ESRA

European Safety and Reliability Association

Newsletter

http://www.esrahomepage.org

March 2013

Editorial

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

Dear ESRA member,

First of all, I take the opportunity of this first issue of 2013 to send you my best wishes for a rewarding new year in your professional activities and a fulfilling new year from the personal point of view.

ESRA also is looking forward to another rewarding new year, filled with many successful activities and opportunities of technical and human exchanges within our community.

Among the many activities which see ESRA involved, directly or indirectly through partnership, I inform you that this year we are going to directly provide financial support to a number of initiatives proposed by our members in response to our annual call for project proposals. These initiatives concern activities ranging from an international workshop on accident modelling in Germany, to a workshop on reliability technologies within the international conference on digital technologies in Slovakia, to an international course and a conference on RAM and PHM in Italy, to an international workshop on imperfect maintenance modelling animated by our Belgian and French colleagues from both ESRA and our companion association ESReDA, to an international conference and an international summer school on RAMS topics in Poland. Congratulations to all the proposers and looking forward to hear the story and technical contents of your initiatives, which I hope that many of our ESRA members will participate to.

ESRA is also involved, without funding, in several initiatives of support of conferences and courses around the World, accompanying partner associations in the development and spread of the knowledge on reliability and safety for application in a variety of technologies and industries. The PSAM 2013 Conference in Tokyo is just an example. These initiatives are important for the development of our technical fields of interest and to provide the due visibility to ESRA and its member experts.

Of course, our major activity is the ESREL Conference and I am happy to remind you to get ready to join in the next ESREL 2013 Conference in Amsterdam at the end of September. Approximately 600 abstracts have been received and paper reviews are under finalization: our colleagues in the Netherlands are definitely getting ready to host us and I want to thank them for the big work already done and the even bigger they are going to do in the future months.
Finally, this is also the time of the year when I need to ask you to proceed with the payment of your membership to ESRA: your membership is important to us for your personal involvement and professional expert contribution in our activities; your fee is important for us to continue running these activities and proposing new initiatives to the benefit of all members. Please go on our website www.esrahomepage.org and proceed as indicated.

Cordially,

Enrico Zio
Chairman of ESRA

Feature Articles

Bayesian games for security assessment – basic assumptions and limitations

Tony Rosqvist
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Introduction

VTT is one partner of the EDA-funded Athena-project 2010-2013 coordinated by TNO. Athena stands for 'asymmetric threat environment analysis'. ATHENA's mission is to improve or create asymmetric urban threat models and scenarios that can be used in advanced tools for mission planning and training. VTT's work in Athena was focused on exploring the feasibility of game theory to model the use of roadside Improvised Explosive Devices. Some conclusions are applicable for civil security, especially in the context of organized crime.

Organized crime modelled as a game

Game theory provides an approach to model and analyze players' rational choices in a game-like conflict. In a conflict between two opponents, the win of one is equal to the loss of the other. In a static game, the players may make their moves separately but will know the actions chosen by the other players at the same time. The famous example is the prisoner's dilemma where the criminals know the payoffs (years in prison) related to their choice of keeping silent or betraying.

It can be argued that the payoffs or utilities of the opponents in Afghanistan i.e. ISAF and the Insurgents, as well as in organized crime, are also known: the mission of the ISAF/police is to safeguard law and order, whereas organized crime strives for power and wealth irrespective of law and order. This can be modelled as a constant sum-game. The adopted tactics (choices) are, however, not fully known. Tactics are continuously developed by the adversaries, and will, from time to time, materialize in kinetic actions (see Figure 1).

Bayesian games

The Bayesian game formulation allows the modelling of the uncertainty of the players' adopted tactics [2]. The main difference between Bayesian games and games of complete information is that in Bayesian games players are assumed to play as different types: 'weak', 'normal, 'strong', for instance. In the game the players do not know the type of the other player(s), but they know the joint probability distribution p over all types. In an actualization of a game each player knows his type, but not the others'. This individual knowledge is termed private knowledge.

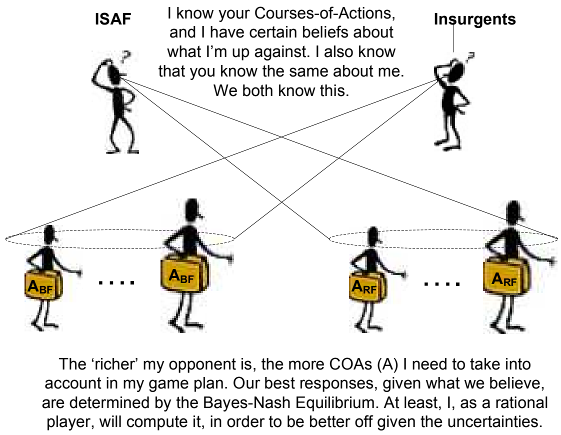

Figure 1. In a Bayes game the uncertainty of the opponents Courses-of-actions is modelled by defining opponent *types* that may be encountered in a game instantiation

> Asymmetric war refers to the 'waging of unbalanced or un-proportioned armed or unarmed war against the enemy" [1]'. In more concrete words, it refers to the situation were the adversaries have different capabilities and tactics to use against each other, as in the war between the ISAF and the insurgents in Afghanistan, for example. The role of intelligence or intel is crucial in this warfare. The party who has more correct information (with disinformation filtered out) has an advantage in the war.

In a Bayesian game, the payoff matrix shows the expected utilities associated with each player's 'strategies'. The strategies are combinations of the player's type and a tactic played by this type. It also reveals for the players what is the equilibrium strategy of each player. This Bayes-Nash equilibrium (BNE) point guarantees the maximum expected utility given the tactical uncertainty. All rational players are assumed to know it, and follow it.

The payoff matrix in Fig. 2 shows the result of an assessment conducted in the Athena-project where the notation 'b11b21' reads 'ISAF plays as type 1 adopting tactic 1, or, plays as type 2 adopting tactic

1'. The best response of the ISAF is adopting tactic 2, irrespective of which type he is, as indicated by the BNE point (the shaded point). The assessment also indicates that ISAF receives expected utility value 5.35, whereas the Insurgents receive 10-5.35=4.65, where the sum is fixed to 10, indicating that neither opponent is superior at the BNE point (or any other point as a matter of fact). For a detailed description of the tactics and the expected utility computations related to the strategies, see report [3].

strategies	r11 r21	r11 r22	r11 r23	r12 r21	r12 r22	r12 r23
b11 b21	5,06	5,10	5,10	5,21	5,25	5,26
b11 b22	5,12	5,15	5,16	5,26	5,29	5,29
b11 b23	5,08	5,11	5,11	5,23	5,26	5,26
b12 b21	5,29	5,32	5,31	5,39	5,41	5,40
b12 b22	5,35	5,37	5,36	5,43	5,45	5,44
b12 b23	5,31	5,33	5,31	5,40	5,42	5,41

Figure 2. Bayes-Nash equilibrium strategy indicates what tactic to adopt when playing as a specific *type* where maximum win over the opponent is 10. The best response by the players, shaded above, indicates a balance in the relative strengths of the adversaries.

Limitations of Bayesian games in security assessment

The main assumption of Bayesian games is that the joint distribution of types p (and thus tactics) are known to all players. This reflects the idea that all players in the 'war theatre' share the same experience of what has happened earlier, also including more uncommon tactics like feints. Player types, adopting rare tactics, are assigned low probabilities. The key assumption is that all players have correctly assessed the type distribution p.

Based on the above we have now an idea of what may be the basic limitation of modelling organized crime as a Bayesian game: Bayesian games do not encompass genuine 'surprises'. On the other hand, it can be argued that acquiring intelligence about the opponent is a key objective in order to surprise the opponent and be superior in a confrontation.

A game where the players are free to specify odd types, reflecting surprise tactics, would lead to games called Selten games [3]. Such specification freedom would lead to the loss of the commonly known joint distribution p. As a consequence, the game would represent an imaginary game by its creator rather than being a game shared.

Based on the Athena-project it seems that static Bayesian games are not capable of capturing the essence of asymmetric threats or organized crime where intelligence should be key in beating the opponent.

Acknowledgements

This work has been sponsored in parts under the ATHENA (Asymetric Threat Environment Analysis) project, coordinated by the European Defence Agency (EDA) and funded by 20 contributing nations in the framework of the Joint Investment Programme on Force Protection (JIP-FP).

References

[1] U.S. Joint Forces Command Glossary. Asymmetric warfare. Available at http://www.jfcom.mil/about/glossary.htm

[2] Harsanyi J. Games with Incomplete Information Played by Bayesian Players, I-III. Management Science, Vol. 14, No. 3, 1967.
[4] Myerson RB. Harsanyi's Games with Incomplete Information. Management Science, Vol. 50, No. 12, 2004.

[3] Eskola Olli. Bayesian Games for Analysis of Asymmetric Warfare and Tactics"; Master's Thesis; Eskola, O.; Aalto University School of Science; 2011

PhD Degrees Completed

Analysis of the causes of delay in collaborative decision-making under uncertainty in pharmaceutical R&D projects

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Co-supervisors: Dr. Sophie Bougaret and Dr. François Marmier

Problem statement

Collaborative decisions may be deferred when faced with a high degree of uncertainty, especially when public health and high investments are at stake and in situations that seem non-urgent, as is the case in pharmaceutical R&D projects. Drug development projects are composed of phases of tests and studies on new compounds. At the end of each phase, a group of various experts has to decide whether the development of a new medicine should be continued or stopped. These decisions, called Go/No Go decisions, depend on the multidisciplinary results of the tests that become progressively more accurate and complete throughout the different phases of the projects. This thesis investigates the causes of delay in difficult Go/No Go decisions. The choice of this subject is motivated by the cost of ultimately delaying or invalidating a decision in terms of human effort, time, and financial investment. This work was supported by the Foundation for an Industrial Safety Culture (FonCSI) of Toulouse, France.

Research performed

In the first part, to better understand the problem of delay in decision-making under uncertainty, we first review the notion of uncertainty. Two approaches to define uncertainty are pointed out: 1) the object-based approach, which defines uncertainty based on the lack of information about an object whose state is unknown (epistemic uncertainty) or change randomly (aleatory uncertainty), and 2) the subject-based approach, which defines uncertainty based on the state of mind of a subject who doubts. In project management, both the object (a project) and the subjects (actors) should be taken into account to process uncertainty. Thus, we propose a more encompassing definition of uncertainty adapted to project management, taking into account four key aspects implicit in its creation and treatment: uncertainty is a **subject**'s conscious lack of knowledge about an **object**, which is not yet clearly known, in a **context** requiring a decision (an action) within a certain **time** frame. This definition leads us to structure the factors that impact the generation, perception, and processing of uncertainty (see figure 1). Once uncertainty defined, our purpose is to describe the process used to make Go/No Go decisions under uncertainty and to identify when there is a risk that decisions be invalidated.

In the second part, the decision-making process in drug development projects is modelled, highlighting the information life cycle from its generation to its consumption *i.e.* the decision itself. Our model of the Go/No Go decision-making process, first, takes into account the transformation of information before its transmission to decision-makers. Figure 1 presents a macro vision of this model: 1) intelligence and design stage, 2) test stage, 3) new information analysis stage, and 4) choice and review stage.

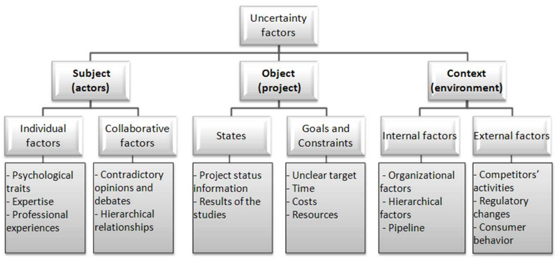

Figure 1: Typology of uncertainty factors

Then, the last stage is detailed in a framework, which includes both individual reflection and group interaction, clarifying how information is differently processed by decision-makers. Based on this model, an index of decision invalidation is defined. It measures the risk of invalidation of a decision *a posteriori* and helps analyse previous conflicts in past decisions and can be used to anticipate future conflicts. First, the dissatisfaction of each individual with the collaborative decision is calculated. Then, the aggregation of the individual dissatisfaction indices gives the index of decision invalidation. After modelling the decision-making process, we identify the key factors that affect this process, causing delays or helping reduce them.

In the third part, the process modelled is used as a basis to collect information on the key factors that affect decision-making. Two categories of major actors in Go/No Go decision-making are interviewed: 3 project managers and 4 decision-makers. Through these in-depth interviews, 252 key factors are pointed out, including 111 causes of delay and 141 efficient practices. The results show that all the interviewees agree that Go/No Go decisions are frequently delayed or invalidated, or some of them are never made and the projects are "left to rot", as one project manager puts it. Two activities of the decision-making process, most cited by the interviewees are Preparation and presentation of results and Collaborative decision-making. Almost half (49%) of the key factors outlined by the interviewees are related to the context, 31% to the subject(s), and 20% to the object. The same tendency has been observed within both the categories of the actors interviewed. Based on the identified factors, a compendium of practices is constructed for the actors of the decision-making process that help collaborative decisions to be formed, matured, digested, respected, and finally executed.

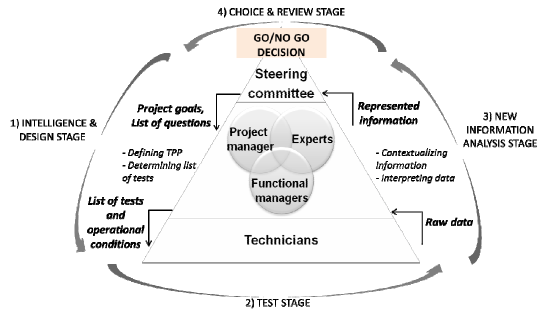

Figure 2: Four macro stages of Go/No Go decision-making process

Conclusions

We conclude that while much attention is quite rightly paid to the way in which the tests are performed and the results are provided, little attention is given to the way the results are aggregated, prepared and presented, and to the way decisions are made. In sum, the Preparation and presentation of results and the Collaborative decision-making are presumed to be "natural" activities that do not need training, practice, or even the necessary time to be performed. Inadequate interpretation of the results of the tests, information overload during the decision meetings, lack of debate and deliberation are some causes of delay directly linked to the activities of the model of Go/No Go decision-making process. But the three most often mentioned factors involved in decision delay are related to the professional environment and not directly to the activities of the decision-making process: fear of uncertainty, fear of hierarchy, and difficulty of No Go decisions.

Approaches to modeling dike failure probability and decision making in the operational flood risk context

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The research "Approaches to modeling dike failure probability and decision making in the operational flood risk context" consists of two parts. The first part is devoted to the concept of operational dike failure probabilities. In the second part, mathematical approaches to decision making in the face of flooding are considered.

The annual dike failure probability is applied to indicate whether reinforcements of the dike are necessary. This is a long-term probability as it refers to the period of one year and it is based on information gathered over a long time. For a dike manager, the annual dike failure probability is of little use when a flood wave or a storm is approaching, because then hydraulic loads (water level, waves) at the dike are more specific. In the danger of flooding, evaluation of a dike should be conditioned on the upcoming event leading to derivation of operational dike failure probability. In this research, the operational dike failure probability is defined as the dike failure probability within a future time window (several hours or days ahead). The operational dike failure probability is derived using information that refers to the time window such as probability forecasts for hydraulic loads and/or dike sensor measurements. Two methods for estimation of operational dike failure probabilities are proposed. The first method uses fragility curves and the second method is based on the model Hydra-VIJ. Furthermore, a special attention is given to electronic dike sensors, i.e., innovative dike monitoring techniques. Approaches to modeling cost-effectiveness of a dike sensor system are introduced.

Decisions about application of emergency flood protective measures (e.g., preventive evacuation) are usually taken under uncertainty: the moment and place of an eventual dike breach are unknown. These uncertainties are, to some extent, captured in the operational dike failure probabilities. In this part, approaches to decision making in the face of flooding are considered using the operational dike failure probabilities as inputs. To assist authorities in flood-related preventive evacuation decision, probabilistic criteria are derived for main dike-ring areas[1] in the Netherlands. The probabilistic criteria consist of minimal flooding probabilities for which the preventive evacuation decision is cost-effective. Furthermore, the dynamic decision making is considered in this research. Decision problems in the operational flood risk context are dynamic in nature as hydraulic loads are dynamic variables. The loads change in time and so information approximating the future loads to decision makers, e.g., forecasts. In this research, two dynamic decision models are introduced. In the models, application of one emergency flood protective measure is considered. The models use the minimum expected cost criterion to choose the optimal decision accounting for time-dependency of the hydraulic loads and their forecasts.

Reliability analysis of systems using belief functions theory to represent epistemic uncertainty

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1. Problem statement

Since the beginning of reliability engineering, probability theory has become the accepted standard to represent uncertainties regardless of their nature or the background knowledge available to support them. In parallel to this, other communities started to question the use of probability theory, in some cases, to represent uncertainty. Their arguments are based on the fact that uncertainty has different natures and should be treated accordingly. These natures or sources can be classified in two types: aleatory and epistemic. The former comes from the natural variability of a random event while the latter represents lack of knowledge. As a consequence, several alternative theories have emerged that provide a better level of uncertainty expressiveness, such as imprecise probabilities, belief functions theory *(also known as Dempster-Shafer theory)*, possibility theory, to name a few.

During the past decade there has been a growing interest in the community of reliability and risk analysis on this matter. Several special issues have appeared and special conference sessions have been organized *around the alternative representations of epistemic uncertainties (e.g. PSAM 11 & ESREL 2012). Indeed, there are several issues that emerge when there is a considerable lack of knowledge. The most important ones being:*

1. Modeling uncertainty about basic evens.

[1] A dike-ring is an uninterrupted system of water defences (such as dikes and dunes) and high grounds.

2. Aggregation of experts' opinion.

3. Representing model uncertainty.

4. Propagation of uncertainty.

5. *Decision making under uncertainty.*

2. Research performed

Following this context, the main focus of this Ph.D. was to explore the potential application of belief functions theory as a mathematical tool to represent and propagate epistemic uncertainties in reliability analysis of systems. This theory is considered a generalization of classical probability theory as well as of set theory, which gives it a better level of uncertainty expressiveness. The work covered the first four listed issues with its strongest points gathered around the propagation of uncertainty.

Within this framework, uncertainty about the basic events is represented by an interval of belief and plausibility. This interval can be either constructed from experts opinions or from scarce reliability data. Special attention was paid to the meaning of this interval. It represents the bounding limits of the real value of the probability of the basic event. Indeed, it was shown that this has a high impact on the applicability of certain rules and principles, especially in the aggregation of experts opinion.

As for the representation of the model, several hypotheses regarding uncertain structures were studied. For the trivial case, i.e., a known and certain structure, the system is represented by either a mass function or by a direct mapping (the structure function). Starting from this base, three methods were proposed to represent different uncertain systems: When there is a doubt about a given structure, when there is incomplete information about the structure and when there is uncertainty about the dependencies between the basic events.

Several methods to propagate uncertainty about the components reliabilities and the structure of the system to a system level were proposed. The most relevant result in this part of the thesis is that the propagation is highly simplified for coherent structures with independent components. It has been proven that the lower (upper) bound of reliability of a system depends only on the lower (upper) bounds of reliability of components. This is a conclusion of one of the main contributions of this thesis, i.e., the discovery that belief and plausibility functions are additive over the collection of minimal path-sets and cut-sets. A direct consequence of this is that the computational cost is only two times greater than that of a probabilistic approach.

3. Conclusions

This thesis has provided a complete framework for the analysis of reliability of systems using belief functions theory to represent and propagate epistemic uncertainty. The research was mainly focused on coherent systems with a binary nature (working/failed state). Some preliminary ideas for non-coherent systems were discussed, specially about the additivity of belief and plausibility functions on such systems.

The result of three years of research have led me to conclude that the treatment of epistemic uncertainty in reliability analysis is a delicate subject. It is true that people does not like the loss of informativeness that represents the use of alternative uncertainty theories. This loss of informativeness may slow down projects, science, progress itself, but it does this for the sake of safety. However, it cannot be seen as a loss when for the first place you didn't have enough background knowledge to have something as informative as a probability distribution. In such a case, belief functions theory should be seen as an advantageous theory that makes us win in expressiveness of the true credal state.

Many others have provided their own solutions to tackle the representation and propagation of epistemic uncertainties in reliability and risk analysis. The next step for the community should be to compare these different frameworks. At a mathematical level, the several frameworks provide similar results, but at the semantical level they tend to differ. For example, using a possibilistic approach, the variable of interest is the frequency. Under the belief functions approach the variable of interest is an event, i.e., a working/failed state. Yet, both approaches provide similar values once the uncertainties are propagated. Why choose one framework over the other? Should the community converge to a unified framework? What tools are provided by these frameworks for the decision making process? Consider these questions, and many other, as an invitation for future collaborations!

Contribution to uncertainties modeling and processing within multidisciplinary risks analyses of industrial systems – Application to the Heat Sink system of an energy power plant

Ph.D. work made in the frame of partnership between EDF R&D and the Nancy Research Center for Automatic Control (CRAN UMR CNRS 7039).

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Supervisors:

Pr. Benoit IungDr. Philippe Weber
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Problem statement

Industrial systems are always established in physical, social and regulatory environments leading to consider several stakeholders. Moreover, these systems are complex by incorporating also human actions taken within their organizational context. This complexity and the multi-disciplinarity of these systems imply to deal with different types of risks at the same time. In order to satisfy the environment and stakeholders requirements, it is thus necessary to demonstrate that all the risks are under control. In that way, several approaches provide more integrated risk analysis covering globally technical, human, organizational and environmental risks. One of these approaches is called "Integrated Risks Analysis" (IRA) and is considered in EDF as a relevant solution using a "barrier model" to capture all knowledge through a multidisciplinary, generic and unified Bayesian Networks model. However, this approach should be improved with regard to the modeling and processing of knowledge (provided by statistical experience feedback and expert judgments). Indeed, knowledge contains different types of uncertainty that influence the significance of the results provided (aleatory and epistemic uncertainties).

Therefore, this thesis aims at improving the IRA approach in order to offer a suitable process to collect, model and treat the different types of knowledge and uncertainties by proposing contributions on the three following issues:
(1) Achieve a flexible and consistent collection of the different types of knowledge and uncertainties.
(2) Merge and propagate different sources of knowledge and different types of uncertainties.
(3) Help to take a decision with uncertain results thanks to a decision-making process.

Research performed

The first problem attacked in this thesis is the choice of a suitable modeling framework for the modeling and the treatment of different types of knowledge expression. The *evidence theory* (as an interpretation of imprecise probabilities) provide coherent and flexible modeling and treatment of knowledge and the attached uncertainties. This theory allows merging probabilistic and non-probabilistic expressions. Moreover, the *evidential networks* provide a quantitative tool for the use of the evidence theory. It is supported by graphical model of the relationships between multistate variables that can be either qualitative or quantitative. They are based on Conditional Masses Table (CMT) and an inference mechanism for the propagation as well as the diagnostic of uncertain knowledge in the risks model. By leaning on the evidence theory and the evidential networks, this thesis proposes three main contributions for the collection, the modeling and the treatment of knowledge and their uncertainties in risks analysis.

The first contribution concerns the *formalization of the risks quantification by expert judgments* by proposing various tools for a more complete and flexible collection of expert judgments (risks quantification). Indeed, the use of expert judgments requires a structured and formalized collection to avoid biases associated to expert judgments (expert biases or analyst biases). Therefore we propose several qualitative and quantitative collection tools. First of all, a structured and exhaustive questionnaire enables to collect several knowledge on variables to be quantified. It is completed by three other tools to obtain an assessment directly by the expert: a quantification grid, several elicitation grids helping the quantification and priorisation grids (they are used when the expert is not able to provide a direct quantification). In that case, the analyst can then use all these tools to quantify variables. The simplicity of these tools as well as the associated documentation allows reducing the tools interpretation biases by the experts and the analyst. Finally, thanks to these tools, the expert's knowledge is collected in a less biased way.

The second contribution aims at providing an *evidential risks model* allowing to represent the different knowledge expressions in a more coherent way and to assess all the risks (risks analysis). The main stake in this contribution is to formalize the definition of the CMT. This definition is based on probabilistic or extra-probabilistic quantifications and the use of logical structures (AND, OR, Leaky Noisy-OR, etc.). First of all, a formalization of the links between the evidence theory and the other uncertainty modeling framework is investigated in order to transform all the quantifications in their equivalent in the evidence theory. For logical structures application, the Noisy-OR and Leaky Noisy-OR structures do not have an equivalent in the evidence theory. Consequently, we propose evidential Noisy-OR and Leaky Noisy-OR allowing to take into account the uncertainties on all the parameters of these structures. These contributions allow to define easily all the CMT of the evidential risks model. Moreover, the use of evidential networks allows a joint and coherent propagation of aleatory and epistemic uncertainties and provide more relevant results to help decision-making.

In the third contribution, some tools are proposed for *decision-making in uncertain environment* (risks evaluation). Indeed, the results providing by the evidential risks model correspond to imprecise probabilities which have to be compared with a threshold or ranked between them. In that case, the decision-making is difficult when there is a covering between the values to be compared and lead to ambiguous situations. To help the decision-makers in such cases, our works propose processes. First, we suggest reducing the epistemic uncertainty by identifying the strongest contributors and how to reduce their uncertainty. Then, we suggest moving aleatory uncertain by identifying the component or the barrier which can be improved and the way of improving them. Finally, if the situation is always ambiguous, we propose various transformations to the expert accordingly to his behavior (pessimistic, optimistic or rational) and to the goals of the study (availability, safety, etc.). Finally, these contributions allow aiding the decision-making in the presence of uncertainties by proposing well adapted tools.

Conclusions

The results of this thesis provide a multidisciplinary approach well suited for risks analysis of sociotechnical industrial systems with different types of knowledge and uncertainties. Our works proposed contributions on each step of a risks analysis by providing: 1) Relevant and flexible collection tools, 2) Evidential networks-based risks model, 3) Tools to help decision making with uncertainties. Finally, the implementation of these contributions on a Heat Sink system of an energy power plant (EDF application)highlights the feasibility and the suitability regarding more conventional approaches. It also allows us to identify future development for the IRA approach.

Calendar of Safety and Reliability Events

PSAM Topical Conference: In light of the Fukushima Dai-ichi Accident – PSAM 2013

Tokyo, Japan
14 - 18 April 2013

Tokyo PSAM 2013 is a special Topical Conference which will put the spotlight on the Fukushima Dai-ichi Nuclear Power Station Accident from the PSA point of view.

Tokyo PSAM 2013 will offer the international PSA community an open forum atmosphere to focus on Fukushima Dai-ichi and discuss: what went wrong, how likely was it, and what were the consequences. This Topical PSAM naturally follows the Fukushima Accident Sessions to be held in PSAM11 in Helsinki in 2012.

Important Dates

Submission of Abstracts	31 August 2012 **Extended**
Notification to Authors	28 September 2012
Full Paper Submission	15 January 2013
Notification of Acceptance	**22 February 2013 Extended**
Final Paper Submission	**8 March 2013**
Conference Dates	14-18 April 2013 14 April: Reception 18 April: Technical tour

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Conference Website: www.psam2013.org/

Advances in Risk and Reliability Technology Symposium

Loughborough, United Kingdom,
21 - 23 May 2013

The 20th AR^2TS 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

9th International Conference on Digital Technologies 2013

Zilina – Slovak Republic
29-31 May 2013

The Ninth International Conference DT'2013 is the annual event that is held in Žilina traditionally. The aim of the conference is to bring together researches, developers, teachers from academy as well as industry working in all areas of digital technologies. The conference makes is focused on a wide range of applications of computer systems. Topics of interest include:

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

Important dates

Full paper submission	15 March, 2013
Paper acceptance notification	15 April, 2013
Camera-ready papers	10 May, 2013
Final program	15 May, 2013

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

22nd SRA-European Annual Conference

Trondheim, Norway
17 - 19 June 2013

The theme of the conference is "Safe societies – coping with complexity and major risk", concerning challenges related to our society's vulnerability to major risk of natural and industrial disasters, malicious attacks, financial breakdowns and epidemic diseases.

The conference is open to all interested researchers, experts and industry representatives interested in risk analysis, including risk assessment, characterization, communication, management, and policy across all sectors and societal levels.

Important dates

15 January, 2013 - Deadline for submission of abstract and symposia.
1 June, 2013 - Deadline for submission of optional full length papers.
Conference Website: www.srae2013.no

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

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 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

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.

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
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- 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
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- University of Mining and Geology, Bulgaria
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- Technical University of Liberec, Czech Republic
- University of Defence, Czech Republic

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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

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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.

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