European Safety and Reliability Association

Newsletter

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Editorial

Enrico Zio
ESRA Chairman
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Dear ESRA Colleagues,

It is once more a pleasure for me to address you in the opening of our newsletter.

This year 2014 is another year full of developments and initiatives by and for the ESRA community. Of course, the number one initiative is still ESREL 2014, in Wroclaw, Poland, in September: papers are now flowing in and we are looking forward to yet another exciting moment of scientific and technical exchanges and social sharing; please, keep supporting the conference.

In parallel, the activities proposed by some of you and sponsored with seed money by ESRA are well on track and you will read their successful stories in this and the future newsletters.

Also, various activities are involving the participation of our members to the development of project proposals within the EU calls concerning safety and reliability.

From the administrative point of you, it is important that we prepare to a number of important actions this year. One, in particular, is the formalization of the approval of the bylaws of ESRA that had already been voted in the General Assembly meeting during ESREL 2011 in Troyes and, then, professionally refined to respect current legislation concerning our type of association. The successful closure of this necessary procedure is all due to our General Secretary, Coen van Gulijk, to whom goes all the gratitude.

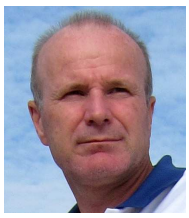
Another action that we have been undertaking is the update of the memberships, and related payments. This is an obviously necessary task that any association should carry out, to guarantee legitimate participation of its members. I urge you to update your situation by proceeding with the membership fee payment for 2014.

Finally, we are undertaking a novel initiative of organizing a workshop dedicated to the young generation of scientists and researchers which will lead our field in the near future. You will read the outcome of this in the next newsletter.

Enrico Zio
Chairman of ESRA

Feature Articles

Reliability of power systems – catastrophic sleet and ice rain in Slovenia 2014



Marko Čepin
Faculty of Electrical Engineering, Slovenia

Introduction

The power systems can be placed among the most complex systems developed by the man kind [1]. They include the power networks with transmission and distribution systems exchanging between the voltage levels at transformer stations, switchyards, the power plants such as nuclear power plants, thermal power plants, hydro power plants, wind power plants, solar power plants and other types of power pants, the protection systems, communication systems and control and management systems [1]. The quantity of generated electric energy has to be adjusted with the quantity of consumed energy for every moment in time considering also at the power losses. One of the first indicators of imbalance between electric energy generation and consumption is the decreased quality of electric energy, where the frequency and/or voltage can deviate from the desired values. The worst case is a loss of power supply to selected consumers or their groups. The worst event that can happen is the blackout, which is an event, where a large territory losses electric power for a larger time.

Sleet caused collapse of power towers

Slovenia faced extreme weather conditions at the end of January and beginning of February in the year 2014, when the sleet and ice rain caused mechanical overload of many power lines at large territory due to extreme weather conditions. The sleet and the ice rain were the heaviest in the history, which has not been remembered being worse even by the oldest inhabitants of the region. The power lines received the weight of sleet which exceeded the design parameters so much that many of the power towers collapsed. The collapsed power towers caused loss of power lines. The collapsed power towers included all voltage levels up to the highest voltage level in Slovenia, which is 400 kV. This means that in addition to the distribution lines, also the transmission lines collapsed. The transmission operator was fully busy to prevent complete blackout, which finally has not happen. But nevertheless, the consequences were terrible. Many roads were blocked at the same time, train lines were damaged. Electric infrastructure of train system was demolished completely. The forests were ruined. Trees have fallen one over another. The situation is even worse because the forests cover a large percentage of Slovenian territory which makes Slovenia as one of three countries with the largest percentage of forests surface in Europe together with Sweden and Finland.

A large territory of Slovenia was cut out of electric power. Many people were without electric power for days. Portable generators were immediately used wherever possible. The international help was appreciated due to the lack of our own portable power generators with many of them borrowed for many weeks from volunteer countries ready to help. In spite of activating portable generators, the most distant villages were cut out of electric power for more than a week.

The consequences have been mitigated with enormous help of firemen, army, police, other rescue units and unselfish volunteers, which worked for days and weeks in the heaviest work conditions to help whatever could be done. Many photos exist, which can be searched on the internet in Slovenian journals and in other materials using the words: “žled” (this means sleet in Slovenian) combined with “Postojna” and “Logatec” which were the most affected cities.
The economic losses are measured in hundredths of millions of Euros and are going to be assessed in due time. Months will be needed to rebuild the power towers and establish the power lines of the 400 kV and 220 kV power systems. The expected repairs of power systems at medium voltage levels are expected to be done earlier at least to some extent.
Reduction of damage in the forests and cleaning of forests is going to last for years, because it is not possible to use more than the existing number of equipped and educated foresters to deal with the damage although their number is going to be increased as much as possible.

Conclusions

The conclusion of looking to this extreme weather event of sleet may be the following. The nature can be wild and the speculations that the extent of catastrophic weather events raise with time may be true. So, the standards connected with building the infrastructure may be strengthened and analyses are needed to find out how the extreme weather events relate with all parameters of spatial planning. The environmental matters may be studied at all technical fields which may be connected with the issue.

Data Analysis of Heavy Haul Locomotive Wheel-sets’ Running Surface Wear at Malmbanan, Sweden

Dr.Jing Lin
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Sweden

Introduction

The service life of the train wheel-sets can be significantly reduced due to failure or damage, leading to excessive cost and accelerated deterioration. One common preventive maintenance strategy is re-profiling wheel-sets after they run a certain distance. Re-profiling affects the wheel-set’s diameter; once the diameter is reduced to a pre-specified length, the wheel-set is replaced by a new one.

To solve the combined problem of small data samples and incomplete datasets whilst simultaneously considering the influence of several covariates, Lin (2013) has explored the influence of locomotive wheel-sets' positioning on reliability using Bayesian reliability inference with Markov Chain Monte Carlo (MCMC). The results indicate that the particular bogie in which the wheel-set is mounted has more influence on its lifetime than does the axle or side it is on. Since 2013, as a continuous study, both the integrated procedure for Bayesian reliability inference using MCMC and other traditional statistical theories (incl., reliability analysis, degradation analysis, Accelerated Life Tests (ALT), Design of Experiments (DOE)) are applied to a number of case studies using heavy haul locomotive wheel-sets' running surface wear data from Iron Ore Line (Malmbanan), Sweden. The research continuously explores the impact of a locomotive wheel-set's installed position on its service lifetime and attempts to predict its reliability related characteristics (Lin, 2014).

Related studies were sponsored by Luleå Railway Research Centre (Järnvägstekniskt Centrum (JVTC), Sweden), LKAB (Swedish Iron Ore Mining Company) and Swedish Transport Administration (Trafikverket) between 2012 and 2014. Results from this research program is aimed to support development maintenance strategies by analysing the information and data of the wheels' running surface wear.

Research approach

In these studies, data used are from January 2010 to May 2013 collected from Iron Ore Line - Malmbanan, Sweden and data analysis is carried out in four parts. In the first part, an integrated model for reliability analysis is developed and tested. In this integrated analysis, Bayesian statistics using MCMC methodologies is applied. In this part, the study also explores the impact of a locomotive wheel's installed position (Figure.1) on its service lifetime and attempts to predict its reliability characteristics by using parametric models, non-parametric models, and frailty factors, etc.

In the second part, comparison analysis for the wheel-sets on two selected locomotives is carried out. Based on the study, it is proposed to integrate the reliability data with both degradation data and re-profiling performance data. The case study also includes: 1) degradation analysis using a Weibull frailty model; 2) work orders for re-profiling; 3) the performance of re-profiling parameter; and 4) wear rates. In the third part, data are collected from two specific locomotives at Malmbanan. The corresponding case study undertakes a reliability analysis using both classical and Bayesian semi-parametric frameworks to explore the impact of a locomotive wheel's position on its service lifetime and to predict its other reliability characteristics. Results are used to illustrate how the wheel-sets' running surface wear data can be modelled and analysed using classical and Bayesian approaches to flexibly determine their reliability. In the fourth part, a holistic study is developed by analysing group data from 26 locomotives and 57 bogies at Malmbanan. In this part, data analysis is carried out from both the locomotives and the bogies' perspective (Figure 2 & Table 1). The results suggest that Malmbanan should consider the wheel-sets' data from both the locomotives' and the bogies' point of view. Next, wheel-sets' running surface wear data from a group of 16 bogies' are studied as a whole. More holistic results are drawn from both degradation and wear rate analysis. The report concludes by proposing some recommendations for future research into locomotive wheel-sets' running surface wear data analysis and suggesting some maintenance strategies for Malmbanan.

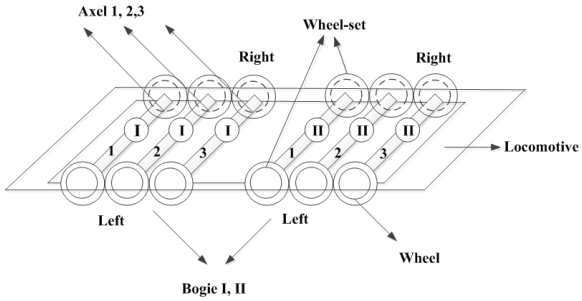

Fig.1 Wheel positions specified in this study

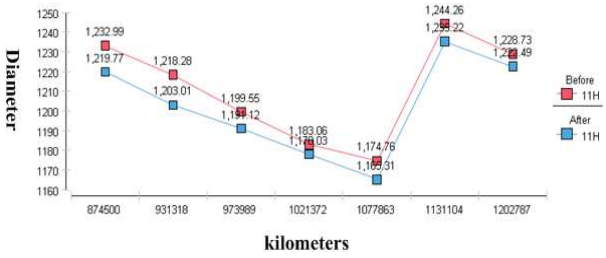

Figure 2 One Example: Re-profiling history by locomotive and operating distance
(one wheel installed in one locomotive 3, bogie I, axel 1 on the right side)

Bogie number	IORBOG195902	Axel	1	Side	H					
Installed Locomotive	111					Total/Average			102	Total/Average
Installed position (Bogie)	2								1	
Wheel Life Cycle NO.	1								2	
WO reported times in each life cycle	0	1	2	3				1*	2	
Reported Date (Installed* & reprofiled)/ year, month		201010	201201	201204				201207	201302	
Reported kilometers /1000km		90,767	135,333	162,965		72,198		184,873	231,588	
Absolut kilometers /1000km		0	44,566	27,632		72,198		0	46,715	
Diameters (before)/mm		1233,67	1205,41	1182		/		1	1245,25	
Diameters (after)/mm		1210,88	1165,3	1154,22		/			1238,35	
re-profiling Amount/mm		22,79	40,11	7,78		70,68	47,89		6,9	
Natural Wear/mm		0	5,47	3,3		8,77	8,77		0	
Total Wear/mm		22,79	45,58	11,08		79,45	56,66		6,9	
re-profiling Amount %		1	0,88	0,702		0,89	0,845		1	
Natural Wear Amount %		0	0,12	0,298		0,11	0,155		0	
WearSpeed_re-profiling/1000km		/	0,9	0,282		0,979	0,663		0,148	
WearSpeed_Natural/1000km		/	0,123	0,119		0,121	0,121		0	
WearSpeed_Total/1000km		/	1,023	0,401		1,1	0,783		0,148	

Table 1: An example of data preparation for bogie no. IORBOG 195902

Conclusions

The proposed integrated procedure *(1st part)* has built a full framework for related academic research and engineering applications to implement modern computational-based Bayesian approaches, especially for reliability inference. The parametric Bayesian models, non-parametric Bayesian models, frailty models are all useful tools. The case studies' results

reveal that, the wheel-sets' lifetimes differ according to where they are installed on the locomotive. In the comparison study *(2nd part)*, we reach the following conclusion: 1) rolling contact fatigue (RCF) is the main type of re-profiling work order; 2) the re-profiling parameters can be applied to monitor both the wear rate and the re-profiling loss; 3) the total wear of the wheel-sets can be determined by investigating natural wear and/or loss of wheel diameter through re-profiling loss, but these differ across locomotives and under different operating conditions; 4) the bogie in which a wheel is installed is a key factor in assessing the wheel's reliability. *(3rd part)*Traditional statistical theories (incl., ALT, DOE) are also useful tools for exploring the impact of the locomotive wheel-sets' installed position on their service lifetime and for attempting to predict the reliability related characteristics. The holistic study *(4th part)* using data from 26 locomotives and 57 bogies at Malmbanan shows that Malmbanan should consider the wheel-set data not only from the locomotives' but also from the bogies' point of view. For the studied group, a linear degradation path is more suitable; following the linear degradation, the best life distribution is a 3-parameter Weibull distribution; comparing the wear data of the wheel-sets' running surfaces (including total wear rate, natural wear rate, re-profiling wear rate, the ratio of re-profiling and natural wear) is an effective way to optimise maintenance strategy decision making. The results of the case studies show natural wear occurs for the wheels installed in axel 1 and axel 3; this supports findings in related studies at Malmbanan. In addition, all case studies' results reveal that, the wheel-sets' lifetimes differ according to where they are installed on the locomotive. The differences could be influenced by such factors as the operating environment (e.g., climate, topography, track geometry), configuration of the suspension, status of the bogies and spring systems, operating speeds and applied loads, as well as human influences (drivers' operations, maintenance policies, lathe operators etc.).

References

- Lin J, Using Integrated Reliability Analysis to Optimise Maintenance Strategies – A Bayesian Integrated Reliability Analysis of Locomotive Wheels. Research Report. Published by: Luleå University of Technology. ISSN: 1402-1528; ISBN: 978-91-7439-600-3 (tryckt); ISBN: 978-91-7439-600-3 (pdf). 2013

- Lin J, Data Analysis of Heavy Haul Locomotive Wheel-sets' Running Surface Wear at Malmbanan. Research Report. Published by: Luleå University of Technology. ISSN: 1402-1528; ISBN: 978-91-7439-898-4 (tryckt); ISBN: 978-91-7439-899-1 (pdf). 2014

PhD Degrees Completed

Ageing management and life extension of technical systems. Concepts and methods applied to oil and gas facilities

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Co-supervisors: Dr. Tom Anders Thorstensen and Prof. Stein Ove Erikstad.

The oil and gas (O&G) industry is becoming increasingly interested in prolonging the operation of some facilities beyond their original design lifetime. The main challenge when extending the life of an ageing facility is to achieve a longer period of economic benefit while ensuring that safety and integrity are kept within acceptable levels. Key factors to consider are physical deterioration, operation, and maintenance of the facility, although less obvious factors may also have an important impact on safety, such as obsolescence of equipment and changes in the organisation.

The main purpose of this PhD thesis is to improve the current understanding and knowledge regarding how to manage the ageing of these O&G facilities, and what measures can be taken to extend their life. The research work is directed towards physical ageing (e.g., deterioration and maintenance) of technical systems and components installed in O&G facilities, and hence structures are not explicitly considered. However, some of the methods and approaches developed in this research can be applied to structures, and to other areas relevant for the management of ageing (e.g., obsolescence and organisational issues).

The work presented in this thesis reviews current methods and approaches used for modelling, managing, and extending the life of ageing systems. The research identifies the main challenges the O&G industry must face currently to achieve an effective management of ageing, and proposes a methodology for facilitating the implementation of ageing management and life extension assessments into existing O&G facilities. Another important issue when extending the lifetime of ageing systems is the decision making process, whose main objective is to find feasible alternatives and provide clear information to the decision maker in order to select the best one. This PhD work identifies relevant factors influencing the decision making process, and develops models and methods for assessing and selecting optimal alternatives under uncertainty.

The main contributions of this thesis are:

- Providing an overview of knowledge gaps and challenges for achieving an effective management of physical ageing and life extension in the O&G industry.

- Proposing a systematic and holistic approach based on systems engineering and information models with two main applications: (i) analysing gaps in existing O&G facilities for addressing the management of ageing; and (ii) implementing in an effective manner new procedures and methods for ageing management and life extension assessment.

- Identification of factors that influence the physical ageing and performance of technical systems, which are relevant for the decision making process.

- Development of three probabilistic models for decision making support under uncertainty:

1. A Bayesian network for assessing the technical condition and remaining useful life of ageing repairable systems.
2. A virtual age model for life extension assessment of ageing repairable systems.
3. A dynamic Bayesian network for life extension assessment of ageing repairable systems.

The thesis and articles present the new models and methods developed throughout the research, describe the steps needed to build and use them, and include detailed case studies with examples of application to real O&G systems. The case studies illustrate how the outputs and results obtained with these models can be used for improving the management of ageing and the assessment of life extension possibilities. Finally, the thesis summarises the work performed and results obtained, and proposes further research related to the management and life extension of ageing systems.

Past Safety and Reliability Events

University of Stavanger, Norway
Workshop 20 February 2014
Black Swans
Improved understanding, assessment and management of risk and the unforeseen

Terje Aven
University of Stavanger, Norway

20 February this year a workshop on black swan risk was held at University of Stavanger Norway. The concept of black swan has gained a lot of attention recently and is a hot topic in many forums that discuss safety and risk. Also in the scientific community it has been focused in the aftermath of Nassib Taleb's best-selling book The Black Swan (2007). The workshop addressed a number of issues linked to the challenge of conceptualising black swan type of risk, and how to confront it (assess and manage it). Some of the issues addressed were:

- How important is it to improve our hazard/threat identification methods?
- What type of improvements can be made?
- Can the use of alternative uncertainty representations add something to the analysis?
- Can signals and warnings be used to improve our assessment?
- Can red-team approaches be used? Scenario analyses? How?
- To what extent are robustness and resilience the answer to meet black swans?
- What does Taleb's antifragile concept add to this?
- Does risk assessment have a role to play at all in cases of deep uncertainties?

Can we draw insights from other areas, like High Reliability Organisations (HROs), with its five characteristics: preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience and deference to expertise?
About 80 people attended the workshop, most participants coming from the oil and gas industry. The workshop was the first in a series of seminars and conferences to be organised by the Black swan project, funded by the Norwegian Research Council and the oil and gas industry. The main aim of this project is to develop concepts, principles, approaches and methods for the proper understanding and assessment of risk, in particular major accident risk, for the Norwegian petroleum activities, that gives due attention to the knowledge dimension and surprises (black swans).

Prepared reflections on the topic were held by Terje Aven (Norway), Andrew Stirling (UK), Ortwin Renn (Germany), Enrico Zio (Italy, France), Seth Guikema (USA), Kjell Sandve (Norway), Malene Sandøy (Norway), Carsten Busch (Norway) and Ullrika Sahlin (Sweden).

Examples of black swan type of events and near black swan events were presented and discussed, both from the oil and gas industry and the public sector. Aven distinguished between three types of black swan type of events: unknown unknowns (a), unknown knowns (b) (events known to some but not others) and known events which are not believed to occur because of low judged probability (c) (all events having extreme consequences). He pointed to the fact that knowledge

is the key to meet all these types of risk, and that this justifies further work on improving the practice of risk analysis as a main goal of risk analysis is to strengthening the knowledge dimension. It is however necessary to see beyond the current probability-based approach to risk and give stronger weight to the strength of knowledge that these probability judgments are based on, as well as the potential for surprises relative to the existing explanations and beliefs. How to best do this is a huge research challenge and is one of the key tasks of the Black swan project. Aven outlined some possible directions for the research, linked to inter alia hazard/threat identification methods based on creative thinking, red teaming and scenario analyses, and approaches integrating signals and warnings, adaptive analysis, ideas of the collective mindfulness concept, and robustness & resilience principles.

Andrew Stirling highlighted the importance of the precautionary principle in relation to black swan types of risk: uncertainty requires deliberation about action; deliberation produces more robust knowledge than probabilistic analysis - there is a need for seeing beyond the "science-based" approaches. As a basis for his discussion on how to confront black swans he used a model for structuring risk problems, having four main categories, depending on the two dimensions (axes) knowledge about likelihoods and knowledge about possibilities. The term incertitude is used to reflect the degree of problematic "scores" for these two dimensions - black swans we may experience for cases of moderate and high incertitude. Stirling concluded his reflections by providing some specific comments to the nine issues mentioned above.

Ortwin Renn pointed also to three different types of black swans; (1) the tail ends of a normal distribution (low probability or dependent probabilities); (2) events linked to problems in knowledge and lack of transfer of knowledge (asymmetry of knowledge distribution) and (3) unique events for which there is no historical record for a re-occuring patterns. These three types of black swans demand different and tailored methods of assessment and management. Tail ends phenomena need better assessment methods to characterize and evaluate rare events beyond the two or three standard deviation integral. Asymmetry of knowledge demands better methods to monitor knowledge, access new sources of knowledge and decrease communication hierarchies. Finally, unique events cannot be calculated or assessed but systems may vary to the probability that they can get under stress from unique events. Geological formations may not be very vulnerable, stock markets are probably highly vulnerable. The more vulnerable a system is the more important are management preparations to increase resilience. Vulnerable systems need to be enhanced so that they can sustain their functionality even when they are stressed by unknown events. However, this requires a delicate balance between resilience and efficiency. He underlined that highly efficient systems are usually not resilient. As Stirling he concluded that to make appropriate decisions there is a need for broad value judgments where due weight is given to the uncertainties.

Enrico Zio focused in his talk on complex socio-technical systems operating in an uncertain environment and the use of both deterministic and probabilistic safety assessment (DSA&PSA). His point of departure was that unknown plant vulnerabilities are left unknown in traditional DSA and PSA. Zio reviewed and discussed this challenge in relation to two basic different approaches to safety managment:
Safety I: Anticipation by explanation. The future can be described as a (re) combination of past events and conditions that have been problematic. It is possible to predict and calculate future risk events.
Safety II: Anticipation by imagination. The future has not been seen before. It involves a combination of known performance variability that usually is seen as irrelevant for safety (signals, precursors).

Seth Guikema discussed the use of historical data and related data-driven models in relation to risk and black swans. He underlined that historical data cannot identify black swans of the unknown unknown type (c), but they are still essential for the management of the black swan risk. Data-driven models can identify relationships between system response and hazard inputs. A strongly-validated, data-driven model can help understand the potential for Black Swan types of events if the initiating drivers can be imagined. Guikema also discussed the use of decision-focused, robust risk management planning. The idea is to generate a suitable set of scenarios, assess them using some performance model, and then select alternatives to maximize robustness and flexibility. Then one selects some new creative alternatives and monitor for signals and warnings – make some decision on alternatives and repeat the process.

Kjell Sandve and Malene Sandøy discussed some challenges related to the use of quantitative risk analysis (QRA). They highlighted that these assessments are often used as direct input to the decision-making, without proper reflections on the limitations of the tool producing the QRA results. The analysis is to some degree a black box, the result being that important decisions are in practice taken by technical experts (consultants). To meet this challenge there is a need for research that can bridge the gap between the management and the technical content of the analysis, for example the development of some type of overall assessment based on broad organizational discussions and participations. This type of assessment is seen as an interesting topic for the Black swan project.

Carsten Busch gave an example of a type of black swan event of type c) – judged so unlikely that it is not believed to occur – and discussed various means to confront this type of risk, including measures improving the robustness, resilience and antifragility. His summary of the workshop is available at http://heach.blogspot.no/2014/02/black-swan-workshop-20-february-2014.html

Ullrika Sahlin drew a line from traditional statistics, via Bayesian analysis to the challenge faced in the project requiring a broader risk perspective which is better able to reflect the knowledge dimension and the unforseen. Inspiration on how to deal with Black swans can be found in climate and environmental management type of problems, in which evidence-based decision making is confronted by the need to evaluate qualitative aspects of knowledge and the knowledge producing process per se, under multiple sometimes conflicting decision objectives.

At the end of the workshop Aven reported what is coming next. He highlighted that different cases and decision-making situations will be studied, and that the project group will decide on which research directions to pursue in the near future. A follow-up workshop/conference is planned next year, where the ambition is to present some initial research results.

Fostering current practices to a new generation approach dealing with Domino Effects in the Process Industries

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An expert workshop on domino effect assessment was organized in Bologna on April 16th and 17th, 2014 with the contribution of ESRA. The workshop had the aim of tracking and discussing the state-of-the-art on the assessment and management of domino scenarios in the process industry and in the transportation sector.

It is well-known that escalation events or so-called domino effects may cause the more severe accident scenarios in the chemical and process industries. A relevant research effort was invested on the subject in the last 15 years. However, due to the difficulties in both the technical assessment and the organizational management of accident escalation and propagation with respect to time and space, but also due to the extremely low frequency of such accidents, and to the increasing complexity of industrial facilities, adequate and efficient methods to deal with domino scenarios are still an open research problem. The workshop aimed to spread relevant safety and reliability knowledge with respect to domino effects. Three main objectives of the workshop are worth to be mentioned: defining the state-of-the-art of tools for the assessment of domino effects, discussing the current industrial management practices to deal with domino effects, and identifying further research needs.

The workshop promoted a discussion with academia, industrial stakeholders, control authorities and software owners. By doing so, the way was paved to the further implementation of consolidated research results in current practice.

In the first session, the state of the art was framed, evidencing the open issues, mainly in the correct identification of domino scenarios, in the assessment of frequencies where relevant progress is expected by improved models and approaches, and in the management of domino scenarios, where the application of modern approaches, as game theory, is expected to play a relevant role in the more effective management of external domino effects. Finally, the importance of domino effect assessment in the field of the transportation of hazardous substances was also evidenced.

In the second session, industry needs were pointed out. The need of a precise and noncontroversial definition of what is intended as a domino effect was discussed. The importance of developing consolidated approaches at different levels of complexity (thresholds and/or separation distances, simplified damage models, CFD and FEM tools) was also mentioned. The importance of procedures and design details that may cope with an inherent safety approach, for the prevention of escalation scenarios was also proven.

The third session concerned the exchange of viewpoints on the potential progress that may come from new approaches to domino assessment. The introduction of dynamic assessment based on Bayesian Belief Networks and by their integration with safety barrier performance assessment was pinpointed as a promising approach for a more robust assessment of escalation expected frequencies. The need of extending domino assessment to natural events as triggering scenario (NaTech) was also shown.

In the fourth session, the potentialities of several different software tools in the assessment of domino effect were illustrated and debated. Although no specific comprehensive tool is yet available for domino effect assessment, several software suites may provide tools allowing the assessment of specific aspects related to escalation possibility, probability or consequences.

In the final discussion, the analysis of further needs, also in the light of progress in advanced assessment techniques as dynamic risk assessment, was analyzed to identify shared research drivers for further scientific progress on the subject.

Besides the participation of experts from several countries, several Ph.D. students that are developing their thesis on the subject received a financial support

from ESRA in order to participate in the workshop. As a follow-up, a special issue collecting original research contributions on the subject will be prepared and published in a Special Issue of Reliability Engineering and System Safety on the exciting topic of domino effects in the process industries.

The slides of presentations given at the workshop may be downloaded at the following address: [http://www. .... still to be set]

Calendar of Safety and Reliability Events

7th International Conference on Pervasive Technologies Related to Assistive Environments (Petra 2014)

Rhodes Island, Greece
27-30 May, 2014

The 7th International Conference on PErvasive Technologies Related to Assistive Environments is organized by the University of Texas at Arlington, USA.

The workshop title is "Assistive Technologies For Safe Operation Of Complex Technological Systems Including Industrial Sites, Shipping, Off-Shore Platforms And Mining Activities".
This workshop will include papers/presentations on: a) Technologies that monitor normal and emergency conditions in complex systems, b)recognition of critical system parameters, c) operators training systems, d) human and environmental risk assessment tools, e) computer aided systems on emergency response and rescue, d) depiction of human factors involved in safe operation, f) IT methodologies for the siting of hazardous installations, g) tools for the communication of risk, h) aiding of competent authorities in applying legal aspects and any other related to the above topic.

Topics in this workshop include: Technologies to monitor normal and emergency conditions in these systems, training systems, human and environmental risk assessment, emergency response and rescue systems, human factors involved in safe operation, siting of hazardous installations, communication of risk, legal aspects and many other related topics.

Important dates

Abstract Submission Deadline extended: **February 20, 2014**

March 20, 2014 - Paper Submission Deadline
April 06, 2014 - Paper Acceptance Notification
April 20, 2014 - Camera Ready Paper Deadline

Submission Information

Abstracts of 500 words are due for Feb. 10. Please email abstracts to Dr. Zoe Nivolianitou (zoe[at]ipta.demokritos.gr).

Submissions are to be done through the workshop's submissions page.

33rd International Conference on Offshore Mechanics and Arctic Engineering (OMAE 2014) Structures Safety and Reliability Symposium

San Francisco,CA,USA
8-13 June, 2014

Coordinator: Carlos Guedes Soares

Important dates

September 30, 2013 - Abstract Submission
October 21, 2013 - Abstract Acceptance
January 6, 2014 – Submission of Full-Length draft paper to review
January 27, 2014 – Notification of Paper Acceptance
March 16, 2014 – Submission of Final Paper

Conference Website: http://www.omae2014.com

12th International Probabilistic Safety Assesment and Management Conference - PSAM 2014

Honolulu, Hawaii
22-27 June, 2014

The PSAM conference brings experts from various industries, research organizations, regulatory authorities and universities in the fields of nuclear, process and chemical industries, off-shore and marine, transportation, space and aviation, IT and telecommunications, bio and medical technology, civil engineering, financial management and other fields. The multi-disciplinary conference is aimed to cross-fertilize methods, technologies and ideas for the benefit of all.

Important dates

February 27, 2014 – Online Registration Open
March14, 2014 – Full Paper Submission Deadline
April 30, 2014 - Speaker's Bio Submission Deadline

Secretariat
Dr. Todd Pauloos
Email: secretariat@psam12.org

Conference Website: http://www.psam12.org

10th International Conference on Digital Technologies 2014

Zilina – Slovak Republic
9-11 July, 2014

The Tenth International Conference DT 2014 is the annual event that is held in Žilina traditionally. 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. The conference makes is focused on a wide range of applications of computer systems. Topics of interest include:

- Reliability analysis and risk estimation
- Testing and fault-tolerant systems
- Accident and incident investigation
- Human factor
- Risk and hazard analysis
- Software reliability

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

- International Workshop on Biomedical Technologies
- International Workshop on Reliability Technologies

Important dates

31 March, 2014 - Full paper submission
5 May, 2014 - Paper acceptance notification
30 May, 2014 - Camera-ready papers
30 June, 2014 - Final program

All submitted papers will be reviewed by Program Committee members. Accepted papers will be published in conference proceedings (CD-version under an ISBN reference).

Secretariat

DT'2014 Organizing Committee
Department of Informatics / University of Zilina
Univerzitna 1, 01026, Zilina, Slovakia
dt@fri.uniza.sk

Conference Website: http://dt.fri.uniza.sk

23rd International Conference Nuclear Energy for New Europe

Portorož, Slovenia,
September 8-11, 2014

Coordinator: Igor Jencic

Important dates

April 30, 2014 - Abstract Submission
June 21, 2014 - Abstract Acceptance
August, 2014 – Submission of Full-Length paper

Conference Website: http://www.nss.si/nene2014

24th European Safety and Reliability Conference - ESREL 2014

Wroclaw, Poland
14-18 September, 2014

The XXIV edition of the conference, ESREL 2014 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 2014 will also be an opportunity for researchers and practitioners, academics and engineers to meet, exchange ideas and gain insight from each other.

The conference will be hosted by the Congress Centre at the Wrocław University of Technology.

Important dates

26 January, 2014 – Submission of abstracts
31March, 2014 – Submission of full length papers
30 May, 2014 – Early bird registration

Secretariat

Wrocław University of Technology
27 Wybrzeże Wyspiańskiego St.
50-370 Wrocław
Poland
Phone: +48 71 320 2817
Phone: +48 71 320 3817
Fax: +48 71 328 2546
Mail: info@esrel2014.org

Conference Website: http://www.esrel2014.org

7th International Conference Workingonsafety.net Learning from the past to shape a safer future

Scotland, UK,
30 September – 03 October 2014

Workingonsafety.net is an international network of decision-makers, researchers and professionals responsible for the prevention of accidents at work. The network attracts researchers, regulators, inspection bodies, safety professionals and other experts in this field of research and policy-making. It consists of an Internet platform (www.workingonsafety.net) and a biennial conference).

The organizing committee of the 7th conference invite to Scotland, United Kingdom. The hosting organization is the Institution of Occupational Safety and Health (IOSH), based in Leicestershire, England. Abstracts should be submitted electronically through the conference website, www.wos2014.net.

Important dates

January 31, 2014 – Abstract Submission
Mid March, 2014 - Notification of Acceptance
June 15, 2014 - Full Paper Submission and end of early registration
August 31, 2014 – Deadline for the receipt of presentations

Secretariat
WOS Administrative Secretariat and National Organising Committee
Institution of Occupational Safety and Health
The Grange, Highfield Drive, Wigston, Leicestershire LE18 1NN, UK
Tel: +44 (0) 116 257 3378
mail: info@wos2014.net

Conference Website: www.wos2014.net

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
- Institute "Jozef Stefan", 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
- LuleåUniversity, 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

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Politecnico di Milano, Italy
Ecole Centrale Paris, Supelec

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Treasurer
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NCSR Demokritos Institute, Greece

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

Technological Sectors

4.1 Aeronautics Aerospace
Chairman: Darren Prescott, UK
E-mail: d.r.prescott@lboro.ac.uk

4.2 Critical Infrastructures
Chairman: G. Sansavini, Italy
E-mail: Giovanni.Sansavini@mail.polimi.it

4.3 Energy
Chairman: Kurt Petersen, Sweden
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4.4 Information Technology and Telecommunications
Chairman: Elena Zaitseva, Slovakia
E-mail: Elena.Zaitseva@fri.uniza.sk

4.5 Nuclear Industry
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E-mail: smartore@iqn.upv.es

4.6 Safety in the Chemical Industry
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Email: Michalis.Christou@jrc.ec.europa.eu

4.7 Land Transportation
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4.8 Maritime Transportation
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E-mail: J.Wang@ljmu.ac.uk

4.9 Natural Hazards
Chairman: P. van Gelder, The Netherlands
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Methodologies

4.10 Accident and Incident Modelling
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Email: stig.o.johnsen@sintef.no

4.11 Prognostics & System Health Management
Chairman:Piero Baraldi, Italy
E-mail: Piero.baraldi@polimi.it

4.12 Foundational Issues in Risk Assessment & Management
Chairmen: Terje Aven, Norway & Enrico Zio, Italy
E-mail: terje.aven@uis.no; enrico.zio@polimi.it

4.13 Human Factors and Human Reliability
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4.14 Maintenance Modelling and Applications
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Email: christophe.berenguer@utt.fr

4.15 Mathematical Methods in Reliability and Safety
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4.16 Quantitative Risk Assessment
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E-mail: marko.cepin@fe.uni-lj.si

4.17 Systems Reliability
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4.18 Uncertainty Analysis
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4.19 Safety in Civil Engineering
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4.21 Occupational Safety
Chairman: Ben Ale, The Netherlands
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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@tudelft.nl.
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