European Safety and Reliability Association

Newsletter

http://www.esrahomepage.org June 2016

Editorial

Terje Aven
ESRA Chairman
University of Stavanger, Norway

Dear ESRA Colleagues,

The program for ESREL 2016 has now been released and for sure this will be an interesting conference with many stimulating talks and discussions, covering a broad spectre of topics related to safety, risk and reliability; with generic contributions as well as more applied work. In addition to the plenary speeches, I would like to draw attention to the ninety minute keynote tutorials, for those wishing to learn more about specific topics: "Reliability Assessment of Complex Systems" by Antoine Rauzy, "Cyber Security for High-Reliability, Safety Critical Systems" by Chris Johnston, "Uncertainty Quantification and Global Sensitivity Analysis: an introduction" by Emanuele Borgonovo and "Demystifying Human Performance Modelling: An Absolute Beginner's Guide to Dynamic Human Reliability Analysis" by Ron Boring.

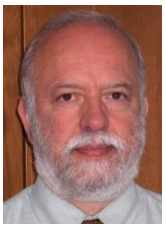
A special plenary ESRA session is also provided at the end of the conference: informal Question & Answer session on methodological and practical issues of broad interest regarding Safety and Reliability, led by the former and the current ESRA Chairman. Your questions will be distributed to experts from the ESRA Technical Committees for competent responses. Questions and answers will be read and discussed interactively during the session. For further details, see our new ESRA website (esrahomepage.eu) which has now be launched.

An email is sent out to all ESRA members and ESREL conference participants, with invitation to get in contact with one or more of ESRA's 27 Technical Committees (TCs). When registered you will be informed by the Chairs of the TCs on relevant activities, and how you can be involved in these if you are interested. See the website (esrahomepage.eu) for further information.

The second ESRA webinar was held 14 June 2016 (titled Challenges and opportunities in reliability engineering: the big KID (Knowledge, Information and Data), with Professor Enrico Zio as presenter. It was indeed stimulating and if you missed it, you can find a recorded video of it on the ESRA website. The next webinar will be hold by Professor Michael Beer on uncertainty treatment. An announcement will soon be released.

See you soon in Glasgow 25-29 September.

Editorial



Carlos Guedes Soares
ESRA Newsletter Editor
Instituto Superior Técnico,
Universidade de Lisboa

The ESRA Newsletter has been published for a number of years now. It started in 2002 and at that stage it was only possible to produce 2 per year. In 2012 an improvement in frequency has been possible and since then it has been produced 4 times per year, which is felt to be the right compromise to keep a regular flow of information and not to overload contributors and readers with excessive material.

One of the strong supports of the Newsletter has been its Editorial Board, which has in principle one person from each of the relevant countries from its membership. The role of the Editorial Board members are to collect news and feature articles for the Newsletter, eventually writing themselves some of the news from their countries.

The other strong support has been the ESRA Technical Committees that have contributed with several of the feature articles included in the Newsletter. There is however scope for improvement in this area, which would very much help to keep a timely production of the Newsletter. If each Technical Committee would take the responsibility to produce one feature article (1-2 pages) per year there would always be material ready for the Newsletter to be produced, avoiding some delays that occur unfortunately more often than desired. So here I leave my invitation and challenge to the Technical Committees.

After several years without changing the Editorial Board we have now a significant change bring a group of younger members to substitute the more experienced one and to keep the Newsletter activity alive. There are 5 Board members that retire now and 6 new members joining. I would like to extend my thanks for the outgoing members for their support during the years and to wish the new ones good luck in their activities to mobilise ESRA members to contribute to the Newsletter.

PhD Degrees Completed

Foundational issues in risk analysis and risk management: Advancements in the treatment of model uncertainty and deep uncertainty

Torbjørn Bjerga
University of Stavanger, Norway
Supervisors: Prof. Terje Aven
Co-supervisor: Roger Flage

On 11th of May, 2016 Torbjørn Bjerga presented and defended successfully his PhD thesis titled Foundational issues in risk analysis and risk management: Advancements in the treatment of model uncertainty and deep uncertainty, at the University of Stavanger, Norway. The members of the judging committee were Associate Professor Enrique Lopez Droguett (main opponent), University of Chile, Dr. Ullrika Sahlin (opponent), Lund University, Sweden, and Professor Eirik Abrahamsen (administrator), University of Stavanger. Torbjørn has been supervised by Professor Terje Aven, with Associate Professor Roger Flage as co-supervisor. He also visited Professor Enrico Zio and his research team at Ecole Centrale Paris for three months during the Spring of 2014.

The thesis mainly addresses the treatment of model uncertainty and deep uncertainty - two foundational issues in risk analysis and risk management[1] that are relevant for many applications and industries, for example the oil and gas industry.

Deep uncertainty is referring to cases where there is a poor knowledge base - little relevant data, shaky assumptions, poor phenomenological understanding, experts not in consensus, potential for surprises - and accurate prediction models cannot be established. Deep uncertainty cases may include complex offshore drilling operations, operations of highly intertwined infrastructure, and how to prepare for potential terrorist attacks. Also, the poor knowledge base means that probabilities are hard to justify. Hence, traditional risk perspectives based on probabilities are not very suitable for dealing with deep uncertainty cases. It is a major challenge for risk analysts and managers how to deal with the deep uncertainty cases.

One approach commonly advocated is adaptive risk management, and one contribution in the thesis is to do adaptive risk management using the new risk perspectives. A key thinking in the new perspectives is to separate between the concept of risk and how to measure it, and that uncertainty is a main component of risk[2]. This thinking opens up to approaches other than purely probability based, and in the thesis, some different ways are used, also qualitative ones.

A second deep uncertainty contribution concerns the relationship between risk analysts and the managers. From a manager's perspective: what should the risk analyst provide so that the deep uncertainty challenges, with poor knowledge and the potential for surprises, is better incorporated into the decision-making process? A new request form for that very purpose is presented in the thesis.

Complex systems are cases were accurate prediction models are hard to establish. One key issue being interdependencies not being sufficiently accounted for. Traditional risk analysis tools such as event chain models suffer from these insufficiencies. However, there are methods and models being developed that aim to address the complexity issues. In the thesis, the Functional Resonance Analysis Method (FRAM) and the System-Theoretic Accident Model (STAMP) approach are discussed. The thesis argues that these approaches would provide better decision support if being combined with tools to better describe uncertainties and the potential for surprises.

Even though it can be difficult to establish accurate prediction models for deep uncertainty cases, models are commonly used in risk assessments, typically of the types logical, physical or probabilistic. A model is a simplified representation of reality, and it comes natural to ask how 'good' the model actually is. It is common to refer to model uncertainty and (model) completeness uncertainty, but there are different ideas on what is meant by these terms and how to treat them. In the thesis a conceptual framework by Aven and Zio[3], which tries to clear up certain aspects concerning model uncertainty, is illustrated in use. New ways of describing model uncertainties, both quantitative and qualitative are tried out and evaluated. The thesis also argues that the new framework covers, and makes obsolete, completeness uncertainty, a category found in a common epistemic uncertainty classification system.

The thesis is obtainable in pdf-format by sending a request to: *torbjorn.bjerga@uis.no*.

References:
1. Aven T and Zio E. Foundational issues in risk assessment and risk management. Risk Analysis, 2014, 34.7: 1164-1172
2. Society for Risk Analysis. Glossary. Retrieved August 3, 2016 from http://www.sra.org/resources
3. Aven T and Zio E. Model output uncertainty in risk assessment. International Journal of Performability Engineering, 2013, 9.5: 475-486.

Development of Data-Driven Methods for Prognostics and Health Management under Variable Operational Conditions in Industrial Equipment

Sameer Al-Dahidi
Politecnico di Milano, Italy
Supervisors: Dr. Francesco Di Maio and Prof. Enrico Zio
Co-supervisor: Prof. Piero Baraldi

Prognostics and Health Management (PHM) is a field of research and application aiming at detecting the degradation onset of industrial equipment, diagnosing its faults, predicting its failure time and proactively managing its maintenance to avoid shutdown by means of fault detection, fault diagnostics and fault prognostics systems, respectively (refer to *Figure 1*). PHM relies on diverse sources of information collected through sensors placed on the equipment representative of the equipment behaviour (e.g., vibration) and of the operational conditions the equipment is subjected to (e.g., temperature) that affect the equipment behaviour information.

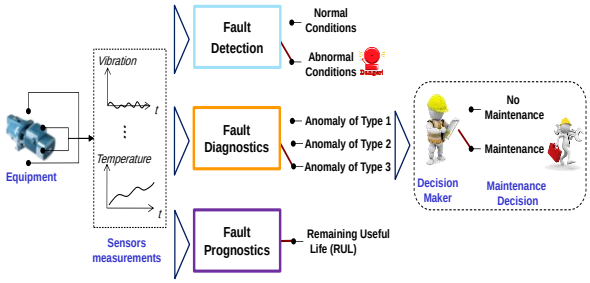


Figure 1: PHM systems.

This PhD work addresses the challenges that fault detection, fault diagnostics and fault prognostics systems development faces when dealing with industrial equipment working under variable operational conditions. In this work, novel computational methods are proposed to address the detection of incipient faults, the diagnostics of their causes and the prognostics of the available time to undertake effective countermeasures on an equipment working under variable operational conditions.

Firstly, a method is proposed for quantifying and controlling the uncertainty affecting the performance of a fault detection system due to the variable operational conditions experienced by an equipment during its life, based on the offline estimation of Prediction Intervals (PIs) with a predefined confidence level by using Order Statistics (OS) theory. PIs are, then, exploited within an online non-parametric, sequential decision strategy to assess whether the equipment is working in normal or abnormal conditions irrespective of the actual operational conditions. This method will be shown to overcome traditional auto-associative approaches when dealing with fault detection under variable operational conditions, for example during transients affected by large process uncertainty.

Once an abnormal condition is detected, a fault diagnostics system is generally used to identify the causes of the occurred abnormality. This is traditionally done by partitioning the collected data into dissimilar groups (whose number is generally "a priori" unknown, that makes the problem unsupervised) and, then, among these, identifying the characteristics of the different groups of behavior. To this aim, an unsupervised ensemble clustering method is developed for identifying the characteristics of the equipment behaviour under different operational conditions that can be provided to the diagnosis system as an adjuvant information that may enhance the characterization of the causes of degradation process that leads the equipment towards failure.

Finally, the benefit of utilizing the information collected on an heterogeneous fleet of equipment experiencing different operational conditions is shown on the performances of both fault diagnostics and fault prognostics systems. With respect to the former, a framework of analysis is proposed that capitalizes all the available information of the fleet by incrementally learning different equipment behaviours and operational conditions of the fleet, without forgetting the previously learnt knowledge. With respect to the latter, a method based on an Homogeneous Discrete-Time Finite-State Semi-Markov Model is proposed to model the degradation process and, correspondingly, estimating the Remaining Useful Life (RUL) of an equipment of a fleet, whose operational conditions are fundamental to characterize the states describing the process.

The effectiveness of the proposed fault detection approach is demonstrated on real industrial case concerning 27 shut-down transients of a Nuclear Power Plant (NPP) turbine, whereas the proposed fault diagnostics approaches are applied to a fleet of two NPPs turbines of 149 and 116 shut-down transients. Finally, the applicability of the proposed fault prognostics approach is shown on two case studies regarding an heterogeneous fleet of aluminium electrolytic capacitors used in electrical automotive industry and an heterogeneous fleet of turbofan engines used in aircraft industry.

Results show that, in case of industrial equipment working under variable operational conditions, the proposed PHM methods allow obtaining more accurate, robust and precise detection, diagnostics and prognostics results than with traditional PHM approaches.

The use of diffusion process for deterioration modeling, condition-based maintenance and prognosis

Houda Ghamlouch defended her Ph.D. degree with honors in Troyes University of Technology, in the field of reliability engineering, data analysis and applied statistics. Her thesis was supervised by Mitra Fouladiradand Antoine Grall from Troyes University of Technology (UTT)

The PhD was supported by the Regional Council of Champagne-Ardenne (RCCA) and the European Regional Development Fund (ERDF) in the framework of RISK PERFOM project. The main aim of the project was to adopt advanced methods used in financial domain in reliability calculations and prognosis of industrial systems.

The PhD was defended successfully the first day of summer, 21 June 2016, in front of internationally well known researchers in reliability engineering and statistics:

- Bruno CASTANIER (University of Anger, France)
- Serkan ERYILMAZ (Atilim University,Turkey)
- Anne GEGOUT-PETIT (University of Lorraine, France)
- Antoien Grall (Troyes University of Technology, France)
- William Q. MEEKER (University of Michigan Medical School, USA)
- Ananda SEN, (University of Michigan Medical School, USA)

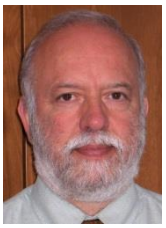
A major concern for engineers and managers nowadays is to make high quality products and highly reliable systems. In this context, reliability analysis and failure prediction, besides of efficient maintenance decision-making are strongly required. Deterioration modeling and analysis is a fundamental step for the understanding and the anticipation of system behavior. Consider a functional system operating in unstable conditions or environment where the deterioration level is not observable and could not be determined by direct measures. For this system a set of measurable health indicator that indirectly reflects the system working conditions and deterioration level can be defined and examined. Considering these indicators, the development of a mathematical model describing the system behavior is required.

In this thesis, a set of non-monotone indicators evolving in a dynamic environment is considered. Taking into account the major features of the data evolution as well as the impact of dynamic environment consequences and potential shocks, stochastic models based on Wiener and jump processes are proposed for these indicators. Each model is calibrated and tested, and their limits are discussed. A decision-making approach for preventive maintenance strategies is then proposed. In this approach, knowing the RUL of the system, a simulation-based real options analysis is used in order to determine the best date to maintain. Considering a case study of a wind turbine with PHM structure, the decision optimization approach is described.

For a very first time a jump diffusion process with markovian covariates is used to model the deterioration. The thesis give a methodology for reliability and lifetime estimation of a non increasing deteriorating system when the increments are not normally distributed. First the statistical properties of increments are studied.

Afterward the measures dependency is tested in order to decide whether time series such as AR, ARCH should be used or a Levy process could capture the deterioration features. If the increments dependence is discarded, a jump diusion process with covariates can be considered to fit the model. The deterioration modeling is applied to a large set of collected data corresponding to aggregated health indicators of similar complex systems.

RESS News



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

The Reliability Engineering and System Safety (RESS) Journal has had a long association with ESRA, as shown in the Journal cover page. You may have noticed that in the recent past a more active policy towards having special sections or issues on specific topics has been implemented.

Presently there are three special issues in the process of completing the paper reviews and soon will be published:

Special Issue: “Games and Decisions in Reliability and Risk”, Guest Editors: Refik Soyer, USA, Suleyman Ozekici, Turkey.

Special Issue: "Reliability and Safety Certification of Software-Intensive Systems" Guest Editors: Barbara Gallina, Sweden and Roberto Natella, Italy.

Special Issue: "Reliability and Performance of Multi-State Systems", Guest Editors: Gregory Levitin, Israel and Liudong Xing, USA.

It is of interest to bring your attention to the **call for papers** that is now open for two new Special issues, inviting you to consider submitting to those:

Special Issue: "Complex Systems RAMS Optimization: Methods and Applications " Guest Editors: David Coit, USA, Enrico Zio, Italy. (Submissions start June, 2016)

Special Issue on "Maintenance Modelling" Guest Editors: Shaomin Wu, UK, and Phuc Do, France. (Submissions start July, 2016)

I hope that several of you may feel inclined to submit to these special issues.

Past Safety and Reliability Events

35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2016) Symposium on Structures, Safety and Reliability

Busan, South Korea
19-24 June 2016

Carlos Guedes Soares, Coordinator of the OMAE2016 Structures, Safety and Reliability Symposium
Instituto Superior Técnico, Universidade de Lisboa

This Symposium, which has been on-going at the OMAE Conference since 1990, includes all types of probabilistically based formulations as well as the risk and reliability papers presented at the OMAE Conference. Few years ago it started including also Papers dealing with topics of offshore structures. ESRA is one of the Associations that support this Conference and this Symposium in particular.

In the past Symposium 110 papers have been presented in 26 sessions, from which about 10 were more specific of structures. The Safety and Reliability papers were spread in sessions of probabilistic and spectral modelling of waves, Probabilistic Models of Forces and Motions, Reliability of Marine Structures, Fatigue Reliability, Reliability of Mooring and Riser Systems, Risk and Reliability of Renewable Energy Devices, Reliability Based Maintenance and Inspection Planning, Risk Analysis and Safety Management; Human and Organizational Factors. Many interesting papers have been presented and interested discussions have followed. The electronic proceedings are available from ASME, The American Society for Mechanical Engineers.

6th International Conference on Accelerated Life Testing and Degradation Models (ALT2016)

Troyes, France
22-24 June 2016

Conference website: https://alt2016.sciencesconf.org
Mitra Fouladirad, Troyes University of Technology

ALT'2016 the 6th international conference was concerned with the latest scientific results and applications in reliability testing and analysis. The conference brought researchers and practitioners from universities, institutions and industries, together to present and discuss innovative methodologies and practical applications in the reliability field: assessment, modeling, testing, analysis, design and optimisation. Theoretical issues and applied case studies ranged from academic considerations to industrial, medical, and social applications were considered.

The industrials participated largely to the organisation and presentations. The industrial committee was composed with personalities from the industry Alstom, EADS, Renault, Orange, SNCF, etc. all working in reliability. This committee involved in the organisation of the conference helped into promoting the relationships between academics and industrialists.

The conference was held from June 22th to June 24th 2016 in Troyes (France). Troyes is largely a 16th century city, with most of today's buildings and layout dating from what locals call the "beautiful 16th century". This pivotal era, spanning both the Middle Ages and the Renaissance, has left a lasting legacy on Troyes as it is today.

Based on the previous editions, around 5 half-days were planned for the talks. Each morning and afternoon started with plenary invited talks. Between, there will be an alternate of parallel sessions and plenary invited talks. The program included around 40 talks and the plenary invited talks were given by academics as well as industrials. The following internationally well known researchers in statistics were involved in plenary talks:

- William Meeker Iowa State University (USA)
- Jean Francois Dupuis INSA de Rennes (France)
- Ananda Sen University of Michigan Medical School (USA)
- Serkan Eryilmaz Atilim University (Turkey)

For the plenary talks, were also invited three industrials representing very famous and influential european companies:

- Nicolas Bousquet Electricity of France (EDF France)
- Leïla MARLE Research and innovation centre for gas and new energy of GDF SUEZ (France)
- Thomas Santini Airbus Defence and Space (France)

The conference was very international. Researchers from all over the world participated to the conference. ALT2016 had presentations and participants mainly from Europe but also from Middle East (Iran, Turkey),

Asia (Hong kong, Taiwan, …), South America (Brazil), North America (USA) and Africa (Algeria, Morocco, …).

The presentations were addressed to statistical researchers and practitioners. Several fields have been addressed such as Simulation-Based Inference in Reliability, reliability calculation of complex systems, Degradation modelling by stochastic processes, Accelerated Lifetime testing, Bayesian analysis and reliability estimation, inference methods for reliability assessment, maintenance policies under stress and environment factors, maintenance optimisation with unknown reliability parameters, Repairable Systems and Competing Risks, Better than new maintenance modelling, Imperfect maintenance. Several application fields have been considered: Evaluation of maintenance efficiency and optimisation for natural gas compressor, Acceleration Degradation Test in Aerospace applications, Mixed Flowing Gas Testing on electronics, etc.

A round table composed of academics such as Min Xie, William Meeker and industrials from EDF, Renault, Airbus, StatXpert discussed several issues in maintenance, reliability and lifetime analysis and proposed interesting perspectives for future collaborations between university and industry.

For the social program, the participants visited the museum of Charles De Gaulle in Colombey-les-Deux-Églises near Troyes. Afterward, all the participants and the accompanying persons were taken to a small village in Champagne, to visit wine and Champagne cellars, to test different champagne production. A very traditional dinner composed by local products and served with Champagne closed the social activities.

The International Conference on Information and Digital Technologies 2016 (IDT 2016)

Rzeszów, Poland

5-7 July 2016

Elena Zaitseva, co-chair of IDT 2016, University of Zilina, Slovakia

The International Conference on Information and Digital Technologies is organized by team from University of Zilina (Slovakia). In this year the Conference was held in Poland at the University of Rzeszow on July 5 – 7 and for supported by ESRA. The Conference (http://idt.fri.uniza.sk) is annual and covers topics within digital signal processing and information technologies, reliability, risk and safety, testing and fault-tolerant systems, etc.

Multidisciplinary character of the Conference was conditioned for the organization of some Workshops under the Conference that thematically agree with principal investigate areas and topics of the Conference. One of them is Reliability Workshops. All papers presented at this Workshop were included in the Conference Proceedings. The Program Committee of this Workshop was formed by internationally recognized experts. Chairs of this Workshop Prof. Radim Briš (Czech Republic) and Prof. Enrico Zio (France, Italy) significantly contributed to organization of the Workshop. Next plenary presentations were at this Workshop:

- *Designing High-Reliability Health Care*, Paul Barach, MD, MPH, Maj(ret.) - Wayne State University School of Medicine, Detroit, United States
- *Critical (Cyber) Computing: Challenges and Cases for Industry and Human Domains*, Prof. Vyacheslav Kharchenko - National Aerospace University "KhAI" (Kharkiv, Ukraine).

More than 100 submissions from 21 countries were obtained. 52 papers were selected to publish in the Proceedings based on the reviewing. Every paper has been reviewed at least two reviewers. The approved papers are organized into 3 plenary presentations, 12 working sections and poster section. In the plenary sessions, distinguished plenary speakers give a review of the future perspectives in their research areas: reliability, information technologies and biomedical informatics. About 50% submitted papers were published in the Conference Proceedings. The Conference Proceedings of the Conference IDT 2016 has been included in the well-known scientific repositories: Scopus and IEEEXplore (*http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=7547853*).

The ESRA sponsoring allows us to support participation of PhD students and young researchers, and colleagues from such countries as Belarus and Ukraine. Thanks to this sponsoring we were able to support of invited lectures at the Workshop. Moreover the organization support of ESRA is useful too. A lot of ESRA members were involved in the Conference Program Committee and reviewing process. Our organization team will be glad to extend the cooperation with ESRA members. New ESRA members are welcome in the Program Committee. We will be glad to obtain your proposition about cooperation and new ideas for the Conference by e-mail of organization *team idt@fri.uniza.sk*. Therefore the support of ESRA was very important for the organization team of the Conference.

Our organizational team is grateful to all members of the Program Committee for the support of reviewing process. Their work to improve the scientific level of the Conference is greatly appreciated. Also I would like to acknowledge the local organizing committee from the University of Rzeszow.

Beside the scientific field, several cultural and social events held in pleasant atmosphere.

In 2017 year next Conference will organized. Our team hopes that the International Conference on Information and Digital Technologies

(*http://idt.fri.uniza.sk*) in July 2017 will involve a lot of participants in reliability engineering.

International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE 2016)

Jiuzhaigou, Sichuan, China,
25-28 July 2016

Carlos Guedes Soares, Co-Chair of QR2MSE2016, Instituto Superior Técnico, Universidade de Lisboa

The 2016 International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE 2016) was held together with the 2016 World Congress on Engineering Asset Management (WCEAM 2016). The Conference was chaired by Professor Hong-Zhong Huang, Director of the Institute of Reliability Engineering of the University of Electronic Science and Technology of China. The Co-Chairs were Professors Joseph Mathew, Queensland University of Technology, Australia; Carlos Guedes Soares, University of Lisbon, Portugal; Dong Ho Park, Hallym University, Korea; and Tadashi Dohi, Hiroshima University, Japan.

The Conference was supported by a number of professional organizations, among which ESRA.

Almost 500 papers have been submitted to this conference and 193 papers have been selected from all the submissions and included in the conference proceedings distributed at the Conference, both in paper and electronically. The conference program included 9 keynote speakers, 4 special sessions, and 20 regular technical paper oral sessions. Among the keynote speakers one was from the ESRA Technical Committee on Maritime Transportation: Prof Jin Wang introduced Risk-based Decision Making in Design and Operation of Large Engineering Systems under Uncertainties.

The Conference has been held every year since 2013, organised by the same institute at different locations in China and has been growing its international participation and its quality. It is organised in a way that is somewhat common in China with plenary lectures every morning and a number of parallel sessions in the afternoon. The sessions were well attended and all papers were presented and discussed in English.

The location of the Conference was also an excellent one with a well know Natural Park in the vicinity allowing the post-conference tour to visit Jiuzhaigou.

In summary the Conference was very worthwhile to participate in.

Continuing education course: "Advanced methods for reliability, availability, maintainability, diagnostics and prognostics of industrial equipment"

Milan, Italy
16-20 November 2016

The 2015 professional one-week training course: "Advanced methods for reliability, availability, maintainability, diagnostics and prognostics of industrial equipment" took place at Politecnico di Milano, Milan (Italy) on November 16-20. The course was the XVIII edition of the series. Its goal has been to provide the participants with the methodological competences and the computational tools necessary to tackle critical problems in the areas of reliability, availability, maintainability, diagnostics and prognostics. To this purpose, the course has presented proven methods to improve safety, increase efficiency, manage equipment aging and obsolescence, automate maintenance and reduce maintenance costs of industrial systems.

Since the beginning, the course has been officially supported by ESRA and since 2005 official scholarships have been offered. The 2015 edition of the course has been supported by ESRA with two scholarships covering the registration fee. The 2015 scholarships have been offered to two Ph.D students, one of Università degli Studi di Salerno (Salerno, Italy) and the other of University of Twente (Twente, The Netherlands).

The first part of the course has been devoted to the presentation of advanced methods for the availability, reliability and maintainability analysis of complex systems and for the development of Prognostics and Health Management (PHM) and Condition Based Maintenance (CBM) approaches. In this respect, the basics of Monte Carlo Simulation, nonlinear regression and filter models (Artificial Neural Networks, Principal Component Analysis, Auto Associative Kernel Regression, Ensemble Systems, Particle filter) is illustrated. In the second part of the course, exercise sessions on Monte Carlo simulation, Artificial Neural Networks, Auto Associative Kernel Regression and Ensemble systems provide the participants with the opportunity of directly applying the methods to practical case studies. Finally, in the last part of the course, real applications of the advanced methods have been presented by the course organizers and participants. The applications range from Monte Carlo Simulation for availability analysis and condition-based maintenance management to regression and classification techniques for fault detection, classification and prognosis in different industrial sectors.

During the last day of the course, participants had the opportunity to take part at the seminar "Diagnostics and Prognostics for Maintenance Engineering and Management: Achievements and Challenges" organized by Politecnico di Milano and supported by ARAMIS S.r.l, the Prognostics and System Health Management technical committee of ESRA and the IEEE Reliability Society, Italy Chapter. Talks by Dr.

Kamal Medjaher and Prof. Noureddine Zerhouni (FEMTO-ST Institute/National Institute in Mechanics and Microtechnologies, France), Dr. Stavros Ntalampiras (Politecnico di Milano, Italy) Prof. Gyunyoung Heo (Kyung Hee University, South Korea), Dr. Pierre Dersin (ALSTOM Transport's Information Solutions, France) addressed relevant topics in the prognostic and health management field.

The 2016 edition of the course fill take place at Politecnico di Milano, Milan (Italy) on November 21-24. The ESRA support will cover 2 registration fees to be awarded to PhD students.

Calendar of Safety and Reliability Events

The 35th International Conference on Computer Safety, Reliability and Security (SafeComp 2016)

Trondheim, Norway
20-23 September 2016

Since it was established in 1979 by the European Workshop on Industrial Computer Systems, Technical Committee 7 on Reliability, Safety and Security (EWICS TC7), SAFECOMP has contributed to the progress of the state-of-the-art in dependable application of computers in safety-related and safety-critical systems. SAFECOMP is an annual event covering the state-of-the-art, experience and new trends in the areas of safety, security and reliability of critical computer applications.

SAFECOMP provides ample opportunity to exchange insights and experience on emerging methods, approaches and practical solutions. It is a single track conference without parallel sessions, allowing easy networking.

The conference covers all aspects related to the development, assessment, operation and maintenance of safety-related and safety-critical computer systems.

Important dates:
- February 1, 2016 – Workshop proposal submission
- March 4, 2016 – Full paper submission
- May 6, 2016 – Notification of acceptance
- June 13, 2016 – Fast Abstract submission
- September 20, 2016 – Workshops
- September 21-23, 2016 – Conference

Conference website: **http://ntnu.edu/safecomp2016**

35th Symposium on Reliable Distributed Systems (SRDS)

Budapest, Hungary
26-29 September 2016

The 35th Symposium on Reliable Distributed Systems (SRDS 2016) plans to run pre-conference workshops (half-day or full-day) on September 26th, 2016, similarly to what happened in previous editions of the conference. Researchers interested in organizing a workshop on topics related to reliable distributed systems are invited to submit workshop proposals.

The proposals shall be submitted via e-mail to the SRDS 2016 Workshop Co-chairs:
- Sanjay Madria, Missouri University of Science and Technology, USA - madrias@mst.edu
- Miguel Correia, INESC-ID, Instituto Superior Técnico, Portugal – miguel.p.correia@tecnico.ulisboa.pt

Important dates:
- February 28, 2016 – Workshop proposals
- March 4, 2016 – Notification of acceptance
- September 26, 2016 – Workshop day

Conference website: **http://srds2016.inf.mit.bme.hu**

Advanced methods for reliability, availability, maintainability, diagnostics and prognostics of industrial equipment

Milan, Italy
21-24 November 2016

The course is mainly dedicated to engineers, analysts and researchers in the area of reliability and risk analysis, and to developers and users of systems for Diagnostics, Prognostics and Health Management (PHM) and Condition Based Maintenance (CBM), including Controls/Diagnostic Engineers, Engineering Supervisors, Operator/Maintenance Engineers, and Program Managers.

The goal of this course is to provide participants with the methodological competences and the computational tools necessary to tackle critical problems in the areas of reliability, availability, maintainability, diagnostics and prognostics of industrial equipment. The course presents proven methods to improve safety, increase efficiency, manage equipment aging and obsolescence, automate maintenance and reduce maintenance costs of industrial equipment and systems.

Important dates:
- November 13, 2016 – Registration deadline

Conference website: **http://www.lasar.polimi.it**

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.

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 (ESRA Website: esrahomepage.eu)

The 27th edition of the international conference, 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.

Abstracts and Papers, Proceedings and Publication:

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 about 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**

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
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- 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
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- 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

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 modeling
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4.3 Foundational Issues in Risk Assessment and Management
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4.14 Uncertainty analysis
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Application Areas - Technological Sectors

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4.16 Chemical and Process Industry
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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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