

We had some great days in Glasgow. ESREL 2016 was undoubtedly a success. I have received many positive feedbacks expressing that the conference was very good. There were a lot of interesting presentations and discussions and, as always, the conference is an important meeting place. The images of risk was a fun innovation. And for sure, people in Glasgow are nice. Thanks again to all who contributed to making ESREL 2016 an event that we will never forget.

The preparation for the ESREL 2017 conference in Portorož, Slovenia June 18-22 (http://esrel2017.org) is going well. The Chairman of the conference, Marko Cepin, gave a presentation on the status of the work during the ESRA General Assembly Meeting (GAM) in Glasgow on the 26th September. I hope to see many of you there. I guess many of you work hard now on writing the full papers. The full paper deadline is January 10, 2017.

The GAM approved the venue for the ESREL 2018 conference. It will be in Trondheim, Norway, June 17-21, 2018. Professor Stein Haugen will be the general chair of the conference. Congratulations Trondheim and Stein.

At the GAM, Piero Baraldi, Radim Bris and Terje Aven were elected for two more years as Treasurer, Vice-chairman and Chairman, respectively.

The third ESRA webinar was held by Professor Michael Beer on November 2, 2016. The title was: Alternative approaches to the treatment of epistemic uncertainties in risk assessment. It was an excellent talk and the discussion was also interesting, see a recorded version at our website esrahomepage.eu. The webinar series will continue in 2017, following the talks by Beer, Zio and Aven in 2016. I am very pleased with the webinars; they provide an exciting and useful way of communicating and discussing current issues in our field.

With kind regards,
Terje Aven
Chairman of ESRA

Feature Articles

Assessment of the Frequency of the Loss of Offsite Power System Initiating Event

Marko Čepin
University of Ljubljana,
Faculty of Electrical
Engineering, Slovenia

Introduction

Electric power system is a complex system, which is regularly changed: by new power plants added or old removed, by new power lines added or old upgraded, by update of the technical rules for transmission system operator, by update of the technical rules for distribution system operator, by changes of other components, by changes of rules of operation or market requirements.

Its reliability is difficult to measure by one parameter value, so rather several indices and measures are defined for assessment of its reliability.

The reliable power system contributes to safe nuclear power plants and one of the factors showing this issue is the frequency of the loss of offsite power system initiating event in addition to its duration.

The smaller frequency of loss of offsite power initiating event means the better nuclear power plant safety and contributes to the better power system reliability.

The objective is to review and to assess the frequency of the loss of offsite power initiating event at the particular switchyard related to nearby nuclear power plant considering the changes of the system that were accumulated over last decades.

The measures related directly with the assessment of the frequency of the loss offsite power as defined in nuclear safety field are shown in addition to the measures of power system reliability as defined in the power system reliability field.

Methods

The general method for assessing the frequency of loss of offsite power (f_{LOOP}) initiating event is described in ref. [1], [2], [3], which were developed for the related purposes.

The main equation is the following and is basically summarizing contribution from four causes, which are highly uncertain: frequency due to reasons of loss of offsite power within the plant (f_{plant}), frequency due to reasons of loss of offsite power within the network ($f_{network}$), frequency due to reasons of loss of offsite power due to severely bad weather ($f_{severe\_weather}$), frequency due to reasons of loss of offsite power due to very bad weather ($f_{extremely\_severe\_weather}$).

$$f_{LOOP}(t) = f_{plant}(t) + f_{network}(t) + f_{severe\_weather}(t) + f_{extremely\_severe\_weather}(t)$$

Each of four contributing frequencies is uncertain and their sum is uncertain, because very rare events are considered. E.g. for a specific switchyard one can find one event in 30 years, which can lead to a frequency of $3.3 \cdot 10^{-2}$ per year.

Each of four contributions is elaborated further in details, in sense of a frequency of specific contribution with respect to the specific related conditions. While contributions from the plant and the network can be obtained from the real events, if any, by assigning the ration of the number of events versus the observed period to a specific class, the weather related parameters include statistics of weather conditions related to measured parameters including precipitation, snow fall and wind speeds.

Another aspect of the loss of offsite power initiating event, which is considered within methods, is its duration, so the development of a methods for assessment of frequency as a function of duration equations have been developed [1], [2], [3].

As the period of outage of the nuclear power plant may statistically cause more loss of offsite power events than the period of plant power operation, it is reasonable to distinguish both periods separately and a weighted mean can be calculated knowing the number of yearly hours in either of periods: operation or outage.

$$f_{LOOP} = f_{op} \cdot \frac{t_{op}}{t_{op} + t_{sd}} + f_{sd} \cdot \frac{t_{sd}}{t_{op} + t_{sd}}$$

f_{op} – loss of offsite power frequency - plant in operation,
f_{sd} – loss of offsite power frequency - plant in shutdown,
t_{op} – time period of power operation,
t_{sd} – time period of shutdown.

For consideration of specific locations, specific data is much more representative than the generic data. But on the other side, the power system is very much connected to neighbouring systems, so the data related to the neighbourhood is important, too.

In this sense, a weighted mean value considering both aspects seems to be a good procedure, which puts a weight to analysis based on local specific data and a weight to analysis based on generic data of the system neighbourhood for the overall evaluation.

$$f_{LOOP} = k_{gen} \cdot f_{gen} + k_{spec} \cdot f_{spec}$$

$$k_{gen} + k_{spec} = 1$$

f_{gen} – loss of offsite power frequency based on generic data,
f_{spec} – loss of offsite power frequency based on specific data,
k_{gen} – weight factor for analysis based on generic data,
k_{spec} – weight factor for analysis based on specific data.

The methods listed above assess the loss of offsite power initiating event frequency at a specific power system switchyard related to the nuclear power plant under evaluation.

On the other side, several methods and indices have been developed within the power system reliability evaluation to assess power system reliability from different aspects and including the events, which are in the nuclear industry known as loss of offsite power events. The power system reliability methods are summarized in ref. [6].

The system average interruption frequency index (SAIFI) indicates how often the average customer experiences a sustained interruption over a predefined period of time, usually a year.

System average interruption duration index (SAIDI) indicates the total duration of interruption for the average customer during a predefined period of time. It is usually measured in customer minutes or customer hours of interruption.

Both were originally developed for distribution power systems however they can be in a proper way used for transmission systems, as well. Both indices show the frequency of interruptions and the availability (and unavailability as its complement) of the average customer connected to the power system considering all documented events in the system. The smaller their values are, the better the power system reliability is.

Analysis and results

The results for determining the frequency of loss of offsite power initiating event in particular countries with nuclear power plants are yearly published [4], [5]. Fig. 1 shows overall results.

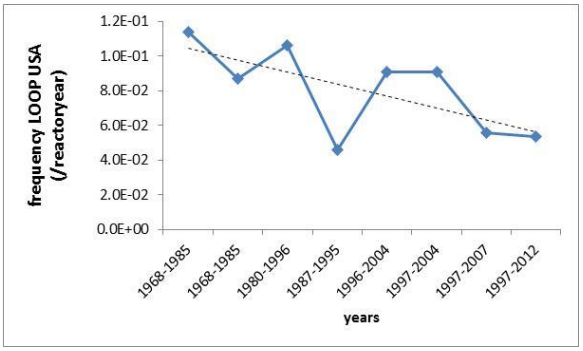

Figure 1: Loss of offsite power frequency in USA

Similar results for Slovenia can be assessed as a frequency of $3 \cdot 10^{-2}$ per year, which is an improvement of the frequency of $5 \cdot 10^{-2}$ per year assessed two decades ago. In the last two decades, no events of loss of offsite power were recorded to particular switchyard, so the decrease of frequency is as expected.

The related power system reliability indices show the following results [7] showing very high availability (and consequently low unavailability) of electric supply for the average customer. Fig. 2 shows SAIFI and SAIDI for the transmission system through the last years. Figure shows that 5 minutes of interrupted power supply to an averaged customer leads to the general unavailability of supply of $1 \cdot 10^{-5}$, which is a low unavailability proving the reliable power system.

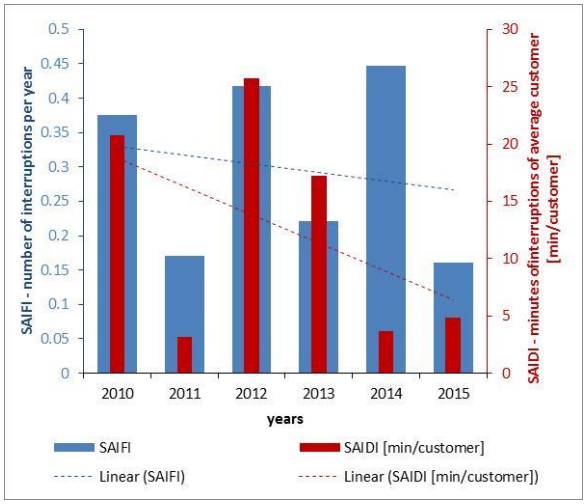

Figure 2: System average interruption duration index and system average interruption frequency index

Conclusions

The reduced frequency of undesired loss of offsite power events for particularly important switchyards was shown in recent years related to the assessment of nuclear safety. In general, the electric power system reliability increases, which is shown not only by reduced number of undesired loss of offsite power events in particular important switchyards but also by the decrease of reliability indices covering overall power systems such as indices SAIDI and SAIFI, which are related to average customer.

References

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5. Analysis of Loss of Offsite Power Events, 2012 Update, NRC, 2013.
6. M. Čepin, Reliability of Power Systems, Springer, 2011.
7. Report on Quality of Supply with the Electric Energy in the Year 2015 (in Slovenian), JARSE, 2016.

PhD Degrees Completed

Safety in the Norwegian fishing fleet – Analysis and measures for improvement

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Department of Marine Technology, Norwegian University of Science and Technology (NTNU), Norway
Supervisors: Prof. Ingrid Bouwer Utne (ingrid.b.utne@ntnu.no)
Co-supervisor: Prof. Bjørn Egil Asbjørnslett

This recent PhD thesis completed at the Norwegian University of Science and Technology (NTNU) has established knowledge of the level of safety within the Norwegian fishing fleet. The objective was to understand past occurrences and analyze succinct accident learning to identify potential risk reduction measures.

Accident statistics, fatality and injury records were used to determine both the relative numbers of accidents occurring per year and incident rates per 10,000 man-years over extended periods within the fishing fleet. Both the number of fatalities and injuries has decreased in the last decade across all fleet groups. Single fatality events occur more often than multiple fatality events, such as vessel disasters. The small coastal fishing fleet

has higher fatality rates than the larger fleets. For injuries, the opposite is the case, but the reason may be a high degree of under-reporting in the smallest fleet. Work activities on deck are unsafe, especially those related to shooting and hauling of the gear. Drowning is the most frequent fatality mode, while entanglements or crush injuries, blows by objects and falls are the most prevailing injury modes.

The quality and quantity of accident records is a problem for accident understanding and learning, lacking specific information about the circumstances under which the accidents occurred, their preconditions, initiations or sequences. Unfortunately, the current accident records facilitate only identification of broad improvement measures for increasing safety within the fishing fleet. The thesis discusses these deficiencies, and outlines the information that needs to be included in the accident reporting forms. An improved data collection system has a large potential to secure safer fisheries in the future.

A further improvement measure suggested by the thesis is a simplistic and concise safety management system, which is manageable for smaller fishing vessels, in particular. Even though documentation is required to prove compliance, these documents do not need to be. Communication is actively encouraged as a tool for managing safety and for improving collaboration, sharing of safety information and responsibilities onboard.

The findings of this PhD study should be of interest to those working in Health and Safety in general, as well as to those involved in such research in the fishing industry. Further, it is hoped that the thesis will have a positive impact on future fisheries accident recording by motivating the international community, government bodies and researchers to develop a standardized reporting format to improve learning. Finally, it is hoped that the research in the thesis provides the fishers with some knowledge and tools by which they can improve their safety at sea.

Reliability and Availability Assessment of Degrading Components Equipped with Prognostics and Health Management (PHM) Capabilities

Luca Bellani
Politecnico di Milano, Italy
Supervisors: Prof. Enrico Zio
Co-supervisor: Dr. Michele Compare

Prognostics and Health Management (PHM) is the engineering field that focuses on detection (i.e., the recognition of a deviation from the normal operating condition), diagnostics (i.e., the characterization of the abnormal state of the system) and prognostics (i.e., the prediction of the evolution of the abnormal state of the system up to its failure or up to the time at which it will no longer operate within its stated specifications).

PHM in principle allows identifying problems at an early stage and timely performing the necessary maintenance actions to anticipate failures. Moreover, the estimation of the component Remaining Useful Life (RUL) enables setting an efficient and agile maintenance management, which is capable of providing the right part to the right place at the right time, together with the necessary resources to perform the maintenance task. This reduces the interruption of business operations and possible malfunctions introduced by errors deriving from maintenance.

Boosted by the appealing potential of PHM, a large number of algorithms have been developed for PHM in recent years. On one side, this variety of alternatives is beneficial for PHM engineers who, in principle, have more chances to find the solution suitable to address their peculiar PHM issue. On the other side, the presence itself of diverse algorithms poses the problem of how to compare their performances, which is fundamental to make a decision about the best portfolio of alternatives to invest in for investigation; to tackle this comparison problem, a variety of metrics and performance indicators have been proposed.

However, a general framework that allows to quantify the benefit of PHM depending on these metrics is still lacking.

Against this backdrop, we developed two general, time-variant, analytical models which conservatively evaluate the increase in system reliability and availability, respectively, achievable when a component is equipped with a PHM system of known performance metrics. The reliability model can be applied in safety critical and risk-averse contexts (e.g., applications of the nuclear industry), where the main concern is to avoid to install a PHM tool that over-estimates the system RUL (i.e., failure occurs before predictions) and, thus, jeopardizes the asset and the public. In this setting, then, a reliability model of a PHM-equipped component allows to quantify the increase in system reliability, regardless of the effects that possible early stops due to false alarms have on system availability. The availability model can be applied in contexts where the main goal of PHM is to increase the system availability. In this respect, the developed model supports decision makers who have to decide whether to invest in PHM trading-off the benefit arising from PHM against its possible initial development costs.

The general framework of both models consists of a degrading component periodically monitored with respect to a continuous indicator variable of the degradation state. The degradation process is stochastic and the monitored degradation state variable is characterized by two thresholds: the detection threshold, which mainly depends on the characteristics of the instrumentation used to measure the degradation variable (i.e., for values below this threshold it is not possible to detect the degradation state), and the failure threshold, above which the component function is lost.

Then, the PHM performance metrics are used to give an 'off-line' (i.e., without running the PHM algorithms) conservative estimation of the probability of removing the component from operation at all monitoring instants.

The main difference between the two models, which rely on different metrics, lies in that the availability model has to account for stops in the whole life-cycle because early removals do not allow to exploit all the useful life of the component and, thus, are not beneficial, whereas in the reliability model, the exploited metrics allow to identify a "safety" time region, far from failure, where it is conservatively assumed that the component is never removed from operation.

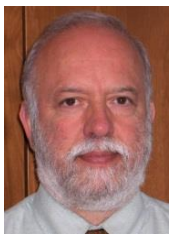
The availability model is applied to a simulated case study concerning crack propagation in a mechanical component: at first, a sensitivity analysis is conducted to figure out the parameters our model is most sensitive to. Then, a cost model is developed to compare the performance of predictive maintenance based on PHM with corrective and scheduled maintenance.

The same simulated case study is used to validate the proposed reliability model: the results of the 'off-line' developed model are compared with those of the 'on-line setting', in which the crack propagation is simulated together with the selected Particle Filtering (PF) algorithm, and with the decisions based on their outcomes as well. The results show that the reliability estimate is close to that obtained from real-time simulation and always under-estimating it.

The reliability model is also applied to a power transmission system, which is modeled by a graph, to select the locations and PHM types to install on the network elements, which are optimal with respect to the objectives of maximizing a global network reliability index while minimizing the development cost. This optimization problem has been tackled within the Portfolio Decision Analysis (PDA) framework. To highlight the worth of addressing the PHM-based network reliability optimization within PDA, we have compared the optimal solutions with those of alternative intuitive approaches, which are based both on centrality indexes and intrinsic reliability of the network elements. This comparison has shown that the PDA is the only way to guarantee an optimal investment.

Further research work will investigate the application of the reliability and availability models to other real engineering situations, to identify when PHM can really bring advantages to the industry business. Other possible developments concern further improvements of the developed models, e.g., for relaxing some conservative assumptions or approximations and encoding diagnostics.

RESS News



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

The Reliability Engineering and System Safety (RESS) Journal is continuing a more active policy towards having special sections or issues on specific topics so as to present a more focused view on them.

Recently closed special sections, which will be shortly appearing on the web site are:

- Reliability and Safety Certification of Software-Intensive Systems
  Guest Editors: Roberto Natella and Barbara Gallina
- Games and Decisions in Reliability and Risk
  Guest Editors: Refik Soyer and Suleyman Ozekici
- Reliability and Performance of Multi-State Systems
  Guest Editors: Gregory Levitin and Liudong Xing

Presently the following special issues are **open to submissions**:

- Maintenance Modelling
  Guest Editors: Shaomin Wu, Phuc Do
- Complex Systems RAMS Optimization: Methods and Applications
  Guest Editors: David W. Coit, Enrico Zio

A **new special issue** will open for submissions in Dec 1, 2016:

- Impact of Prognostics and Health Management in Systems Reliability and Maintenance Planning
  Guest Editors: Joo Ho Choi and Ming Zuo

ESRA News

Journal of Integrated Security Science (JISS)

The Safety and Security Science Group of Delft University of Technology (TU Delft), the Netherlands, has established the Journal of Integrated Security Science (jiss), an open access journal fully free of charge for both authors and readers.

The journal is aimed at publishing innovative scholarly manuscripts that make a significant contribution – theoretically or empirically – to all areas of physical security. Of particular interest are articles that combine science, technology, and regulations to invent sophisticated yet practical solutions for securing assets in various domains including the chemical and process industries, Oil & Gas industry, HAZMAT transportation, power plants (nuclear, LNG, etc.), pipelines, water treatment systems, dams, and commercial and governmental facilities.

Research articles, review papers, and short communications are now invited for possible publication in the journal.

More information about the journal's aims and scope, editorial board, and call for papers can be found at the journal website at http://journals.library.tudelft.nl/index.php/jiss.

The 5th PhD School on Vulnerability, Risk and Resilience of Complex Systems and Critical Infrastructures--T.I.M.E.

The 5th PhD School on Vulnerability, Risk and Resilience of Complex Systems and Critical Infrastructures--T.I.M.E. (Top Industrial Managers for Europe Association) was successfully organized at the School of Reliability and Systems Engineering, Beihang University from October 16th to 22nd. From 2012, this school has been held in Europe for 4 times. In 2015, Prof. Rui Kang, Prof. Xiaoyang Li and four PhD students from the School of Reliability and Systems Engineering, Beihang University took part in the 4th PhD school held in Université Paris-Saclay. In the same year, Beihang University won the host right for the 5th PhD school, which is the remarkable first time that the project is being held outside Europe.

The 5th PhD School on Vulnerability, Risk and Resilience of Complex Systems and Critical Infrastructures has received the support from T.I.M.E., European Safety and Reliability Association (ESRA), Huawei Company and the International Office of Beihang University. Thanks to this support, this year, sixteen PhD students attended the PhD school from various universities such as Politecnico di Milano, Université Paris-Saclay, RWTH Aachen University, Wrocław University of Science and Technology, Beihang University and Wuhan University of Technology.

Six professors from Beihang University, Politecnico di Milano and Université Paris-Saclay delivered lectures, covering advanced methods and techniques for the assessment of the vulnerability, risk and resilience of complex systems. Huawei Company was invited as partner enterprise to provide support for short-time research projects. Students were also given the opportunity to communicate and interact with experts from several other word-class enterprises like Schlumberger Technologies (Beijing) Ltd., Thales China and Electricite de France-China. The students also experienced the Chinese culture through cultural and educational visits. At the end of the PhD school, four teams of students from the different universities presented their short-time research projects, which will be continued in the following six months and finally concluded as project papers.

Group photo of the 5th PhD School on Vulnerability, Risk and Resilience of Complex Systems and Critical Infrastructures

CRESCI Has Successfully Held the Training of 2016 Prognostics and System Health Management

The Center for Resilience and Safety of Critical Infrastructures (CRESCI) has been co-founded on April, 2015, by Prof. Rui Kang and Prof. Enrico Zio. The purpose of CRESCI is theoretical research, technology development and application on resilience, safety and risk analysis for critical infrastructures by making full use of the expertise of both sides involved. The research focuses on life prognostics and health management of major products or facilities, testing and evaluation of cyber-physical systems, fault propagation and risk control of complex networks, etc.

This year, CRESCI has successfully held a Training Course on Prognostics and Health Management (PHM) from October 19th to 21st in Crowne Plaza Chengdu, Sichuan Province, China. The Course has attracted the participation of numerous enterprises and universities like China Shipbuilding Industry Corporation (CSIC), Technology and Engineering Center for Space Utilization of Chinese Academy of Sciences, MESNAC, Qinda, Harbin Institute of Technology and Nanjing University of Aeronautics and Astronautics. During the training, the Chinese director of CRESCI, Prof. Rui Kang, from Beihang University, the international director Prof. Enrico Zio from Ecole CentraleSupelec, Paris and Politecnico di Milano, the deputy executive director Prof. Yanhui Lin from Beihang University and Prof. Priero Baraldi from Politecnico di Milano have given lectures.

In the morning of October 19th, the training officially opened with the welcoming speeches of Prof. Rui Kang and Prof. Zio. Then, the PHM training has continued with 4 lectures. Firstly, Prof. Enrico Zio gave a lecture on Prognostics and Health Management: State

of the Art and Challenges. Addressing the fast development of Industry towards Smart but Complex Systems, Prof. Zio introduced the current developments and challenges of PHM technology. In the afternoon, Prof. Rui Kang integrated theory with practice, elaborating on the PHM Technique for Products Based on the Model of Failure Mechanisms, explaining the four main aspects: concept characterization, main method, failure mode and failure mode, mechanism and effects analysis (FMMEA).

In the morning of October 20th, Prof. Piero Baraldi gave a lecture on Ensembles of Models for Prognostics and Health Management, with application examples in nuclear power plant systems. In the afternoon, Prof. Yanhui Lin presented Experiments and Evaluations for PHM from the point of view of the principles and methods of reliability experiments and project cases.

Figure 1: Students in training

Figure 2: Group picture

Past Safety and Reliability Events

European Safety and Reliability ESREL 2016

Glasgow, Scotland
25-29 September 2016

Dr.Matthew Revie, Technical Co-Chair ESREL 2016
University of Strathclyde, Glasgow, United Kingdom

From 25th-29th September, the University of Strathclyde, Glasgow, hosted ESREL 2016. The event, which saw over 500 participants from over 40 countries and six continents come to Scotland, brought together researchers and practitioners in safety, reliability, risk, resilience and asset management to look at new approaches to deal with challenges faced across all industry sectors. The Technical Chair of the conference was Professor Lesley Walls supported by Dr Matthew Revie as Technical Co-Chair. The conference was organised by ESRA (Terje Aven), University of Strathclyde (Tim Bedford) and the UK Safety and Reliability Society (Richard Denning). The scientific programme included plenaries from leading scientific, business and regulatory speakers, and over 400 contributed papers spanning a range of scientific developments as well as practical applications. In addition, to these events, ESREL 2016 had a number of firsts, including keynote tutorials led by international experts, software demonstrations from leading vendors and an exhibition of images from the first ever Images of Risk Competition.

The plenary presentations were given by: Professor Elizabeth Pate-Cornell, Stanford University, on Cyber Risk Analysis: Method and Illustrations; Dr George Bearfield of Railway Safety and Standards Board on Safety reporting and analysis: A national step change for GB Rail; Dr Simon Parsons of Scottish Water on Building a reliable and resilient water supply; Professor Andrew Curran of Health and Safety Executive on Science in Occupational Safety and Health: Front line service or expensive luxury?; and finally, Professor John Quigley of University of Strathclyde on Empirical Bayes its Now, its Wow.

The four keynote tutorials were widely regarded as a huge success. These 90 minute sessions provided the audience with a rapid introduction to key topics of interest to all professionals in safety, reliability and risk. On Monday, Professor Chris Johnson of University of Glasgow presented on "Cyber Security for High-Reliability, Safety Critical Systems". On Tuesday, Dr Ronald Boring of Idaho National Laboratory presented on "Demystifying Human Performance Modelling: An Absolute Beginner's Guide to Dynamic Human Reliability Analysis" while on Wednesday Professor Emanuele Borgonovo of Bocconi University gave an introduction on "Uncertainty Quantification and Global Sensitivity Analysis". The tutorials were completed on Thursday by Professor Antoine Rauzy of Norwegian University of Science and Technology on "Reliability Assessment of Complex Systems".

The Images of Risk competition proved to be a huge success. The Images of Risk competition, with 25 submissions, were original images which communicated an interesting aspect of some of the research at the conference. The images were displayed in the exhibition space during ESREL 2016, on multi-media during the conference in the Technology and Innovation Centre venue, and after the conference on the ESREL 2016 website. Winners were awarded to best PhD student, best non-PhD student, chosen by Professor Andrew Curran, and highest voted by participants.

The conference was hosted at the University of Strathclyde's Technology and Innovation Centre, a state of the art centre in Glasgow, dedicated to industry-university collaboration. The social event included a drinks reception at the stunning City Chambers and

dinner at the magnificent Kelvingrove Art Gallery and Museum. However, the highlight of the social events was the Ceilidh. Over 250 of the participants braved the Scottish rainy weather to take part in traditional Scottish dancing led by a Scottish folk band. The Ceilidh, which involved 3 hours of dancing, also involved a risk assessment competition on one of the dances.

ESREL 2016 concluded with a discussion session chaired by Terje Aven and Enrico Zio, and a presentation from Marko Cepin, the Conference General Chair of ESREL 2017, the University of Ljubljana's Faculty of Electrical Engineering.

Calendar of Safety and Reliability Events

14th International Probabilistic Workshop (IPW 2016)

Ghent, Belgium
5-7 December 2016

The conference is intended for civil and structural engineers and other professionals concerned with structures, systems or facilities that require the assessment of safety, risk and reliability. Participants could therefore be consultants, contractors, suppliers, owners, operators, insurance experts, authorities and those involved in research and teaching.

Important dates:
- April 1, 2016 – Submission of abstracts
- July 1, 2016 – Submission of full papers

Conference website: **http://www.ipw2016.ugent.be**

27th International Conference on Safety and Reliability (ESREL2017)

Portoroz, Slovenia
18-22 June 2017

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

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

Authors are invited to submit one page abstracts using the predefined abstract template file.

Technical program committee will review the abstracts and inform the authors of the acceptance. The full length papers have to be submitted using the paper template file.

A peer review of the papers will be performed and accepted papers will be published in indexed Proceedings of ESREL2017, published by Taylor and Francis. Extended versions of selected papers will be submitted to a special issue of scientific journal.

Important dates
- November 10, 2016 - Abstract submittal
- November 20, 2016 - Abstracts acceptance notification
- January 10, 2017 - Full papers submittal
- February 15, 2017 - Early bird registration
- June 18-22, 2017 - Conference

Organisers
General Chair: Marko Cepin
General Co-Chair: Terje Aven
Steering Committee Chair: Enrico Zio
Program Committee Chair: Radim Bris

Conference Information and Contacts
Conference website: **http://www.esrel2017.org**
Email: conference@esrel2017.org
Conference secretary phone: +386 1 620 82 35
General chair phone: +386 1 4768 243

36th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2017) Symposium on Structures, Safety and Reliability

Trondheim, Norway
25-30 June 2017

Since 2003, the OMAE conference has more than tripled in size, with over 1,000 participants at OMAE 2015 in St. John's, Canada and over 900 in Busan, Korea. 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.

Call for papers - Authors should submit a title/abstract to begin the paper submission process. Draft manuscripts and final-paper submissions must conform to ASME publication guidelines.

Specific questions can be addressed to the **Symposium Coordinator** at:

c.guedes.soares@centec.tecnico.ulisboa.pt

Important dates:

- October 7, 2016 - Submission of Abstract Due Date
- January 9, 2017 - Submission of Full-Length Draft Paper for Review
- February 6, 2017 - Paper Reviews Completed
- February 13, 2017 - Author Notification of Required Revisions
- February 27, 2017 - Author Notification of Acceptance of Paper
- March 27, 2017 - Submission of Final Paper

Conference Website: **http://www.omae2017.com**

The International Conference on Information and Digital Technologies 2017 (IDT 2017)

Zilina, Slovakia
5-7 July 2017

The International Conference IDT'2017 is the annual event. The aim of the Conference is to bring together researches, developers, teachers from academy as well as industry working in all areas of digital technologies. Especially young researchers and postgraduate PhD students are greatly welcome to participate in this event. Beside the scientific field, several cultural and social events are planned for the enjoyment of the Conference attendees.

Each paper will be evaluated for acceptance by at least two peer reviewers. Furthermore, paid registration to the Conference is mandatory for paper acceptance (one registration per paper). We are going to add the publication of the full set of accepted papers IEEEXplore, Scopus and Web of Science.

Special events:

The two Workshops in framework of the conference will be organized:

- Int. Workshop on Biomedical Technologies
- Int. Workshop on Reliability Technologies

Important dates:

- March 13, 2017 – Full paper submission
- May 22, 2017 – Paper acceptance notification
- June 5, 2017 - Camera-ready papers
- June 19, 2017 - Final program

Conference website:
http://idt.fri.uniza.sk ; **http://idt.fri.uniza.sk/idt2017**

15th International Probabilistic Workshop (IPW)

Dresden, Germany
27-29 September 2017

The conference is intended for mechanical, civil and structural engineers and other professionals concerned with components, structures, systems or facilities that require the assessment of safety, risk and reliability. Participants could therefore be consultants, contractors, suppliers, owners, operators, insurance experts, authorities and those involved in research and teaching.

The 15. Dresdner Probabilistik Workshop will be hold in connection with the 15th International Probabilistic Workshop.

Key topics:
Safety, Risk, Probabilistic Computation, Reliability, Structural Safety, Mechanical Safety

Organisers:
Dr.-Ing. Matthias Voigt,
Prof. Dr.-Ing. Wolfgang Graf,
Prof. Dr.-Ing. habil. Ulrich Häußler-Combe,
Prof. Dr.-Ing. M. Beer,
Dr.-Ing. habil. Dirk Proske
Technische Universität Dresden,
Faculty of Mechanical Engineering & Faculty of Civil Engineering

Important dates:

- March 15, 2017 - Submission Abstract
- June 30, 2017 - Submission Final Paper

Event information and contacts:
Event website: **http://ipw15.probabilistic.info**
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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

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- 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
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- D'Appolonia, S.p.A, Italy
- IB Informatica, Italy
- RINA, Italy
- TECSA, SpA, Italy
- TNO Defence Research, The Netherlands
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- CSIC, Spain
- HSE - Health & Safety Executive, UK
- Atkins Rails, UK
- W.S. Atkins, UK
- Railway Safety, UK
- Vega Systems, UK

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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.

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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.org.
For application for membership of ESRA, please contact the general secretary Coen van Gulijk E-mail: c.vangulijk@hud.ac.uk.
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