Safe manning of safety-critical systems

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Editorial

Enrico Zio
ESRA Chairman
Politecnico di Milano, Italy
École Centrale Paris,
Supelec, France

Dear ESRA member,

I hope you will enjoy reading the third issue (Fall issue) of our newsletter for 2012.

During summer, we have had the pleasure to meet and exchange at the ESREL 2012-PSAM 11 Conference in Helsinki, PSAM11 & ESREL 2012 (https://www.psam11.org/www/fi/), which confirmed to be a major international event in safety and reliability analysis. The Conference brought together an impressive number of people (close to 900 participants!) with different expertise and experience from various industries, research organizations, regulatory authorities and universities.

The Conference was truly multi-disciplinary and allowed cross-fertilization of methods, technologies and ideas under development and applied in different fields like nuclear, process and chemical industries, off-shore and marine, space and aviation, IT and telecommunications, bio and medical technology, civil engineering and financial management, as a perfect blend of ESREL and PSAM traditions. This resulted in quite interesting technical sessions and inspiring keynote lectures, including those offered by representatives of our ESRA technical committees (thanks to Pierre-Etienne Labeau, Luca Podofillini and Antoine Rauzy for their contribution): I encourage you to go in the webpage of the Conference and download the files of these presentations (in the "news" section), for future reference and inspiration.

At the Conference in Helsinki we also had the opportunity to meet in the General Assembly to discuss old and new open issues in the running of the Association and its activities. I was personally pleased by the serene and constructive atmosphere in which discussions took place, founded on the well-being of ESRA built on the efforts of the previous Chairmen and Officers. One matter which deserves a particular mention is the approval of the new statutes of the Association, which have been updated to reflect its current objectives and operation modes.

Motivated by the success in Helsinki, ESRA is continuing the efforts of organising the series of ESREL conferences. Activities are picking up for the next ESREL 2013 Conference (http://www.esrel2013.org/) and I invite you to contribute abstracts for it, within the deadline of December 15.

Meanwhile, our colleagues of Wroclaw University in Poland rest attentive for making the best out of these Conference experiences for their future ESREL 2014 Conference.

Finally, I close by thanking you all for your continuing support to ESRA and participation to its activities and running.

Enrico Zio
Chairman of ESRA

Feature Articles

Safe manning of safety-critical systems

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Introduction

The size of operational teams, the levels of their qualification and training are the determinants for securing their ability to control abnormal situations in safety-critical systems such as nuclear and chemical plants, railway systems, marine transportation, and offshore oil production and drilling platforms. A lack of qualified operational personnel in abnormal conditions may result in a lack of process control, which in turn can lead to a major accident. The steep rise in productivity in European chemical industry combined with the gradual decrease in staffing is one of the reasons for a growing concern [1]. The recent catastrophe in the Gulf of Mexico brings a great deal of attention to the staffing issue in the offshore oil production industry as well. As it is stated with regard to the Gulf catastrophe: "over the years, the manning dwindled down and down and safety was compromised by this" [2]. Safe manning of merchant ships is a hot topic in the international debate as well. Finding the right staffing balance that can guarantee that safety-critical activities are performed safely is a complex issue with sizable research potential.

Background and state-of-the-art

The literature on research-based approaches to optimising staffing levels of safety-critical systems is limited, indicating that little research has been done in this area. New nuclear plant designs and new control rooms developed recently have revived interest in the staffing issue too [3], [4]. In the nuclear domain the problem is tackled from two different angles: (1) applying task-based analysis of different plant designs and (2) using human-operated simulators to see whether the staffing arrangement in the control room can safely manage abnormal or/and accidental situations.

Another method for assessing the manning levels was suggested for the control rooms of chemical installations [5]. This document describes the extensive instrument and by using it, bottle necks in personnel arrangements can be pro-actively detected and handled. Though, the method is not valid for abnormal and emergency situations.

A completely different staffing evaluation methodology targeted at safety-critical and emergency activities was suggested for chemical production as a whole and described in [1]. The evaluation of staffing levels is elaborated in the form of a check list to consider safety-critical tasks in the control room as well as in the field.

The approach and tool to safe manning developed at Technical University of Denmark (DTU) is different and consists in building the so-called Discrete-Event Simulation (DES) models that imitate human activities. If properly developed, the models become a valuable supporting tool for safe manning of potentially hazardous activities. As a starting point, the single-channel theory of selective attention [6] is employed. The activities of human beings represented as a single-channel server performing tasks sequentially can be modelled by queuing systems that in turn are easily amenable to modelling in DES environments.

Manning of ships, both civil and war, is a domain where the use of advanced DES models preceded by a task-based analysis becomes good engineering practice [7], [8]. A team of researchers at DTU has come a step further: a generic computer simulation engine for supporting safe manning of ships has been developed. The software library [9] is written in C♯ .NET 4.0 (Microsoft) and can be used on platforms such as Windows, Linux, and Mac OS X. It is divided into two parts: an open-source generic DES engine (core), and a closed-source software module containing the logic specific to the maritime domain[1]. Other modules could be developed for various domains thanks to an API (application programming interface).

Tool is validated for merchant ships

The developed generic DES engine for simulating human activities has been validated for the merchant ship domain. On a general note, all ships must be safely manned and a minimum staffing for each ship is mandatory. From country to country the minimum staffing is differently defined and the number of crew members can deviate significantly as well. To support making decisions on this issue, a tool was needed that can provide an objective foundation and documentation. As long as all needed tasks are performed as prescribed and safely, the fewer violations of rest rules take place on board, the better

[1] The project was developed in collaboration between the Technical University of Denmark, FORCE Technology (Maritime Division, Denmark), and the Danish Maritime Authority. It was financed by the Danish Maritime Fond.

the staffing is. Given the high dimensionality of the problem, its dynamic nature, stochasticity of tasks durations and other events as well as the non-linearity of tasks durations dependent on the phases of the ship's voyage, one can hardly expect to develop a mathematically well-defined optimisation problem that can be solved analytically. This is why DES modelling is the method of our choice.

To make the generic core domain specific, a maritime module has been developed. Both the engine and module can model all the functions of a ship, and the interaction between staff and these functions. An important achievement of the whole safe manning project is its data structure, capable of modelling the problem, used behind the scene when the end-user is inputting the data, and then by the simulation engine when running the scenario and producing relevant outputs. The concept of *ship* is at the heart of the data set. A ship can contain an arbitrary amount of *tasks*, *crews*, *crewmembers* (e.g. "The captain"), *phase types* (e.g. "Sea passage"), *phases* (e.g. "Sea passage from Amsterdam to London"), and *scenarios*. The information is stored in XML files.

The simulation generates a number of outputs, in particular to help estimating the possibility for the crew to perform all tasks while complying with regulations about rest rules. The average number of rest rules violations is reported for each crewmember, classified by phase type (e.g. port or sea passage), and type of rest rule. Indications regarding the quality of work are mainly provided by the average number of task failures, for instance because tasks were inopportunely interrupted, or could not be completed on time. The crew must be revised until reaching a negligible number of task errors and violation of rules.

Concluding notes and further research

The approach to safe manning of safety-critical systems consisting in imitating human performance in discrete event simulation environments and thoroughly validated for merchant ships becomes gradually accepted by users in different domains. We consider the performed project as a progressive step towards a scientifically grounded approach to safe manning of safety-critical systems. The work on this topic continues and a number of challenges are going to be solved. To our best knowledge, no approach to manning (except for the nuclear domain) has been rooted so far in research results in human reliability, limited cognitive ability to manage complex tasks and combined with them limited physical abilities human operators to perform the tasks within time available with the required quality. The existing approaches and tools are not specifically targeted at assessing the staffing levels in abnormal and safety critical circumstances. The approach we are going to pursue in the future is the following: rooted in psychological and engineering theories of human performance, taking account of limited cognitive and physical abilities of humans and employing the power of computers and up-to-date relevant software to power the model.

References

[1] Reniers, G.L.L. et al. Engineering an Instrument to Evaluate Safety Critical Manning Arrangements in Chemical Industrial Areas. J. of Business Chemistry. Vol. 4, pp. 60-75, 2007

[2] http://coastalcare.org/2010/06/offshore-rigs-and-flag-of-convenience/

[3] B. P. Hallbert, A. Sebok and D. Morisseau. A Study of Control Room Staffing Levels for Advanced Reactors. NUREG/IA-0137, 2000

[4] Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs Study of Construction Technologies. U. S. Department of Energy Cooperative Agreement DE-FC07-03ID14492, 2004

[5] Brabazon, P., and Conlin, H. (2001) Assessing the safety of staffing arrangements for process operations in the chemical and allied industries. Health and Safety Executive, London, UK.

[6] Liu, Y. Queuing Network Modeling of Human Performance of Concurrent Spatial and Verbal Tasks. *IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans*, 1997, Vol. 27, No. 2, March

[7] Kursen er sat mod sikker bemanding. Dynamo, Danmarks Tekniske Universitet, marts 2010, nr. 20, pp. 5-7.

[8] *T. J. Scofield*. 2006. Manning and Automation Model for Naval Ship Analysis and Optimization. Master's Thesis, Virginia Tech.

[9] SimManning open-source library for discrete-event simulation of manning, by the Technical University of Denmark:

Empirical evidences on technologies and services for maintenance in the Italian industry

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Introduction

On February 22, 2012 the first annual research report of the *Observatory on Technologies and Services for Maintenance* of the School of Management of

Politecnico di Milano (TeSeM - www.tesem.net) was presented during a public event, attended by more than a hundred companies from the Italian industry.

The Observatory is a research structure developed with the aim to monitor the state of the art of maintenance choices in the field of industrial plants and infrastructures, within small, medium and large companies located in different regions of Italy. The main purpose of TeSeM is to observe the innovations in technologies and services for maintenance: to this end, a research is carried on an annual basis, through case studies and industrial surveys involving both demand-side firms (as plant operators and asset owners) and supply-side firms (as suppliers of technologies and services).

A collaborative network of Italian universities, sharing the mission of the Observatory, has been created to achieve the objectives of the research through Italy: Politecnico di Bari, Università degli Studi di Bergamo, Università degli Studi di Bologna and Università degli Studi di Firenze contributed to the results obtained in this first annual research [(1)]. An interest for the next years is to enlarge the network at an European level, with the intention to make a comparison of state of the art of different industries across different countries.

Objectives and results of the first annual research

The research aimed at studying the state of the art of organizational, technological and managerial practices required to evolve towards a better balance of maintenance policies, between corrective, time based and condition based preventive maintenance. A specific interest of the research was to study the technological and organizational choices required for the implementation of condition based maintenance programs, as they are adopted in the Italian industry.

Accordingly to the objectives, the results of the research, based on the interviewed companies, are the followings:

- an understanding of how the value of maintenance policies, as "tools" for increasing the business competitiveness, is perceived by the companies;
- an evidence on the distribution of maintenance resources (i.e. dedicated time and costs) between different maintenance policies;
- the identification of the most used and most promising technical and organizational solutions resulting from a combination of maintenance choices (such as: the investment on a CMMS / ERP for the maintenance information system; the development of a maintenance engineering department / function; the development of different types of outsourcing concerning different types of activities / services, ranging from more operational activities to services of technical and economic analysis supported by third party specialists);
- the identification of good / best practices adopted within the maintenance processes in the companies and, subsequently, the definition of a roadmap for the evolution of practices towards more innovative processes;
- the setup of a vision on the evolution of condition based maintenance practices, according to the current state of the art observed in the companies.

In order to identify the good / best practices, as well as to define the roadmap, a methodology for maintenance maturity assessment was developed and adopted within the research scope of this first year of the Observatory. The methodology enables to define a maturity ranking and ends up with the identification of the state of practices inside the interviewed company according to a ranking scale ranging from ML1 (maturity level correspondent to poor practices) to ML5 (maturity level correspondent to well-developed practices, improved according to a continuous improvement approach).

The methodology was developed using, as a main source of inspiration, the CMMI (*Capability Maturity Model Integration*): this method, proposed by the Software Engineering Institute at Carnegie Mellon University, is one of the most mentioned models for building a maturity assessment system. In the TeSeM case, the CMMI was the basis for a further development aimed at establishing an assessment method for the maturity of practices in maintenance processes. The method was initially designed and empirically tested during the first development phase, thanks to the collaboration with different researchers from different institutes and professionals from an industrial association[(2)]. This first annual research of TeSeM enabled to achieve the final release of the questionnaire for maturity assessment, used for gathering a relevant part of information from the different industrial companies target of the interviews

Sample size of the first annual research

The research results come out from interviewing companies through a questionnaire shared between the universities participating in the annual research:

- a total of 108 survey respondents was achieved, distributed between manufacturing industry (56%), process industry (32%) and infrastructures / networks as public utilities (12%);
- among them, 89% of the respondents are located in four Italian regions (Lombardia, Emilia Romagna, Puglia and Toscana), accordingly to the location of the universities involved in the research, while the remainder is in other 6 regions through Italy.

Besides, 6 business cases were carried out in order to make an in-depth analysis of innovation in maintenance, as a validation of the results achieved with the survey, especially for what concern the roadmap. During these case studies, a specific objective was pursued: to study the link between maturity of maintenance practices – analyzed through the maturity assessment – and profitability of specific innovations in maintenance – studied through a cost

benefit analysis, with consideration of both tangible / intangible costs and benefits.

Short summary of survey results

Herein a short summary of the survey results is provided:

- maintenance policies are considered as important "tools" for business competitiveness especially by the top management of companies operating in the process industry;
- business results achieved by leveraging on maintenance policies are lower than the expectations of the top management;
- infrastructures / networks as public utilities spend more resources on preventive maintenance than the other sectors, followed by process industry and manufacturing industry; the average expense is however widely dispersed depending on specific industries and their own business objectives / strategies;
- the development of a maintenance engineering department / function is quite an important choice to achieve best in class performances, while the CMMS / ERP helps if combined with other choices; last but not least, outsourcing is a topic of wide debate, in some cases outsourcing is really a winning choice, in other cases companies leverages on an insourcing strategy to achieve an high level of performances;
- different process areas of practices were characterized through maturity assessment; some have achieved poor maturity levels (for example, the practices related to maintenance engineering process area are still immature in many companies), some others are quite developed, even if they could be improved (for example, practices related to maintenance information systems and their use); hence, the roadmap towards more mature processes identifies a way to go through different maturity levels in order to innovate maintenance management (for example, the investment in maintenance engineering should be graduated depending on the initial maturity level of the company);
- condition based maintenance practices are still poor for many reasons, for example the research brought evidence on a scarce integration of condition based maintenance platforms within the maintenance information system and a scarce development of diagnostics and prognostics, being monitoring and inspection data mainly analyzed by specialists.

References

CMMI Product Team. Capability Maturity Model Integration (CMMI), Version 1.1. Pittsburgh, PA, USA: Carnegie Mellon University, 2001.

Elefante D., Fumagalli L., Garetti G., Levrat E.. A Road-map to the Implementation of Advanced ICTs in Maintenance Organization. In proceedings of the 9th IFAC Workshop on Intelligent Manufacturing Systems, special sessions on "Advanced Maintenance Engineering, Services and Technology", Szczecin, Poland, October 2008.

Fumagalli L., Elefante D., Macchi M., Iung B.. Evaluating the role of maintenance maturity in the adoption of new ICT in the process industry. In proceedings of the 9th IFAC Workshop on Intelligent Manufacturing Systems, special sessions on "Advanced Maintenance Engineering, Services and Technology", Szczecin, Poland, October 2008.

Fumagalli L., Di Leone F., Jantunen E., Macchi M.. Economic Value of Technologies in an e-Maintenance Platform. In Preprints of 1st IFAC Workshop, A-MEST'10, Advanced Maintenance Engineering, Services and Technology, Lisboa, Portugal, July 2010.

Macchi M., Fumagalli L., Pizzolante S., Crespo Marquez A., Gomez Fernandez J.. Towards e-Maintenance: maturity assessment of maintenance services for new ICT introduction. In proceedings of the APMS (Advanced Production Management System) 2010 conference. Como, Italy, October 2010.

(1) The Observatory expresses its gratitude to: Dr. Eng. Giorgio Mossa from Politecnico di Bari, Dr. Eng. Stefano Ierace from Università degli Studi di Bergamo, Prof. Alberto Regattieri from Università degli Studi di Bologna and Dr. Eng. Filippo de Carlo from Università degli Studi di Firenze.

(2) The Observatory express its gratitude to: Prof. Benoit Iung and Dr. Eng. Eric Levrat from CRAN laboratory of the University of Nancy; Prof. Adolfo Crespo Marquez and Dr. Eng. Juan Gomez Fernandez from Seville University; Dr. Eng. Erkki Jantunen from VTT research centre; Eng. Vladimiro Carminati, Eng. Mario Guarino and Eng. Alberto Zaramella from the @megmi no profit association of maintenance professionals.

PhD Degrees Completed

Quantitative techniques for the vulnerability analysis of critical network systems and infrastructures

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Supervisor: Prof. Enrico Zio

Co-supervisors: Dr. Giovanni Sansavini and Prof. Gilles Motet

Problem statement

The subject of this Ph.D. thesis is the analysis of critical network systems and infrastructures with respect to their vulnerability to random failures and targeted attacks. The work was funded by the Institute for an Industrial Safety Culture (ICSI) of Toulouse, France. The focus of the research work was on the modeling of CI as complex systems from the standpoint of network theory. The basic concept of network theory is to build an abstract model of real-world networks and describe the form and, in various degrees, the function of the network by different measures (Figure 1).

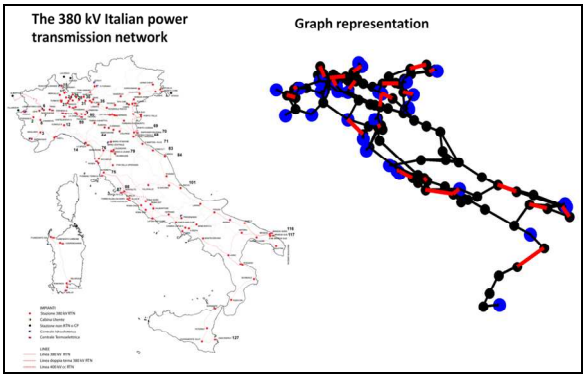


Figure 1 - Example of the topological representation of a CI

Research performed

A pure *topological network analysis* was performed in order to quantify the structural importance of the network components. Several centrality measures have been introduced (e.g. the group degree, closeness and betweenness centrality) and the most important groups of elements of different sizes have been identified within a multi-objective GA framework.

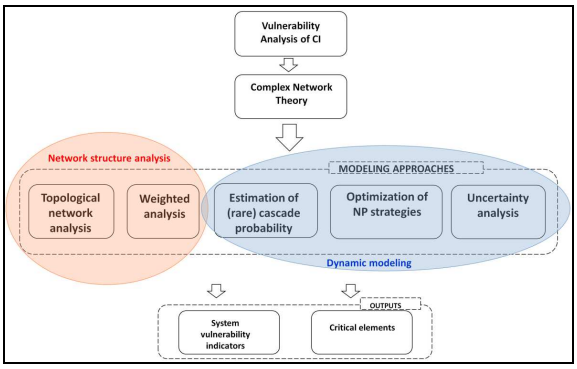


Figure 2 - Pictorial view of the CI vulnerability assessment performed in the Ph.D. research work carried out at LASAR

It was observed that critical groups of components may include components that are not critical when considered individually. Therefore, the criticality of these components may be underestimated if the importance ranking is performed only with respect to individual components.

While the topological approaches for identifying critical components are capable of highlighting structural vulnerabilities, they are limited from the point of view of the functional, physical analysis of the CI. In this view, the importance of groups of edges from the viewpoint of the network structure and flow was analyzed. It has been shown that the topological approach requires minimum information of the network and leads to the identification of a number of critical edges that have also „functional relevance. Nonetheless, the vulnerability analyses based on network structure and flow information provide complementary information.

In spite of the usefulness and of the insights provided by the unweighted topological analysis, empirical results show that it can capture only partially the complex properties observed in a real CI, so that there is a need for extending the models beyond pure unweighted, structural topology.

In this view, the formalism of *weighed networks* has been exploited to provide different graph-theoretical representations and analyses of a power transmission system. Four different perspectives of analysis were considered within the formalism of weighed networks, adding to the purely topological analysis of the system the reliability and electrical characteristics of its components. Based on the comparative evaluation of the perspectives with respect to other approaches for vulnerability assessment, a framework that incorporates the four perspectives in a preliminary screening analysis of network vulnerability was proposed. By performing such an analysis, a better comprehension of the system is achieved, and the different criticalities within the network components are highlighted.

By nature, topological, weighted or unweighted, analyses focus on the static properties of a network. A further important dimension to add to the vulnerability characterization of CI refers to modeling the dynamics of flow of the physical quantities in real network systems. From the abstract modeling of a cascading failure propagation process, it has been possible to accurately *estimate*, by Monte Carlo Simulation (MCS), *the probability of cascading failure under given load conditions*, described by a normal distribution.

The problem of *optimization of protection strategies in critical infrastructures* within a complex network systems perspective was also addressed. Three different protection strategies were proposed that minimize the consequences of cascading failures on the entire system, on predetermined areas or on both scales of protective intervention in a multi-objective optimization framework. The protection strategies

were optimized by devising a modified binary differential evolution scheme that overcomes the combinatorial complexity of this optimization problem.

In the final step of the CI analysis, the *characterization of uncertainties related to electric transmission networks* has been undertaken. In order to quantify the impact that the propagation of the identified uncertainties has on the reliability of the electric infrastructure we developed a stochastic model that simulates the operations of the electric network. The event-based model was embedded in the MCS framework and has shown the ability to represent daily hourly changes in power requests at customer side of the system, room temperature and wind speed. We noticed that increasing variability in the operating conditions lead to an increase in the generated power that may not reach the customers.

Conclusions

The results of this thesis work support the belief that the methods of complex network theory can provide information useful for the vulnerability assessment of CIs, within a screening analysis of their behavior. The screening analysis can be supported by structural information provided by system owners and operators, including the general understanding of main functionalities, interfaces and interdependencies. The evaluation of the statistical indicators derived from the methods of complex network theory can highlight preliminary vulnerabilities, e.g. structural or reliability bottlenecks, which must be the focus of a successive detailed system analysis.

Safety and Reliability Books

Assessment of Power System Reliability - Methods and Applications

M. Čepin, University of Ljubljana, Faculty of Electrical Engineering, Slovenia

The importance of power system reliability is demonstrated, when the electrical energy is lost, no matter if the loss causes the shutdown of our companies and consequently huge economic deficits or the loss only slightly decreases the comfort of our free time at home.

The objective of this book is to contribute to the improvement of power system reliability. The book consists of six parts divided to twenty chapters.

The first part of the book presents the introductory chapters comprising the background issues important to power system reliability including selected blackouts, which are some of the main issues with which the power system reliability has to face. The second part presents the reliability methods, which are used for analyses of technical systems and processes. The third part presents the power flow analysis methods, because the dynamic aspect of the power system is an important part of the related reliability assessments. The fourth and the most important part presents the various aspects of assessing the reliability of power system and its parts including the generating capacity methods, the reliability and performance parameters of selected power plants, the distribution system reliability measures, which highlight the reliability of power system from the eyes of final users. The fifth part presents the optimization methods and the sixth part presents the integration of selected reliability and optimization methods.

The chapters of the book have been written in a simple language including the mathematical representation of the methods with emphasis on their practical use. The book contains simple examples in order to facilitate the understanding of the theory behind and to highlight the procedures for application of the presented methods.

The expected users of the book are the power engineering students, both the undergraduate and graduate level, and the engineers in the electric power industry.

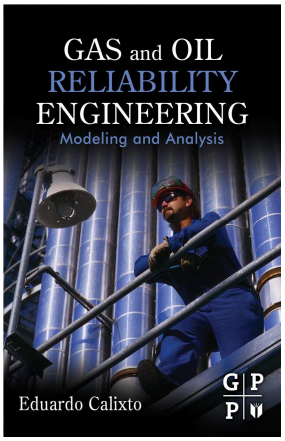
Springer 2011 -
http://www.springer.com/engineering/energy+technology/book/978-0-85729-687-0

Gas and Oil Reliability Engineering – Modeling and Analysis

Eduardo Calixto
Bombardier
Gorlitz, Germany

The advent of reliability engineering tools coupled with the cost of oil and gas operations has changed the paradigm of maintenance technology, product development and process performance. A simple strategy of efficient replacement of failed equipment/component has been transformed into a more complex but proactive approach for keeping

equipment running at peak efficiency concept of reliability engineering. In addition, product development phases are being also supported by Reliability Engineer tools as well as system performance analysis.



Applied Oil and Gas Reliability Engineering: Modeling and Analysis is the first book to apply reliability engineer a long enterprises lifecycle analysis to the Oil and gas Industry. With this book in hand, engineers also gain a powerful guide to the most important methods tools which aid in the planning and execution of an effective reliability target for equipments, equipment development, inspection and maintenance program, system performance analysis, as well as human factor and safety assessment.

Concise and easy to understand, the book identifies equipment and procedural problems inherent to oil and gas operations then applied a systematic approach for solving them. In this book, the author combines qualitative and quantitative methods with powerful software modeling tools to assist engineers in formulating reliability and availability targets for systems and equipments, a custom maintenance policy which will ensure process efficiency, reduce projects cost, reduce redundancies and optimum equipment replacement time.

Dr Eduardo Calixto is Bachelor of Science in Production Engineer by Federal Fluminense University, Master of Science in Safety Management by Federal Fluminense University (LATEC) and Doctor of Science in Energy and Environment, research line on risk analysis and management by Federal University of Rio de Janeiro (Coppe). Worked as professor of Risk Analysis and Management by Pontificia University Catholic (PUC-RJ) on Safety Engineer Specialization course from 2009 to 2011.Was certified as Reliability Professional (CRP) in 2006 by ReliaSoft Corporation.

The last ten years has been dedicated to Reliability Engineer in Oil and Gas Industry. From 2001 to 2003 work by Vale as Production Engineer. In 2004 start to work by Petrobras as Production Engineer carry on Reliability Engineer Analysis and Risk Assessment until 2011. From 2010 to 2011 worked as Reliability Consultant by Reliasoft Brasil and ReliaSoft Corporation. Has published several papers on The European Safety and Reliability Conference (2006, 2007, 2008, 2010, 2012), Internaional Applied Reliability Simposium (2010, 2011, 2012), Simposio Internacional de Confiabilidade (2004-2011), Working on Safety (2006,2008,2012) and Euromaintenance 2012. Nowadays work as RAM specialist by Bombardier in Gorlitz, Germany.

Calendar of Safety and Reliability Events

10th International Probabilistic Workshop

Stuttgart, Germany, 15-16 Nov., 2012

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.

The event is organized by the Institute of Geotechnical Engineering, University of Stuttgart, Stuttgart, and the Institute for Mountain Risk Engineering, University of Natural Resources and Applied Life Sciences, Vienna.

Submission deadlines

Submission of abstract:	1st May 2012
Submission of final paper:	17th August 2012

Website

http://www.uni-stuttgart.de/igs/igs_verschiedenes/Veranstaltungen/Probabilistic_Workshop

Further information from:

Prof. Christian Moormann (info@igs.uni-stuttgart.de)
or
Dr.-Dirk Proske (dirk.proske@boku.ac.at)

Advances in Risk and Reliability Technology Symposium

Leicestershire, United Kingdom,
21 - 23 May 2013

The 20th AR^{2}TS will be an international forum for presenting and discussing recent advances made in the general area of reliability, risk, availability and maintainability. Contributions will be provided from both the university sector and from industry. It will be of benefit to both practitioners and academics involved in this field who want to keep in touch with the latest developments and perhaps through discussion, influence the future direction of work.

The event is organized by Loughborough University and the University of Nottingham, in collaboration with: The Safety and Reliability Society and The Institute of Mechanical Engineers .

Important dates

31 October, 2012 - Deadline for receipt abstract.
5 November, 2012 - Informed of provisional acceptance and full paper requested.
4 February, 2013 - Deadline for receipt of full draft papers.
4 March, 2013 - Notification of final acceptance of papers.
15 April, 2013 - Deadline for receipt of final papers.

Conference Website:

www.nottingham.ac.uk/engineering/conferences/ar2ts

2nd International Conference on Transportation Information and Safety - ICTIS 2013

Wuhan, China, 28 June - 1 July

Conference Website: www.ictis-online.org:8080/ictis

8th International Conference on Mathematical Methods in Reliability: Theory, Methods, and Applications - MMR2013

Stellenbosch, South Africa, 1-4 July

The theme of MMR 2013 is "Reliability: A View of the Past and Ideas for the Future" . It aims at enhancing international exchanges and promoting advances in reliability/risk theories and techniques, and organizing an international forum on emerging issues in reliability engineering and risk management. We sincerely hope that you can join us for a rich experience in this unique environment.
Conference Website: www.sastat.org.za/mmr2013

4th International Conference on Risk Analysis and Crisis Response (RACR 2013)

Istanbul, Turkey, 27-29 August

Important dates

Deadline	Notification
Special session proposals	1 December 2012 1 January 2013
Abstract submission	1 February 2013 15 February 2013
Paper submission	1 April 2013 15 April 2013
Final paper due	1 May 2013

Contact

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Conference Website: www.flins2012.itu.edu.tr

2013 Prognostics and System Health Management Conference - PHM 2013

Milan, Italy, 8-11 September 2013

As many efforts are being devoted to the development of techniques for health monitoring, fault detection, diagnosis and prognosis with the intent of improving the safety and economic performances of existing and future structures, systems and components, this conference aims at exchanging on the state of the art in Prognostics and System Health Management (PHM) research and application.

Presentation of developments in various industrial fields is expected to highlight differences in research challenges and practical needs, while at the same time beneficiating from cross-fertilization of methods and applications.

The PHM-2013 Conference is promoted by the Chair on Systems Science and the Energetic challenge, European Foundation for New Energy-EDF, Ecole

Centrale Paris-Supelec, France and Politecnico di Milano, Italy.

The event is organized by AIDIC, The Italian Association of Chemical Engineering.

Details on the Conference may be found at http://www.aidic.it/phm>www.aidic.it/phm

The First Deadline for Abstract Submission is: **23 October, 2012**

Submission of abstracts can be done electronically at

http://www.aidic.it/phm/abstractsubmission.html>http://www.aidic.it/phm/abstractsubmission.html

Do not miss this opportunity for presenting your work, meeting academic researchers and industrial experts, and contributing to this competent forum.

Accepted papers presented during the Conference will be published in Chemical Engineering Transactions http://www.aidic.it/cet>http://www.aidic.it/cet. The quality of this publication is valued by ISBN & ISSN numbers, referenced by SCOPUS and THOMSON REUTERS (ISI Web of Knowledge, conference proceedings) indexes.

Also, the extended version of selected papers presented at the Conference will be proposed for special issues on indexed scientific journals.

The PHM Organizers will be very pleased to receive your scientific contribution and already greatly appreciate your personal help in disseminating the call for papers.

For any further information or assistance you may contact the secretariat at phm@aidic.it.

Important dates

October 23, 2012 - Abstract Submission
November 23, 2012 - Abstract Acceptance
January 23, 2013 - Full Paper Submission
March 23, 2013 - Notification of Acceptance/Rejection
April 3, 2013 - Notification of lecture/poster presentation
May 23, 2013 - Final revised manuscript submission and Registration deadline for Authors to have the paper included in final program and proceedings

Secretariat

Correspondence should be addressed to AIDIC Secretariat:
PHM-2013 Secretariat
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Conference Website: www.aidic.it/phm

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
- Technical University of Liberec, 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
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- TU Braunschweig, Germany
- Institute of Nuclear Technology Radiation Protection, Greece
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- Universita Degli Studi di Pisa, Italy
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- Institute for Energy Technology, Norway
- Norwegian Univ. Science & Technology, Norway
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- Institute of Fundamental Techn. Research, Poland
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- Fluminense Federal University, Brazil
- Pontifícia Universidade Católica, Brazil
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- European Commission - DR TREN (Transport and Energy), in Luxembourg
- Vestel Electronics Co., Turkey

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3 Management Board

The Management Board is composed of the ESRA Officers plus one member from each country, elected by the direct members that constitute the National Chapters.

4 Standing Committees

4.1 Conference Standing Committee

Chairman: K. Kolowrocki, Gdynia Maritime Univ., Poland

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.

4.2 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.

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