ESRA

European Safety and Reliability Association

Newsletter

http://www.esrahomepage.org

June 2015

Editorial

Terje Aven
ESRA Chairman
University of Stavanger, Norway

Dear ESRA Colleagues,
It is summer and I hope you all will be able to relax and enjoy some weeks off, and in this way build energy and enthusiasm for the work coming up. Many of us will meet in Zurich in September for the ESREL conference. I am both delighted and excited when hearing that more than 500 papers will be presented. A great conference program it will be, with also several plenary speakers, all being highly recognized experts in our fields. I cannot wait hearing Nassim Taleb talking about black swans and the concept of antifragility.
A key task for the ESRA officers is to seek out opportunities for providing tangible benefits to our members. Several new initiatives are being considered, including webinars. The primary objective of the webinars is to offer the members of ESRA opportunities to gain insights from recognized experts in various topics, in an efficient and stimulating way. Since these webinars are held online and can hence be attended without any travel time and travel expenses, the webinars provide a possibility for taking part in an exciting learning activity without much effort and investments. Please contact me if you are interested in offering such webinars for ESRA.
We also work on improving the communication platform in other ways; we need for example a more living website. Measures have been taken to this end and we hope to present the new initiatives at the ESREL conference in Zurich.
In my December 2014 editorial I mentioned the new glossary that the Society for Risk Analysis (SRA) has developed. 22 June 2015 it was approved by the SRA Council and it is now made available to all (see http://www.sra.org/frasg). I am convinced that this glossary will also be very useful for our society.

With kind regards,
Terje Aven
Chairman of ESRA

Feature Articles

The study of the national context – a need when planning a National Geological Repository

Veronica Andrei
Romanian Association for Nuclear Energy
Romania

The national context (NC) aspects might be potential reasons for significant delays in the schedule of an early geological disposal program while the existing international expertise and cooperation cannot be

used to fix these delays without a more detailed and adapted analysis [1].
The author made a research on how to set up the essential aspects of the specific NC that define the basis of the current National Geological Repository (NGR) Strategy dedicated to the nuclear spent fuel generated by the Romanian Nuclear Power Plant (issued in 2009) allowing its updating by evolving to a sustainable NGR program.
A PESTEL (P=Political, E=Economical, S=Social, T=Technical, E=Environmental, L=Legal) analysis was used to help understanding the "big picture" forces of change that the duty of the elaborator and implementer of the NGR program might be exposed [2]. The analysis was integrated as the first step in a gradual systematic study of the national context risks (NCRs) influence on the current NGR Strategy, as represented in Fig.1. The methodology used for performing each step of this study relied on producing a set of documents containing comprehensive information and important outputs obtained on the basis of extensive analyses that were performed by using appropriate methods and tools, in agreement with international recognized standards and guides. The author relied on knowledge and experience from national and international nuclear projects.

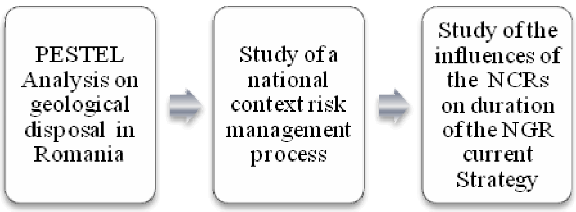

Fig.1. Gradual systematic study of the NCRs influence on the current NGR Strategy

Qualitative risk analyses made in the first 2 steps of the study have allowed [2]: to understand better the external factors that that would have an impact on the organizational environment within which the NGR program should be developed; and, to identify 21 NCRs most likely to impact the program together with their owners, sources and impacts as well as with the identification of their treatment strategy and plans.
The 3rd step of the study has been approached as a risk schedule analysis dealing with the uncertainties induced by NCRs on the durations of the current NGR Strategy schedule.
The idea was that it would be of a real need to define, with an adequate trusting level, a general process for analyzing the risks' actions and integrating adequate response solutions on the current NGR schedule, in well defined scenarios. Through such a process [3], the duration of the NGR's Siting and Site Licensing Process, which was found out to be influenced by NCRs, was calculated as a sum of the new estimated durations of its all major activities in each of the defined scenario.
To obtain confidence distributions for estimating durations, a triangular probability distribution for estimating the duration of each major activity was considered to be well satisfactory. Hence, the approach was to estimate 3 values - maximum time, minimum time and most likely time – which would represent new duration of each major activity in the current NGR schedule due to integration of response solutions to NCRs influence, as described in 3 distinct scenarios.
The main method used to manage the uncertainties was an approximate method of combination between PERT "Program Evaluation and Review Technique" and CPM "Critical path method" techniques used in project management [3].
The results of the study indicated that NCRs could delay the schedule of the Siting and Site Licensing Process with 17.5 years in the pessimistic scenario and 11.5 years in the most likely scenario.
The study of NCRs in different scenarios identified the need for a phase for preparation of the NGR program and required for defining an optimum solution for integrating risk responses for planning a sustainable NGR program, starting from its preparation stage. Currently, the author's research is on how to identify such a solution which should allow symbiosis from national and international expertise for integrating NCRs responses in the planning of the NGR program.
The author has made this research supervised by Prof. Ilie Prisecaru within the Doctoral School from Faculty Energetica at the Univ. Politechnica of Bucharest, Romania. The author would like to express her gratitude to the Romanian NGOs, AREN and Romatom, for providing support allowing exchange and dissemination of information with experts in different areas of the researches she has made. The author also expresses thanks Prof. Paul Ulmeanu for his useful comments and targeting for an increased dissemination of the work results.
[1] Andrei, V. and Prisecaru, I., Risk Management Process for National Geological Repository Program, Proceedings of WEC Central & Eastern Europe Regional Energy Forum – FOREN 2014, 22-26 June 2014, ISSN-L-2284-9491.
[2] Andrei, V. and Prisecaru, I. The use of PESTEL analysis in development of the Romanian Geological Repository, U.P.B. Scientific Bulletin, 2014, Series C, Vol. 76. ISSN 2286-3540.
[3] Andrei, V. and Prisecaru, I. The study of the national context in support of planning geological disposal in Romania, ICAPP 2015, Nice, France, May 3-6, (2015).

Dynamic fault detection from high-dimensional data streams

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Fault detection is a crucial step to enable the implementation of condition-based maintenance.

Early discovery of system faults may ensure the reliability and safety of industrial systems and reduce the risk of unplanned breakdowns. In industry, with the development of sensor technology and Information & Communication Technologies (ICT), reams of high-dimensional data streams are being collected and curated by enterprises to support their decision-making. However, it is generally hard to detect faults from these high-dimensional data streams using existing fault detection techniques.

Both high dimensionality and the properties of data streams impose stringent challenges on fault detection applications. From the perspective of data modeling, high dimensionality may cause the notorious “curse of dimensionality” and lead to the accuracy deterioration of fault detection algorithms. On the other hand, fast-flowing data streams require fault detection algorithms to have low computing complexity and give real-time or near real-time responses upon the arrival of new samples. In addition, concept drifts in the data stream demand fault detection algorithms to be adaptive to the time-varying behavior of the monitored system.

In this research [1], an Angle-based Subspace Anomaly Detection (ABSAD) approach to fault detection from high-dimensional data is developed. Based on the sliding window strategy, the approach is further extended to an online mode with the aim of detecting faults from high-dimensional data streams. The sliding window strategy assumes that recent data bear greater significance than historical data. It discards old samples from the window, inserts new samples into the window, and updates the parameters of the model iteratively. As shown in Figure 1, the sliding window-based ABSAD comprises two stages: offline model training and online fault detection. The first stage is a one-off task which learns the normal behavior of the samples from the first window and initializes the window profile. The second stage continuously processes each new observation from the data stream upon its arrival. To enhance the computational efficiency, the window profile is stored and maintained iteratively.

Based on the numerical illustration (see Table 1), it can be concluded that the proposed sliding window ABSAD algorithm can simultaneously tackle challenges associated with high dimensionality and data streams in fault detection tasks. Specifically, i) the experiments indicate that the ABSAD approach has the ability to discriminate low-dimensional subspace faults from normal samples in high-dimensional spaces. Moreover, it outperforms the LOF approach in the context of high-dimensional fault detection; ii) the experiments further demonstrate that the sliding window ABSAD algorithm can be adaptive to the time-varying behavior of the monitored system and produce better accuracy than the primitive ABSAD algorithm even when the monitored system has time-varying characteristics; iii) by applying the concept of trading space for time, the sliding window ABSAD algorithm can perform an isochronously online fault detection.

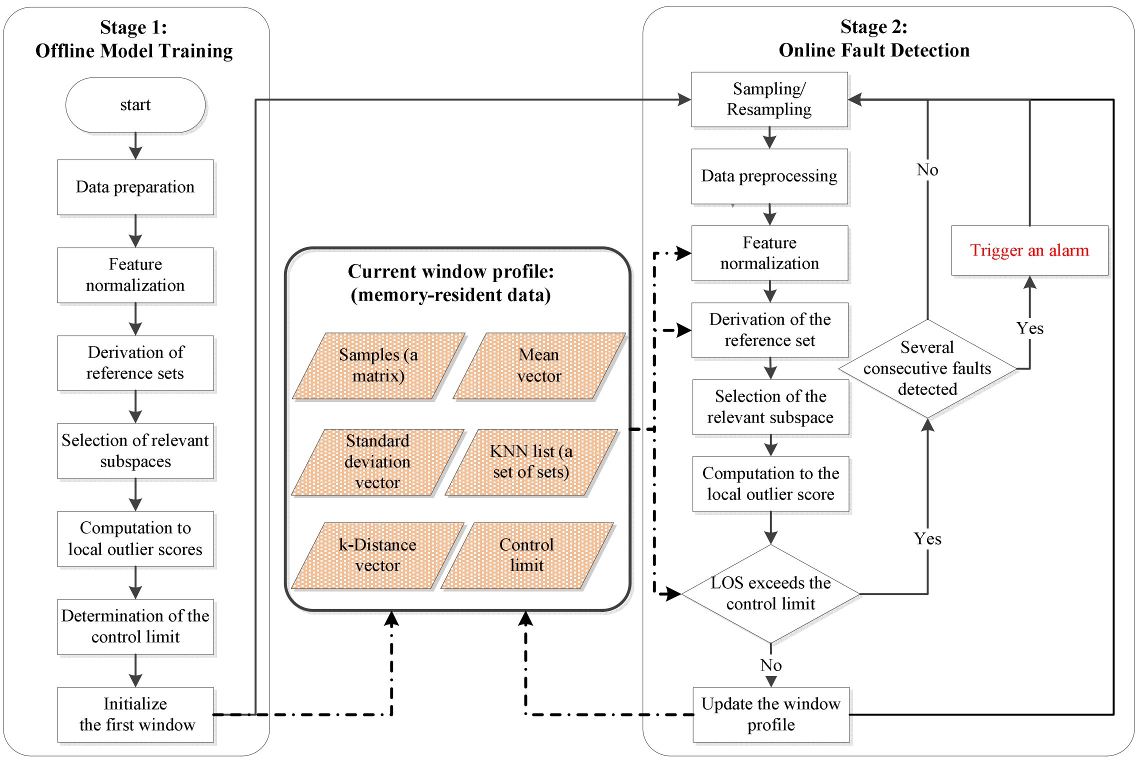

Figure 1: Structure of the sliding window ABSAD algorithm

Table 1: Fault detection results of the numerical example

Dataset and error type		Primitive LOF	Sliding window LOF	Primitive ABSAD	Sliding window ABSAD
Fault 1	Type I error	1.73[a]	1.73	8.4	0.67
	Type II error	32.2	91.8	0.2	4.4
Fault 2	Type I error	2.4	3.73	8.4	0.8
	Type II error	38.8	51	0	0
Fault 3	Type I error	2.8	2.27	8.13	1.2
	Type II error	0	36.4	0	0
Fault 4	Type I error	2.13	1.87	8.8	0.67
	Type II error	4.8	6.8	3.8	4.2

[a] Units of the decimal numbers in this table are in percent (%)

Reference

[1] L.W. Zhang. "Big Data Analytics for eMaintenance: Modeling of high-dimensional data streams". Licentiate thesis. Luleå tekniska universitet. Luleå, Sweden. June, 2015

Major hazards versus minor hazards

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Accidents associated with more complex event consequences related to Major hazards (electrical problems, explosion, fire) constitute only a small proportion of the work accidents (11%) whereas related to Minor hazards realised through simpler accident event consequences dominate with 42% attributable to body movements, 23% to slips, trips and falls and 21.5% to loss of control of machines and tools. Only 12 % of the fatalities and 2 % of long term sick leave were caused by the more serious hazards while the rest by the more minor hazards.

The Minor hazards and simple accident events need more awareness if the goal to reduce the number of severe consequences is to be achieved.

The hazards of nuclear power, oil and gas, chemical manufacture, rail transport and shipping are all associated with the potential for severe harm to many people and the environment. This kind of hazards is also named "Major hazards"; because the consequences could be great and therefor there are major efforts to minimize the likelihood of such accidents occurring. In contrast, work activities that do not pose the same degree of consequence severity, can be described as "Minor hazards" because in most cases work accidents lead to recoverable injuries to single individuals. Such accident events occur quite frequently and may not require reporting to the regulator unless they are particularly serious. The reduction of the number of accidents at work is usually focused on minimizing the risks of the more severe consequences at the expense of action on minor ones.

The goal is also to show that accidents with serious consequences happen in all type of accident events (as classified by type of accident scenario) and to show that accidents with serious consequences (deaths + permanent injuries + absence more than 6 months) happen in absolute numbers more often by Minor hazards like falls, trips, hit against, etc. than accidents connected with Major hazards.

Eurostat's special request (Eurostat request DK533) for the 27 member countries + Norway show 4,381 fatal accidents in 2009 and 4,567 fatal accidents in 2010 and a registered number of non-fatal work accidents of 4,499,437 for the two years (2,435,979 in 2009 and 2,054,510 in 2010). On the basis of the evaluation of underreporting in the individual countries, it is judged that these figures reflect around 3.5 million work accidents annually.

In the Eurostat system the "deviation" expresses what went wrong at the moment of the accident. The definition of deviation is the abnormal event or the last link in a chain of abnormal events that triggers the accident. The deviation is registered according to a two-digit classification (see appendix 2 for the first digit classification). A total of 63.2 % of the accidents have data about the deviation. The following Table shows data for 2009 and 2010 from the 27 European countries + Norway distributed for the deviation information (first digit level) and the accident's severity.

Deviation	Fatal	%	Most serious nonfatal injuries	%	Minor serious nonfatal injuries	%	Total	%
Deviation due to electrical problems, explosion, fire, overflow, overturn, leak breakage, bursting, collapse of materials	1.586	17,7	25.892	7,0	293.344	7,1	320.822	7,1
Loss of control of machinery, means of transport or handling equipment, tools, object.	2.595	29,0	38.052	10,4	570.535	13,8	611.182	13,6
Fall to lower or same level	1.304	14,6	73.223	19,9	587.872	14,3	662.399	14,7
Body movement with or without physical stress	546	6,1	62.334	17,0	1.047.274	25,4	1.110.154	24,7
Shock, fright, violence, aggression, threat, presence	321	3,6	4.515	1,2	72.856	1,8	77.692	1,7
Other deviations not listed above	400	4,5	3.593	1,0	56.683	1,4	60.676	1,3
Total	8.948	100,0	367.411	100,0	4.123.078	100,0	4.499.437	100,0

Eurostat registered accidents at work in 2009-2010 reported to Eurostat from 28 countries, according to severity of the accident and the type of deviation. The percentages are made for the columns.

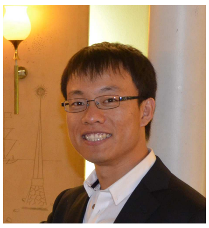
Because of the potentially severe consequences that major hazards represent a lot of effort has been, and has to be, taken to obtain the lowest possible probability for such an accident, often through technologically complex and tightly coupled systems with a high degree of control and defense-in-depth, developed through predictive analyses. As and when a major accident happens a lot of effort has been put into identifying causes and cause –consequence relations driving a learning process aimed at removing causes.
Simple occupational accidents have a much higher frequency and have in fact killed or permanently injured more people in total than the major accidents which have occurred. Nevertheless, the consequences for each occupational accident can be seen as minor compared to the major accidents. However this is only according to a view from society or the regulator; for the victims it does not make any difference whether they are killed or maimed alone or as one of a crowd. The types of hazards and causes leading to occupational accidents and injuries are many and complex and occur often in loosely coupled (work) systems. Most importantly, these systems are believed to be controllable by the victims or those close to them by removing the root causes, identified often by statistical analysis as their errors. The question is if that is true.

Reference

Eurostat (2013,1). Accidents at work and work related health problem data, http://epp.eurostat.ec.europa.eu/portal/page/portal/health/accidents_work_work_related_health_problems/data/database
Eurostat (2013,2). European Statistics on Accidents at Work (ESAW) Summary methodology. European Commission, Luxembourg. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-12-102/EN/KS-RA-12-102-EN.PDF
Jørgensen, K. (2015). Serious work accidents and their causes – an analysis of data from Eurostat, Safety Science Monitor, Volume 19, 2.issue.

PhD Degrees Completed

Failure Prognostics by Support Vector Regression of Time Series Data under Stationary/Nonstationary Environmental and Operational Conditions



Author: Jie Liu
Supervisor: Enrico Zio

This Ph.D. work is motivated by the possibility of monitoring the conditions of components of energy systems for their extended and safe use, under proper practice of operation and adequate policies of maintenance. The aim is to develop a Support Vector Regression (SVR)-based framework for predicting time series data under stationary/nonstationary environmental and operational conditions.

Failure prognostics within maintenance engineering aims at predicting the future health of the Systems, Structures and Components (SSCs) of interest on a short-term/long-term time horizon. The benefits of prognostic approaches include: warning of failures in advance; minimization of unscheduled maintenance; extended maintenance cycles; reduction of life-cycle cost of the SSC of interest by decreasing inspection cost and the SSC downtime; improved qualification of the SSC of interest, etc.

There are yet some challenges for failure prognostic approaches, including improving the robustness, adaptability and generalization power and estimating the uncertainty associated with the prediction. For the prognostic approach embraced in this thesis, i.e. SVR, there are also challenges for reducing the computational complexity and tuning the hyperparameters.

In this thesis, single SVR and SVR-based ensemble approaches are developed to tackle the prediction problem based on both small and large datasets. Strategies are proposed for adaptively updating the single SVR and SVR-based ensemble models in the existence of pattern drifts.

The research work carried out during the thesis is based on the work of Baudata and Anouar [1] who proposed Feature Vector Selection (FVS) to select part of the data points (Feature Vectors (FVs)) to represent all the other data points in Reproducing Kernel Hilbert Space (RKHS) with a linear combination of the FVs. As shown in Figure 1, any pair of two linearly independent vector, e.g. φ_1 and φ_2 can be seen as coordinate vectors which form an oblique coordinates system and any other vectors, e.g. φ_3 can be represented in this space as $\alpha_{31}\varphi_1 + \alpha_{32}\varphi_2$. For a vector, e.g. φ_4 outside the bi-dimensional space can be seen as a third coordinate vector when the space is extended to tri-dimension.

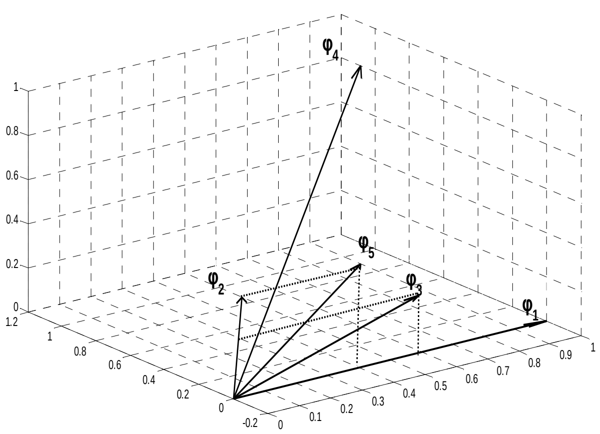


Fig. 1. Geometric explanation of FVS in RKHS.

For small datasets without pattern drifts, a single SVR model is trained with the proposed grid search approach to minimize the Mean Squared Error (MSE) and the width of the prediction intervals. In order to reduce the computational complexity, FVS is integrated for reducing the size of the training dataset. By minimizing the MSE on the whole training dataset during the training process, the generalization power of the SVR model is guaranteed.

For large datasets without pattern drifts, training a single SVR becomes computationally burdensome, and strategies for building ensembles are proposed. Different approaches are proposed for building diverse sub-models and calculating their weights. The outputs of the sub-models are combined with a weighted-sum strategy. The main novelty of the proposed ensembles is dynamically calculating the sub-models weights for each test data point, as shown in Figure 2.

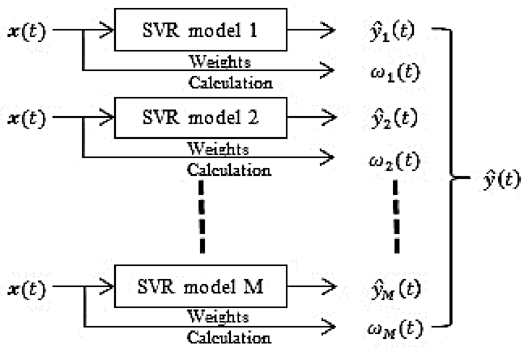


Fig. 2 Paradigm of a dynamic weighted ensemble approach.

In the situations with pattern drifts, adaptive online learning approaches are proposed separately for single SVR model (Online-SVR-FID) and ensemble (OE-FV). Based on FVS, two types of pattern drifts are firstly defined: new patterns and changed patterns. Different actions are taken to make sure that the single model/ensemble follow efficiently the current patterns. Online-SVR-FID can follow timely and precisely the ongoing patterns, but some past patterns are deleted from the model during the update process. OE-FV aims at solving this problem by storing all the past patterns in the ensemble. Each sub-model represents a certain period of the data. Dynamic ensemble selection is integrated in OE-FV to dynamically select the sub-models most relevant to the new data point to generate its predicted value. Dynamic ensemble selection before the prediction can reduce the influence of the irrelevant sub-models on the prediction results.

Considering the interpretability and the computational burden of a SVR model, a geometrically interpretable kernel method, i.e. Feature Vector Regression (FVR), is proposed based on FVS. FVR describes the linear relation between the predicted value of a new input vector and those of the FVs selected form the training dataset. The applications on five public datasets show the robustness and accuracy of FVR, compared to the popular kernel methods.

The proposed methods are tested on a real case study concerning the leakage of the first seal of reactor coolant pump in a nuclear power plant. Experiment results show the accuracy and efficiency of the proposed approaches.

References:
[1] Baudat, Gaston, and Fatiha Anouar. "Feature vector selection and projection using kernels." Neurocomputing 55.1-2 (2003): 21-38.

Dynamic Maintenance Scheduling and Design Methodology for Multi-component Systems

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A doctoral thesis on maintenance scheduling and design methodology has been presented at Univ. Grenoble Alpes, in the research laboratory Grenoble, Images, Speech, Signal and Control (GIPSA-Lab), in March 2015. This collaborative work, developed with the Volvo Group, is applied to maintenance issues of commercial vehicles.

The main objective of this thesis work has been to provide a customized maintenance service offer for each vehicle in connection with the user constraints. In the transport industry, these constraints are defined by e.g. the limited number of maintenance opportunities and the high immobilization cost generated by the vehicle unplanned stops. These constraints introduce the necessity to guarantee the system autonomy on given operations period.

To reach this objective, mathematical models are required to quantify the influences of maintenance decisions on system reliability and costs. In this framework, the current state of the art offers a large amount of dynamic maintenance policies for multi-component systems. These policies are mainly based on the opportunity concept where the maintenance opportunity on a component drives the grouping strategy for the others. However, considering such a grouping strategy makes impossible to ensure failure free operating periods. In this context, an original form of grouping based on system state of health is proposed [1,2].

In this framework, the developed maintenance policy ensures, with a given risk probability, maintenance free operating periods (MFOP) for a multi-component system. During these periods, the system should be able to carry out all its assigned missions without maintenance actions and system fault. At the end of each period, the maintenance decision rule evaluates if a maintenance action is required to offer maintenance-free and fault-free operation on the next period with a specified confidence level. When a maintenance action is mandatory, decision criteria considering the maintenance costs and the maintenance efficiency [3] are used to select the maintenance operations and the set of components to be maintained.

To make the maintenance decision, the component reliability models, the system structure and the available monitoring information are integrated in the dynamic maintenance decision process. Both state of health and operating conditions may be used as sources of information to update the maintenance decision [4]. The process flexibility allows making a maintenance decision in using different information levels for system components. The policy decision variables, namely the period length and the confidence level value, are optimized based on the total maintenance cost. This cost, evaluated on a finite horizon, is composed of directs costs related to maintenance operations and indirect costs generated by system immobilizations.

In order to improve the system uptime and to reduce the maintenance impact on operating costs, the maintenance policy optimization alone is not sufficient. From a methodological point of view, answering to these issues requires the development of a broader approach to involve the system and its maintenance since the early conception phases. To design jointly the system architecture (redundancies, monitoring architecture, components reliability) and the dynamic maintenance policy, an iterative approach is thus proposed in the thesis [5]. A cost-based importance factor is introduced to target the most important parts of the system that should be redesigned in priority. This importance metrics is sensitive to the component reliability, the maintenance cost, the purchase cost and the system structure. It is a relevant indicator to drive the re-design action for maintenance efficiency. Then, multiple design options are evaluated by simulation on priority component. The selected options lead to reduce the operating costs.

These PhD contributions are illustrated by a test-case on a real heavy vehicle sub-system. A comparison is realized between the current maintenance policy and the MFOP based maintenance policy. The results show the added value resulting from the implementation of this proposed maintenance policy in the commercial vehicles context.

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References
[1] Lesobre, R., Bouvard, K., Bérenguer, C., Barros, A., & Cocquempot, V. (2013). A maintenance free operating period policy for a multi-component system with different information levels on the components state. Chemical Engineering Transactions, 33, 1051-1056.
[2] Lesobre, R., Bouvard, K., Bérenguer, C., Barros, A., & Cocquempot, V. (2014a). A Usage-Informed Preventive Maintenance Policy to Optimize the Maintenance Free Operating Period for Multi-Component Systems. Probabilistic Safety Assessment and Management (PSAM 12). Honolulu.

[3] Lesobre, R., Bouvard, K., Bérenguer, C., Barros, A., & Cocquempot, V. (2014b). Evaluation of decision criteria to optimize a dynamic maintenance policy based on Maintenance Free Operating Period concept. 8th International Conference on Modelling in Industrial Maintenance and Reliability. Oxford.
[4] Lesobre, R., Bouvard, K., Bérenguer, C., Barros, A., & Cocquempot, V. (2014c). Politique de maintenance dynamique pour un système multi-composant intégrant les informations de surveillance. Lambda Mu 19. Dijon.
[5] Lesobre, R., Bouvard, K., Bérenguer, C., Barros, A., & Cocquempot, V. (2015). A design approach for MFOP-based maintenance policy of multi-component systems. 9th International Conference on Mathematical Methods in Reliability. Tokyo, Japon.

ESRA News

SRA Nordic Chapter

SRA-E: NORDIC is a newly established regional chapter of the Society for Risk Analysis Europe (www.sraeurope.org). The Nordic chapter of SRA Europe is meant to be a node for networking between risk researchers and between risk research and policy makers and other decision makers in the Nordic and the Baltic countries.
The Nordic chapter shares the aim with SRA Europe which is "to bring together individuals and organisations interested in risk assessment, risk management and risk communication in Europe". More specifically the SRA-E: NORDIC will promote risk research and knowledge and understanding of risk analysis techniques. This can be to identify and address specifically Nordic and Baltic issues in the field of risk, to promote debate, and facilitate exchanges of information and opinion between professionals in industry, government, universities, research institutes, and consultancies. It has the ambition to convene and promote scientific and educational meetings on risk research, risk analysis and risk management in the Nordic and Baltic countries.
The Nordic Chapter welcomes a broad range of risk research from different disciplines.
Information about activities under the SRA-E: NORDIC will be distributed through an newsletter. Subscribe to the newsletter at the SRA Europe web page / Nordic Chapter or contact the SRA-E: NORDIC president Ullrika Sahlin, Lund University, Sweden ullrika.sahlin [at] cec.lu.se.
As a first event under SRA-E: NORDIC a risk conference will be held in Lund, Sweden, November 16-17, 2015. Further information on the conference can be found at www.lucram.lu.se/event/nordic-chapter-2015-risk-conference. We invite suggestions for activities under SRA-E: NORDIC to be discussed on November 17, 2015 in Lund.

Calendar of Safety and Reliability Events

25th European Safety and Reliability Conference – ESREL 2015
Zürich, Switzerland
7 - 10 September 2015

ESREL 2015 promises to be the largest ESREL to date! More than 850 abstracts were submitted, followed by 650 submitted full papers. The Technical Committee reviewed all submitted papers and accepted about 580 full papers for publication in the ESREL 2015 proceedings and presentation at the Conference. The review process was managed by about 30 track directors, acknowledged experts in the various technical areas covered by ESREL. Key support came from the ESRA Technical Committees Chairs, who traditionally contribute to managing the review process and effectively pass experience on through the various ESREL editions. In all, about 200 reviewers were involved. Technically, the large program will cover the traditional topical and application areas of ESREL. A strong increase in the papers dealing with complex, interrelated systems can be seen: this shows how ESREL addresses nowadays societal and industrial concerns, which require addressing all aspects of risk and reliability relevant for complex systems: technical, financial, societal. Prestigious keynote speakers have confirmed their presence, from the academia and the industry: Prof. Paul Embrechts (ETH Zuerich), Prof. Nassim Taleb (New York University), Prof. Didier Sornette (ETH Zuerich), Mr. Pierre-Alain Graf (CEO SwissGrid), Prof. Pieter van Gelder (TU Delft), Prof. Christophe Berenguer (Grenoble Institute of Technology), and Prof. Antoine Grall (Université de Technologie de Troyes). They will offer their perspective on key topics such as managing the unexpected in various sectors and running an essential infrastructure for the wellbeing of millions of people. The successful experience of plenary talks by the ESRA Technical Committee chairs will be continued this year as well with Pieter van Gelder, Christophe Berenguer, and Antoine Grall. Profs. Enrico Zio and Terje Aven will host a panel discussion on uncertainties, sparkled by the good discussions in reaction to Prof. Aven's Keynote from last year's ESREL 2014. Finally, the Gala dinner will be at the Zurich Kongresshaus: in the heart of the city, with a spectacular view on the lake!

Conference Website: http://www.esrel2015.org

24th International Conference Nuclear Energy for New Europe
Portorož, Slovenia,
14-17 September, 2015

Coordinator: Igor Jencic

The conference is a traditional annual meeting of professionals from nuclear research and educational institutions, nuclear vendors, utilities and regulatory bodies. It attracts around 200 participants from more than 20 countries. The topics discussed are general and include reactor physics, thermal hydraulics, probabilistic safety assessment, severe accidents, nuclear fusion, nuclear power plant operation, nuclear materials, waste management and new reactor designs. The language of the conference is English.

The conference will take place in **GH Bernardin**, Portorož, Slovenia. GH Bernardin is the first and the largest convention hotel in Slovenia.

Important dates
April 30, 2015 - Abstract Submission
June 21, 2015 - Abstract Acceptance
August, 2015 – Submission of Full-Length paper

Conference Website: http://www.nss.si/nene2015

8th Safety and Reliability Conference - KONBiN 2015
Uniejów, Poland
06-09 October 2015

The International Conferences on Safety and Reliability KONBiN are cyclic events that focus on issues of providing safety and reliability for any complex human being – engineering system – environment' system. The Conference is addressed to universities and research institutes, to scientists, industry and transport employees, government and municipal authorities, safety and reliability experts and consultant, and other persons interested in the Conference topics.

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Conference Website: http://www.konbin2015.itwl.pl

13th International Probabilistic Workshop (IPW2015)
Liverpool, United Kingdom
4th - 6th November 2015

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.
Key topics: Safety, Risk, Probabilistic Computation, Reliability, Structural Safety
Conference Language: English
Conference Chairs:
Edoardo Patelli, Institute for Risk & Uncertainty, UK
Ioannis Kougioumtzoglou, Columbia University, USA
Conference co-Chairs:
Michael Beer, Institute for Risk & Uncertainty, UK
Ivan S.K. Au, Institute for Risk & Uncertainty, UK
Dirk Proske, University of Natural Resources and Life Sciences, Vienna, Austria

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2nd International Symposium on Stochastic Models in Reliability Engineering, Life Science and Operations Management - SMRLO'16
Beer Sheva, Israel
15-18 February 2016

Symposium Chairs: Dr. Ilia Frenkel and Dr. Anatoly Lisnianski

The Second International Symposium on Stochastic Models in Reliability Engineering, Life Science and Operations Management (SMRLO'16), will be held on February 15-18, 2016 at the SCE - Shamoon College of Engineering, Beer Sheva, Israel. This will be a continuous and enlarged symposium following the

International Symposium on Stochastic Models in Reliability Engineering, Life Science and Operations Management (SMRLO'10) held in 2010.

This SCE symposium will constitute a forum for discussing different issues of Stochastic Models in Reliability Engineering, Life Science and Operations Management with respect to their applications. The symposium objective is to assemble researchers and practitioners from universities, institutions and industries from around the world, involved in these fields, and to encourage mutual exchange.

Common methods and models will be considered from a general point of view; theoretical modeling, computational and case studies will range from academic considerations to industrial approaches, as well as emphasizing topics on cooperation between industries and research institutions. The cooperation that will contribute to the advancement of research and solutions to engineering issues is of utmost importance.

The proceedings of **SMRLO‘16** will be published by IEEE CPS and will be available in the *IEEE XPlore Digital Library.*

Important dates

May 1, 2015 - Proposals of Invited Sessions

May 15, 2015 - Announcement for Invited Session proposals acceptance

June 15, 2015 - Abstracts submission

June 30, 2015 - Abstracts acceptance

September 30, 2015 - Deadline of papers submission

September 30, 2015 - Deadline for early payment

October 1, 2015 - 20% augmentation of fee registration

February 15-18, 2016 - Presentation of invited and contributed papers

Conference Website: http://info.sce.ac.il/smrlo16/

ESRA Information

1 ESRA Membership

1.1 National Chapters

- French Chapter
- German Chapter
- Italian Chapter
- Polish Chapter
- Portuguese Chapter
- Spanish Chapter
- UK Chapter

1.2 Professional Associations

- The Safety and Reliability Society, UK
- Danish Society of Risk Assessment, Denmark
- SRE Scandinavia Reliability Engineers, Denmark
- ESReDA, France
- French Institute for Mastering Risk (IMdR-SdF), France
- VDI-Verein Deutscher Ingenieure (ESRA Germany), Germany
- The Netherlands Society for Risk Analysis and Reliability (NVRB), The Netherlands
- Polish Safety & Reliability Association, Poland
- Asociación Española para la Calidad, Spain

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- TAMROCK Voest Alpine, Austria
- IDA Kobenhavn, Denmark
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- Bureau Veritas, France
- INRS, France
- Total, France
- Commissariat á l'Energie Atomique, France
- DNV, France
- Eurocopter Deutschland GMbH, Germany
- GRS, Germany
- SICURO, Greece
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- Autostrade, S.p.A, Italy
- D’Appolonia, S.p.A, Italy
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- RINA, Italy
- TECSA, SpA, Italy
- TNO Defence Research, The Netherlands
- Dovre Safetec Nordic AS, Norway
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- Cia. Portuguesa de Producção Electrica, Portugal
- Siemens SA Power, Portugal
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- 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

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- University of Innsbruck, Austria
- University of Natural Resources & Applied Life Sciences, Austria
- AIT Austrian Institute of Techn. GmbH, Austria
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- University of Mining and Geology, Bulgaria
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- Technical University of Ostrava, Czech Republic
- University of Defence, Czech Republic
- Tallin Technical University, Estonia
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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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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.
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