



# European Safety and Reliability Association

## Newsletter

<http://www.esrahomepage.eu>

September 2018

### Editorial



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

Dear ESRA Colleagues!

The 28<sup>th</sup> yearly conference of ESRA took place in Trondheim, Norway, 17-21 June 2018. In parallel to the conference, the ESRA assembly was organised. In addition to the regular activities of the assembly, which are scheduled every year, the election of 3 new ESRA board members was scheduled.

The president of ESRA Terje Aven (2014-2016, 2016-2018), the vice president Radim Briš (2014-2016, 2016-2018) and the treasurer Piero Baraldi (2014-2016, 2016-2018) were replaced by the new board members, who were elected at the assembly. The president of ESRA for the period of 2018-2020 is Marko Čepin. The vice president is Luca Podofillini (2018-2020) and the treasurer is Stefan Bracke (2018-2020).

Assoc. prof. dr. Marko Čepin, University of Ljubljana, Faculty of Electrical Engineering, was the organiser of ESREL 2017 in Portorož.

Dr Luca Podofillini, a senior scientist in the Risk and Human Reliability Group of the Paul Scherrer Institute (Laboratory for Energy Systems Analysis), was the organiser of ESREL 2015 in Zurich, Switzerland.

On behalf of the new team, I thank the previous

ESRA leaders for their enthusiasm and great success of keeping the ESRA activities on the level of an excellent professional society, which joins researchers from universities and research institutes and the professionals from the industry.

The work of the previous ESRA leader team resulted in increasing number of people attending conferences of ESRA and being part of other ESRA activities such as webinars and technical committees.

We intend to keep the level of professionalism on the highest level and strengthen the activities in the fields broad spectrum of areas of reliability, safety and risk assessment and management.

The ESREL 2018 conference (Trondheim, Norway, June 17-21, 2018) was a successful event organised by The Norwegian University of Science and Technology (NTNU) in collaboration with the ROSS Gemini Centre (NTNU) and ESRA.

The event showed the strength of Norwegian participation at ESRA activities, which attracted more than 100 local participants in Trondheim, with overall participation approximately similar to previous events. ESREL 2018 in brief means 400 papers and 500 participants, and the open access proceedings for the first time in the history of ESREL conferences. It was edited by Stein Haugen & Anne Barros, NTNU, Faculty of Engineering, Trondheim, Norway, Coen van Gulijk, University of Huddersfield, Faculty of Computing and Engineering, Huddersfield, UK, Trond Kongsvik, NTNU, Faculty of Economics and Management, Trondheim, Norway, Jan Erik Vinnem, NTNU, Faculty of Engineering, Trondheim, Norway. Proceedings of the 28th International European Safety and Reliability Conference (ESREL 2018), Trondheim, Norway, 17-21 June 2018. It is published by Taylor & Francis Group, London, UK.

We are happy to announce the new technical committees: Innovative Computing Technologies in Reliability (chair: Radim Briš) and Safety

Organizational Factors and Safety Culture (chair Marja Ylönen and co-chair Trond Kongsvik). We wish them a fruitful cooperation within the members of the committees.

The discussions about further ESREL conference in the year 2020 are going on with the International Association for Probabilistic Safety Assessment and Management (IAPSAM) to have again a common event as it happened successfully couple of times in the past.

We are open to new ideas and if there is some interesting initiative, please do not hesitate to contact and of the board members of the society including the secretary general Roger Flage.

Chairman of ESRA  
Marko Čepin

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## Feature Articles

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### Uncontrolled flows of information and energy in cyber-physical systems



*Nelson H. Carreras Guzman  
Technical University of Denmark  
Engineering Systems Division  
Lyngby, Denmark*



*Igor Kozine  
Technical University of Denmark  
Engineering Systems Division  
Lyngby, Denmark*

Traditionally, risk assessment models for safety-critical systems focus on the identification of hazards and the consequent estimation of the likelihood and severity of losses. Hazards are considered potential sources of risk viewed as natural, technical, or human states of a purely unintentional motive. From a safety point of view, they are unsafe physical states that can result in human injuries (possibly casualties), property losses, or degradation of the natural environment.

Arguably, the most pervasive models consider an accident as an uncontrolled or undesired release of energy. This perspective implies that the system regulates or confines certain energy (or material) flows in normal operations. Consequently, an Uncontrolled Flow Of Energy (UFOE) (Rasmussen and Grønberg,

1997) poses a risk to the exposed entities of the system under certain conditions. The types of energy (e.g. potential, kinetic, chemical, thermal, electrical, and radiation, among others) and material (e.g. toxic) vary according to the system under investigation. Some relevant applications include safety in process plants, aviation, and military systems, among others. As an example for process industry, a loss of containment is a typical hazard, while the final consequence is physical harm.

Nowadays, as information technologies (IT) are becoming ubiquitous in many control systems, designers are conceiving them as cyber-physical systems (CPS). Some applications include industrial control systems in manufacturing and process plants, autonomous vehicles, critical infrastructures, military defence systems, medical devices, among others. In general, CPS integrate IT (i.e. computers and communication networks) in the control of physical processes through sensors and actuators in feedback loops. Thus, computers are closing distributed and cooperative control loops in real-time, increasing the levels of automation of many safety-critical systems.

Consequently, new complex interactions are rising between computer-based control and physical processes, considering the technical and human factors involved. While several researchers have examined the implications of security and privacy in CPS (Giraldo et al., 2017) and other approaches analyse the relationships between security and safety (Kriaa et al., 2015), most models fail to incorporate the interactions between the cyber and physical interfaces with a potential to cause physical harm.

In general, advances in CPS entail new challenges for risk identification, making the UFOE concept an insufficient one. First, the integration of modern IT systems in the control of physical processes introduces the vulnerabilities of the cyberspace, making the system prone to cyber threats (i.e. sources of risk to IT systems and real-time control devices). Second, CPS are susceptible to both unintentional and deliberate sources of risk, expanding the range of motives beyond purely accidental cases. Third, wireless networks and Internet access allow hackers to hide their identity and attack from remote locations, exposing CPS to a wider set of exogenous threats, i.e. to phenomena external to the system itself.

In addition, cyber threats are more difficult to predict compared to component failures, human-related accidents, and many natural hazards. Ultimately, risk analysts lack sufficient data to estimate the likelihood of cyber threats, considering the inherent uncertainties of predicting future attacks or accidents with unknown consequences.

In sum, these new challenges require an integration of the safety and security fields, so that a framework can capture the propagation of security issues into safety issues. This integration is much different from the disintegrated approach that conceives both issues separately, neglecting the important relationships between them. While safety analysts traditionally aim to prevent or mitigate harmful consequences to people and physical objects, security analysts aim to prevent

harm related to the security goals of confidentiality, integrity, and availability of IT systems. However, these types of potential harm are deeply related in CPS, requiring a unified analysis of their relationships.

As a unified concept for safety and security, we propose a refinement of the UFOE concept that incorporates the case of an Uncontrolled Flow Of Information (UFOI) as sources of risks in CPS. To capture both flows and their tight interactions, we refer to this new concept as Uncontrolled Flow of Information & Energy (UFOI-E). This concept supports the identification of wide range of sources of risk, including both cyber and physical ones triggered by unintentional and deliberate motives.

The premise of this framework consists in the representation of a cyber threat as an UFOI. In other words, one can relate a cyber threat to a loss of control over information flows in the system. For example, eavesdropping relates to an undesired outflow of information. Likewise, malicious code injections are uncontrolled inflows of information, potentially leading to undesired transformations into malicious commands to actuators and subsequently into an UFOE in a physical process. Similarly, a Denial of Service (DoS) implies no-flow of information, with potential UFOE repercussions in the real-time control of safety-critical systems.

An UFOI leading to an UFOE is consistent with the security challenges in CPS. Particularly, the Stuxnet attack to an Iranian nuclear facility in 2007 demonstrated the possible extent of physical losses resulting from cyber-attacks to CPS. Essentially, CPS differ from traditional IT systems in that they are tightly coupled with physical processes. Therefore, the security goals in CPS are not limited to confidentiality, integrity, and availability of information services. In contrast, the interactions between the IT, control, and physical interfaces in feedback loops enable effect propagations within cyber and physical sources of risk. Thus, in the CPS safety domain, we consider relevant cyber threats as those UFOI that have a potential to trigger UFOE with their implicit risks as final consequences.

In conclusion, the UFOI-E concept promotes the identification of the interactions between the information flows in cyber processes with the energy flows in physical processes. Consequently, risk analysts can determine the possible effect propagation and safety-related consequences of uncontrolled flows of information and energy throughout CPS interfaces.

## REFERENCES

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## RESS News

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

### New Impact Factor

The impact factor of Journals is an important index that the community relates to the quality of the journal. Formally, it considers only the papers published in the last two years and represents the ratio of the total number of citations that the papers from the Journal received, divided by the total number of published papers. This factor is updated every years and the results are released normally late in the summer.

The impact factor has different average values in the different subjects, as the number of researchers active in the various areas vary as well as the traditions on citation frequency. However, within a given group of journals the differences between journals have some meaning.

This year the impact factor of RESS had a significant increase from 3.153 to 4.139, which is gratifying to see and this will benefit the authors that published papers last year. The increase in citations results in general of the increased quality of papers that are then cited more.

We look forward to see an increased trend of the impact factor although we will not certainly have another large jump as the impact factors normally change only few decimal places each year.

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

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

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

The special issue on Surrogate Models for Uncertainty Quantification, Sensitivity and Reliability Analysis has as Guest Editors Bruno

Sudret and Sankaran Mahadevan will accept submissions until January 2019.

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## ESRA News

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### ESRA TC Chairs workshop – Creating Excellence

2-3 June 2018

Sardinia, Italy

Authors: Terjen Aven and Enrico Zio

On June 2-3 of this year, the ESRA Board Members and approximately half of the Technical Committee Chairs met in Sardinia, Italy, in a workshop aimed at discussing a number of issues for the future development of ESRA. It was an unforgettable event, full of enthusiasm, and rich in ideas and plans on how to advance the Association and the related science and profession. Also the venue was absolutely fantastic, as you may see by checking on google “Colonna Resort Porto Cervo”. In more specific terms, the aim of the workshop was to provide an opportunity to discuss and share ideas on how to further develop the fields of risk, safety and reliability analysis and management within ESRA, and the Association itself. The workshop was meant to be an occasion for strengthening the network of ESRA Chairs and contribute to build excellence in activities (projects, publications, presentations, etc.), in people (attitudes, goal setting, improvement processes, etc), and in organization (teams, study programs, etc): a culture for ‘ESRA excellence’.

The workshop has represented an important input to the development of vision statements linked to the ESRA mission and its scientific fields and practices of concern, and the structuring of the related strategies and plans for advancement.

The discussion was structured in:

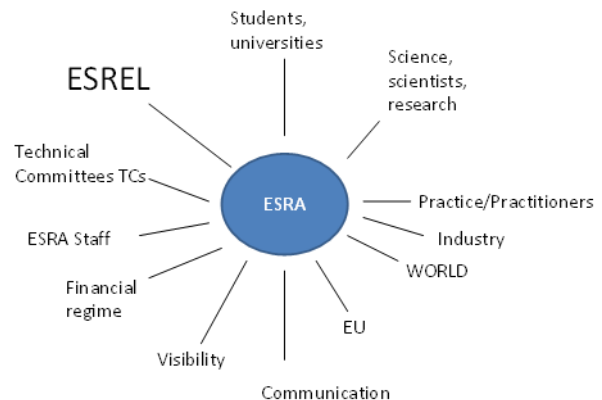
- ‘The current state’,
- ‘Where we would like to go or be’ (the ‘big dreams’, the visions and high-level goals), and
- ‘How to get there’ (the means, the measures, strategies, priorities).

The big dreams create a gap that gives energy and activities for moving in the right direction. Combined with a strategy of continuous improvement, the vision and this gap provide a strong instrument for obtaining top performance over time, when the proper balance is made between confidence (believe in something) and humbleness (be open and learn), and between protection and risk taking. An example of such a vision statement – big dream - is that the safety, reliability and risk fields are recognized and influential sciences and professions, as demonstrated by the fact that these fields are on the curriculum in schools.

As far as the current state is concerned, we conclude that ESRA today is a healthy organization, made of quality people, with a good financial basis. It

relies on a strong group of Technical Committees (TCs), covering a broad set of methodological topics and applications areas. It organizes a high-quality ESREL conference every year. Recently, ESRA has launched some new initiatives, like the webinars, with success. Nonetheless, there is certainly a potential for further developments, as the workshop proved.

The discussion among the participants of the workshop was partly carried out in selected groups, and the ideas emerging from the discussion within each group were presented in a final plenary session. Below, we summarize some of the ideas and reflections that have emerged from this process. They can be categorized as shown in the Figure below, with ESRA being the pivot of the discussion.



The ESREL conference is the main event of ESRA and its quality is, therefore, critical. Many suggestions for how to further improve it were suggested.

These include:

- The option for submissions of abstracts only (and not full papers), to increase industry participation;
- The organisation of a meeting in which PhD students meet ESRA scientific ambassadors (e.g. Sunday before the ESREL welcome reception);
- More panels discussing current issues;
- An ESRA member of the year award;
- A best student presentation based on live polls.

The introduction of awards was mentioned by several of the participants as a means to stimulate activities and involvement. It led to an interesting discussion where the many facets of using such awards were reviewed and elaborated on. There seemed to be broad agreement that some awards could be interesting to experiment on, but the selection of type of awards – as well of the candidates and awardees - should be carefully made to avoid negative feedbacks. The motivation behind any award must be to stimulate people to do something extra for ESRA and the related fields and sciences, in particular students and young professionals. The criteria and process for selecting the winners must to the extent possible be objective.

ESRA is European by nature and history, but there is undoubtedly an increasing interest and participation

in ESRA/ESREL from outside Europe, in particular from China and the Americas. Realizing this, an idea that came up and was discussed was to organize a World ESRA conference every 3-4 years outside Europe, perhaps in joint venture with other conferences, like PSAM. More in general, there seems to be a large potential for enhancing the links to other related organizations, like for example the Society for Risk Analysis (SRA). This Society has a number of Specialty Groups (SGs) which resemble the TCs of ESRA: ways of improving the collaborations between the ESRA TCs and the SRA SGs should be sought, as they are clearly overlapping on both aims and scope.

The role of ESRA as a ‘knowledge organisation’ was strongly highlighted. In this view, ESRA cannot take such roles like, of for example, serving institutions in their needs for practical arrangements related to EU proposals. What ESRA can do is to stimulate and promote activities which can be useful for the institutions in this respect, but not itself conduct the services. The same applies to active participations in research project: ESRA is not a research unit, but it can promote research and projects to be carried out to address relevant topics. And ESRA can certainly increase its visibility towards the EU and also towards industry.

As a “knowledge organisation”, ESRA can provide guidance and communicate ‘state-of-the-art’ knowledge on risk, safety and reliability methods and practices. One concrete suggestion that was made is to establish an ESRA course on core topics of risk, safety and reliability. The vision behind this is that ESRA is seen as a leading authoritative organisation when it comes to the ‘best knowledge’ on safety, reliability and risk. Another idea is that each Technical Committee identifies a set of papers which are considered summarising well the state-of-the-art of the area, as well as presenting some latest research news (2017-2018) (up to three papers in each category).

A related suggestion relates to the establishment of ESRA working groups, for carrying out specific projects with clearly stated goals, and defined duration and deliveries. This is done in other associations, e.g. ESREDA. An example could be a working group aiming at producing guidelines on specific topic; Another example could be a working group doing a project for investigating how different industries can learn from each other experience and practice in risk assessment and management. The projects could be supported by the funding program of ESRA: this would require a change in the current policy so that a proportion of the funds made available yearly for proposals of ESRA activities are specifically dedicated to working groups projects that support the further development of ESRA, and its visions and strategies.

As for ESRA operation, it was discussed that ESRA has not a sufficient income basis for manning a Secretariat, and also the Management Board’s work is not paid: these conditions limit the organisation’s possibilities to grow and serve its members and the possibility of getting some long term sponsors could be looked into.

Collaboration on several aspects of interest to ESRA members was also highlighted, including sharing information on PhD courses. In general, more exchange of information is believed to be beneficial, for example on undergoing projects and open positions. In this regard, a more dynamic and open website offers a potential for updated information exchange on current activities and opportunities.

Also, the issue of better gender balance was discussed: efforts have been made in recent years to improve the current situation, but further measures are needed.

From the point of view of us workshop organizers, we feel very comfortable in saying that the objectives of the workshop have been achieved. The outcomes of the workshop have shown that there is a huge potential in the group of active ESRA TC chairs and to further develop the organization and the related fields and sciences. Action plans with clear responsibility for implementation are now under development for this: we are confident that the new ESRA Management will follow up the ideas and suggestions that have emerged from the workshop and we will support this work with enthusiasm.



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## Past Safety and Reliability Events

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### 3<sup>rd</sup> International “Computational Reliability Engineering (CRE)” Symposium

19 October – 20 December 2017

University of Liverpool ,UK

Author: Marcin Hinz

The “Computational Reliability Engineering in Product Development and Manufacturing (CRE)” Symposium was organized by the chair for reliability engineering and risk analytics of Univ.-Prof. Dr.-Ing. Stefan Bracke already for the third time. In order to extend the international character of the symposium, especially regarding the event location, for the first time it took

place outside Germany. Due to the cooperation with the University of Liverpool, the event took place in the historical buildings of the London campus of the University of Liverpool in England. The CRE symposium was supported by Meiji University in Tokyo, the European Safety and Reliability Association (ESRA), the University of Wuppertal in Germany, the University of Liverpool as well as the Institute for Analytics and Prognostics of technical complex systems (IAP) from Cologne in Germany. The guests from the industry and academic world discussed, as usual, the current topics related to the product reliability and risk analysis. Academics were represented by attendees from Meiji University (Tokyo, Japan), the University of Electro-Communications (Tokyo, Japan), the University of Liverpool (GB), Technical University Delft (Netherlands), the University of Huddersfield (GB), University Paderborn (Germany), Leibniz University Hannover (Germany), University Siegen (Germany), the Technical University of Cologne (Germany), and the University of Wuppertal (Germany).

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

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

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

provided the chance to discuss about the history of the development of navigation tools as well as the theory and practice of high precision manufacturing of measurement systems.

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

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

**For further information please contact:**

Prof. Dr.-Ing. Stefan Bracke

Chair of Reliability Engineering and Risk Analytics

Faculty of Mechanical and Safety Engineering

University of Wuppertal, Germany



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

24 January 2018

Delft, The Netherlands

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

To face this challenge and come up with workable solutions, the Department of Structural Reliability at TNO has organized a workshop on this topic. The aim of the workshop was to bring together researchers, practitioners, and software developers from all over the

world to share experience, learn from each other, and to jointly find ways of solving these challenges.

### **The workshop day**

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

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

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

Each of the lectures was recorded and along the lecture slides made publicly available on a designated website: [www.reliabilitytno.com](http://www.reliabilitytno.com).

### **The outcomes**

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

### **Call**

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

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

For further information, please contact [arpad.rozsas@tno.nl](mailto:arpad.rozsas@tno.nl).

**Website:** [www.reliabilitytno.com](http://www.reliabilitytno.com)

## **Reliability in French Statistical Society**

**28 May – 1 June 2018**

**Saclay, France**

The annual French Statistical Society conference took place in Saclay, May 28th to June 1th, hosted by Electricity of France. Two sessions were devoted to reliability problems and uncertainty evaluation in calculations methods. The main focus was on reliability in computing codes of complex system simulators. These codes have a large number of input parameters where their values are subject to uncertainties.

To have a fair and good analyse of the outputs it is necessary to apply probabilistic methods to measure the impact of the parameters uncertainties on the results. The confidence bounds on output data permit to evaluate the risk in decision making. Concerning complex system simulators, another popular topic was about powerful simulating methods to generate rare events. The second theme highlighted in several presentations concerned deterioration modeling considering the impact of a harsh and random environment. Stochastic processes such as Diffusion or Semi-Markov processes were proposed and their application on case studies by statistical point of view were discussed. Furthermore, new and more general classes of lifetime distributions were introduced and their utility was discussed. The PHM Challenge was also organized by Electricity of France and two groups of PhD students won the first prizes.

## **16<sup>th</sup> International Probabilistic Workshop Conference Report**

**12 -14 September 2018**

**University of Natural Resources and Life Sciences, Vienna, Austria**

The 16<sup>th</sup> International Probabilistic Workshop took place in Vienna from 12 to 14 September 2018 at the University of Natural Resources and Life Sciences. In total there were 4 keynote lectures and 32 presentations.

Posters were also exhibited for the first time. As usual, there were no parallel sessions, but the conference took place in one lecture hall. A total of 55 visitors attended the conference.

The visitors came from more than 10 countries such as Austria, Belgium, Czech Republic, Germany, Italy, Netherlands, Portugal, Slovak Republic, Switzerland, U.K. and the U.S.

The conference proceedings were published as a special edition of the journal *Beton- und Stahlbetonbau*. The conference proceedings are Open Access and can be viewed at <https://onlinelibrary.wiley.com/toc/14371006/current>.

This includes not only the full papers, but also the contributions which were only printed as extended abstract in the conference proceedings, but which are available as full papers on the Internet.

The topics of the conference ranged from natural hazards, such as flashfloods, to the safety of buildings, such as the development of partial safety factors, to safety in transportation, such as possible safety improvements in rail traffic. Of particular importance were the keynote lectures by Prof. Robby Caspeele on the topic of reassessment of existing structures, by Prof. Peter Mark on the evaluation of uncertainty in the lifetime evaluation of bridges, by Prof. Konrad Bergmeister on very rare events with major

consequences and by Prof. Dan Frangopol on the longevity of civil engineering structures.

With this conference the IPW conference series could be continued successfully after conferences in Dresden, Berlin, Ghent, Darmstadt, Delft, Szczecin, Braunschweig, Stuttgart, Brno, Weimar and Liverpool. The conference series was supported several times by the ESRA. Next year the conference will take place in Edinburgh (Scotland) and in 2020 in Guimaraes (Portugal).

The conference series is characterised by a very friendly and open atmosphere. This was confirmed again this year by the participants.

The conference is therefore particularly suitable for young scientists who are presenting their work to an audience for the first time.

The organizers would like to take this opportunity to thank the participants once again for creating this pleasant atmosphere



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## Calendar of Safety and Reliability Events

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### **Course: “RAM&PHM 4.0: Advanced methods for Reliability, Availability, Maintainability, Prognostics and Health Management of industrial equipment**

10 - 13 December 2018

Politecnico di Milano, Milan, Italy

*Author: Francesco Di Maio*

The 2018 professional one-week training course: “RAM&PHM 4.0: Advanced methods for Reliability, Availability, Maintainability, Prognostics and Health Management of industrial equipment” will take place

at Politecnico di Milano, Milan (Italy) on December 10-13. The course will be the XXI edition of the series.

The course is stimulated by the evidence that, in recent years, the volume of data and information available in the industry has been growing exponentially and more sophisticated and performing analytics have been developed to exploit them. This exciting situation offers great opportunities of optimized, safe and reliable productions and products, including optimal predictive maintenance for “zero-defect” production, with reduced warehouse costs and improved system availability with “zero unexpected shutdowns”. To grasp some opportunities, new system analysis capabilities and data analytics skills are needed.

The goal of the course is to provide participants with advanced methodological competences, analytical skills and computational tools necessary to effectively operate in the areas of reliability, availability, maintainability, diagnostics and prognostics of industrial equipment. The course presents advanced analytics to improve safety, increase efficiency, manage equipment aging and obsolescence, set up condition-based and predictive maintenance.

Since the beginning, the course has been officially supported by ESRA and since 2005 official scholarships have been offered. The 2017 edition of the course has been supported by ESRA with two scholarships covering the registration fee. The 2017 scholarships have been offered to two Ph.D students, one of Politecnico di Torino (Torino, Italy) and the other of the China University of Petroleum (Beijing, China).

The first part of the course is devoted to the presentation of advanced methods for the availability, reliability and maintainability analysis of complex systems and for the development of Prognostics and Health Management (PHM) and Condition-Based Maintenance (CBM) approaches. In this respect, the basics of Monte Carlo Simulation, nonlinear regression and filter models (Artificial Neural Networks, Principal Component Analysis, Auto-Associative Kernel Regression, Ensemble Systems, Hilbert Huang and Wavelet transforms) and evolutionary optimization methods (Genetic Algorithms) are illustrated. In the second part of the course, exercise sessions on Monte Carlo simulation, Artificial Neural Networks and Genetic Algorithms 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 illustrated in the course are presented. The applications range from the evaluation of maintenance costs taking into account the reliability and availability of equipment, to the application of Monte Carlo Simulation for system availability analysis and



condition-based maintenance management, to the use of regression and classification techniques for fault detection, classification and prognosis in industrial equipment.

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

**Course program chair:**

Dr. Francesco Di Maio

Tel: (+39) 02 2399 6372

Email: francesco.dimaio@polimi.it

## **17<sup>th</sup> International Probabilistic Workshop**

**11 - 13 September 2019**

**Edinburgh, United Kingdom**

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

Safety, Risk, Probabilistic Modelling and Computation, Reliability, Structural Safety, Risk Analysis, Natural Hazards, Uncertainties.

**Organisation:**

**Chair:** Assoc. Prof. Dr. Daniil Yurchenko  
IMPEE, Heriot-Watt University, Edinburgh, United Kingdom

**Organizing Committee**

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**Conference Secretary**

Dr. Gordon Thomson

IMPEE, Heriot-Watt University, Edinburgh, United Kingdom

E-mail: grt2@hw.ac.uk

**Conference Language:** English

**Deadlines:**

Submission of abstract: February 15 2019,

Notification of acceptance of abstract: February 28 2019,

Submission of full paper: April 19 2019,

Notification of acceptance and mandatory changes: May 17 2019

Submission of final manuscript: May 31 2019 (no extensions possible)

Deadline for presenting author registration: June 21 2019

**Further information:**

Dr. Daniil Yurchenko, DSc, PhD,

Reader, Associate Professor,

Institute of Mechanical, Process and Energy Engineering,

School of Engineering and Physical Sciences,

Room 1.23 James Nasmyth Building, Gate 3,

Heriot-Watt University,

EH14 4AS, Edinburgh, UK

Tel: +44 (0) 131 451 8097

Email: d.yurchenko@hw.ac.uk

## **Save the Date for ESREL 2019 – 29<sup>th</sup> European Safety and Reliability Conference**

**22 - 26 September 2019**

**Leibniz Universität Hannover,  
Hannover, Germany**



The 29<sup>th</sup> edition of the European Safety and Reliability Conference (ESREL) will be held on 22 - 26 September 2019 at the iconic Welfenschloss, the heart of the city. The online submission system will open shortly after the ESREL 2018 conference in Trondheim.

**The abstract deadline is fixed to October 31, 2018.**

We are looking forward to welcoming you in Hannover.

*Michael Beer (Conference General Chair)*

*Enrico Zio (Conference General Co-Chair)*



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E-mail: [radim.bris@vsb.cz](mailto:radim.bris@vsb.cz)

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E-mail: [darren.prescott@nottingham.ac.uk](mailto:darren.prescott@nottingham.ac.uk)

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E-mail: [valerio.cozzani@unibo.it](mailto:valerio.cozzani@unibo.it);

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E-mail: [raphael.steenbergen@tno.nl](mailto:raphael.steenbergen@tno.nl)

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E-mail: [sansavig@ethz.ch](mailto:sansavig@ethz.ch); [enrico.zio@ecp.fr](mailto:enrico.zio@ecp.fr)

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E-mail: [Michalis.Christou@ec.europa.eu](mailto:Michalis.Christou@ec.europa.eu);

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Chairman: Benoit Iung, France & François Peres, France

E-mail: [benoit.iung@univ-lorraine.fr](mailto:benoit.iung@univ-lorraine.fr);

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E-mail: [j.wang@ljmu.ac.uk](mailto:j.wang@ljmu.ac.uk); [ingrid.b.utne@ntnu.no](mailto:ingrid.b.utne@ntnu.no);

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E-mail: [p.h.a.j.m.vangelder@tudelft.nl](mailto:p.h.a.j.m.vangelder@tudelft.nl);

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Chairman: Sebastian Martorell, Spain & Francesco Di Maio, Italy

E-mail: [smartore@iqn.upv.es](mailto:smartore@iqn.upv.es);

[francesco.dimaio@polimi.it](mailto:francesco.dimaio@polimi.it)

#### 4.28 Occupational Safety

Chairman: Ben Ale, The Netherlands & Reniers Genserik, Belgium

E-mail: [ben.ale@xs4all.nl](mailto:ben.ale@xs4all.nl);

[genserik.reniers@uantwerpen.be](mailto:genserik.reniers@uantwerpen.be)

#### 4.29 Security

Chairman: Sissel H. Jore, Norway & Zdenek Vintr, Czech Republic & Genserik Reniers, Belgium

E-mail: [sissel.h.jore@uis.no](mailto:sissel.h.jore@uis.no); [zdenek.vintr@unob.cz](mailto:zdenek.vintr@unob.cz);

[genserik.reniers@uantwerpen.be](mailto:genserik.reniers@uantwerpen.be)



ESRA is a non-profit international organization for the advance and application of safety and reliability technology in all areas of human endeavour. It is an “umbrella” organization with a membership consisting of national societies, industrial organizations and higher education institutions. The common interest is safety and reliability.

For more information about ESRA, visit our web page at <http://www.esrahomepage.eu>

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

Please submit information to the ESRA Newsletter to any member of the Editorial Board:

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

#### Editorial Board:

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**Mitra Fouladirad** – [mitra.fouladirad@utt.fr](mailto:mitra.fouladirad@utt.fr)

University of Technology of Troyes, France

**Dirk Proske** – [dirk.proske@boku.ac.at](mailto:dirk.proske@boku.ac.at)

University of Natural Resources and

Applied Life Sciences, Austria

**Francesco Di Maio** - [francesco.dimaio@polimi.it](mailto:francesco.dimaio@polimi.it)

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**Igor Kozine** – [igko@dtu.dk](mailto:igko@dtu.dk)

Technical University of Denmark, Denmark

**Sylwia Werbinska** – [sylwia.werbinska@pwr.wroc.pl](mailto:sylwia.werbinska@pwr.wroc.pl)

Wroclaw University of Technology, Poland

**Eirik Albrechtsen** – [eirik.albrechtsen@iot.ntnu.no](mailto:eirik.albrechtsen@iot.ntnu.no)

Norwegian University of Science Technology, Norway

**Luca Podofillini** – [luca.podofillini@psi.ch](mailto:luca.podofillini@psi.ch)

Paul Scherrer Institut, Switzerland

**Marko Cepin** - [marko.cepina@fe.uni-lj.si](mailto:marko.cepina@fe.uni-lj.si)

University of Ljubljana, Slovenia

**Jana Markova** – [jana.markova@cvut.cz](mailto:jana.markova@cvut.cz)

Czech Technical University in Prague, Czech Republic

**Sofia Carlos** - [scarlos@iqn.upv.es](mailto:scarlos@iqn.upv.es)

Universidad Politécnica de Valencia, Spain

**Joël Luyk** - [j.luyk@delta-pi.nl](mailto:j.luyk@delta-pi.nl)

Soc. for Risk Analysis & Reliability, The Netherlands

**Uday Kumar** - [uday.kumar@ltu.se](mailto:uday.kumar@ltu.se)

Luleå University of Technology, Sweden

**Zoe Nivolianitou** – [zoe@ipta.demokritos.gr](mailto:zoe@ipta.demokritos.gr)

Demokritos Institute, Greece

**Elena Zaitseva** - [elena.zaitseva@fri.uniza.sk](mailto:elena.zaitseva@fri.uniza.sk)

University of Žilina, Slovakia

**Matthew Revie** - [matthew.j.revie@strath.ac.uk](mailto:matthew.j.revie@strath.ac.uk)

University of Strathclyde, United Kingdom