Activity Report 2014



Laboratoire Génie Industriel - LGI Industrial Engineering Department



Laboratoire Génie Industriel - LGI, EA 2606 Industrial Engineering Department



"For us, Industrial Engineering is not any more the one and only field focusing on the development of methods to assist the organization of industrial companies. It has become a solid scientific corpus which addresses all kinds of cooperation between companies and of human activities. It aims at understanding, designing, and optimizing complex technical and organizational systems in which company and human agents live, act and expect value creation."

Bernard YANNOU

FOREWORD

A bit of history of Industrial Engineering and IE research department at CentraleSupélec, celebrating 20 years!

In 1909, the first curriculum in Industrial Engineering is delivered at PennState University¹, today a research partner of LGI. In its early stages, Industrial Engineering was focusing on designing machines for agriculture and organizing production plants for novel automotive industries.

The tradition of Ecole Centrale has also been to train design engineers and industry managers; for instance, Gustave Eiffel, Louis Renault, André Citroën, André Michelin, Marcel Schlumberger, Louis Blériot², William LeBaron Jenney³ are alumni of Ecole Centrale Paris. After the founders of Centrale, there was a need for "medical doctors for firms and fabrics".

In France, these disciplines have long been taught under the names of Design of Machine Elements (conception d'éléments de machine) and industrial management (gestion industrielle). In 1994, 20 years ago, this Centralien tradition re-flourished with the creation of a Productics-Logistics research department (Laboratoire Productique-Logistique) under the initiative and

leadership of Professor Jean-Claude Bocquet. Concurrent engineering, integrated manufacturing and supply chain management were the main industrial issues. Further, the research department has taken the name of Industrial Engineering, well established on disciplines as Design Science, Operations Management, Project and Risk management, Optimization, Simulation, Decision aid, Economy and Business Science. Finally in September 2016, our corresponding Master of Science will adopt the name of Complex Systems Engineering (Ingénierie des Systèmes Complexes).



Indeed, as for us, Industrial Engineering is not any more the one and only field focusing on the development of methods to assist

the organization of industrial companies (factories, companies, value/supply chains). It has become a solid scientific corpus which addresses all kinds of cooperation between companies and of human activities. It aims at understanding, designing, and optimizing complex technical and organizational systems in which company and human agents live, act and expect value creation. We notably model and study healthcare, mobility and energy systems.

¹ http://www.ie.psu.edu/AboutUs/aboutUs.html

² The fist aviator to cross the France-England Channel, and the founder of Blériot Industries, becoming later Aérospatiale being further integrated into EADS company.

³ Considered as the inventor of steel-made skyscrapers and the first skyscraper designer: the Home Insurance Building of Chicago, 1885.

Laboratoire Génie Industriel - LGI Industrial Engineering Department

The goal of the Industrial Engineering (IE) Department (Laboratoire Genie Industriel, LGI) is to develop models, methods and tools for diagnosing, specifying, designing, developing, manufacturing, launching, exploiting, recycling at best socio-technical systems. These systems are industrial systems (production systems, value chains, eco-parks), complex products (airplanes, cars...), complex factories, transportation systems, health systems, energy networks, service systems and construction systems. Key principles of our research are: multidisciplinarity, life-cycle thinking, societal issues, model-based engineering approaches.

Studied systems are often characterized by the following:

- the presence of sophisticated technical components but also of human agents (organizations, policy makers, operators)
- a large number of individual components that interact,
- heterogeneity of these components, each with specific individual behavior,
- systems that must often be analyzed at different physical, spatial and temporal scales and from different points of view (technical performance, cost, environmental impacts, material flows, skills...)
- a system feedback on its components and the emergence of macroscopic properties.

KEY FIGURES 2014

84 members Faculties: 28 Doctorates: 49 Post-Doctorates: 10 Technical and administrative staffs: 7 Publications (source: Web of science): 87 Contracts: 972 K€ (without the 10 chairs) The control of such systems presents many challenges and issues from both a technical and scientific point of view as well as practical and application perspectives like financial profitability, efficiency, continuity and reliability of service, security. The integration of technical systems is already challenging regarding, for example, aerospace, automotive or energy systems, but it is even more complex when it comes to inter-network systems («System of Systems» paradigm) such as health systems, human mobility infrastructure, distribution of products and services, transport and regulation of energy, gas, water, and other socio-technical systems including human or various agents such as organizations with different and even contradictory strategies, goals and preferences. Our scientific approach consists in adequately modeling for analyzing and simulating in order to better understand the system behavior through virtual experiments on models and, ultimately, finding optimal solutions for the design, deployment and monitoring. Often many life cycle phases of these systems must be modeled and analyzed: collection of needs and requirements specification, development (architectural design, design, validation, manufacture and market launch or startup), system management (its regulation, its maintenance, its failure modes, its upgrade), its dismantling and end of life.



The 4 research Groups of the IE department and their research topics



Laboratoire Genie Industriel: www.lgi.ecp.fr bernard.yannou@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) 2 +33 (0)1 41 13 13 88



Ten industrial chairs and two research institutes reinforce the 4 research groups.

The 10 industrial chairs are about:

Sustainable Construction (Bouygues Construction), Operational Excellence (BNP Paribas), Production and Logistic (Faurecia), Supply Chain (LVMH, Sanofi, Carrefour, Safran), Electro-mobility (PSA Peugeot Citroën), Energy Economy (Capitaldon), Systems Engineering (Safran), Purchasing in complex projects (Total), Systems Sciences (EDF), Anthropolis (Alstom transports, Engie, IRT SystemX, RATP, Renault, SNCF).



The 10 industrial Chairs associated with IE department, see http://www.lgi.ecp.fr/pmwiki.php/Main/Chaires

The **two research institutes** for which the department is a founding member are: IRT System X (Digital Engineering of Complex Systems) and PS2E (Paris Saclay Energy Efficacity).



ACADEMIC PARTNERSHIPS

Europe: University of Stavanger-Norway, DTU-Denmark, University of Liverpool-England, Universidad Politecnica de Valencia-Spain, ETHZ-Switzerland, Politecnico di Milano, Aalto University-Finland, Magdeburg University-Germany, TU Munich, University of Bath-UK, Université de Louvain-Belgique

America: Northwestern University-Chicago, MIT, Penn State University, Georgia University of Technology, University of Minnesota, UFRJ-Brazil, PUC-Brazil

Asia: Beihang University-China, Ecole Centrale Beijing, City University-Hong Kong, Wuhan University of Technology-China, Chiba University-Japan

Africa: ENIT-Tunis, ENIM-Monastir

INDUSTRIAL PARTNERSHIPS

Air Liquide, BNP Paribas, Bouygues Construction, Capitaldon, Carrefour, CEA, Danone, Dassault Aviation, DHL, EADS, EDF, Établissement Français du Sang, Faurecia, Hôpital Georges Pompidou, Hôpital Henri Mondor, Lafarge, Lhôtellier, LVMH, PSA Peugeot Citroën, Renault S. A., Safran, Sanofi, Schlumberger, Schneider Electric, Total, Vallourec, Ville de Paris.



Laboratoire Genie Industriel: www.lgi.ecp.fr bernard.yannou@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) 2 +33 (0)1 41 13 13 88





Research

Our main research challenges address **modeling, analyzing, simulating and optimizing complex systems** (products, processes and organizations). The aim is to contribute to fostering innovation that will **facilitate economic, environ-mental and social transformation**. Research projects yield from industrial collaborations anchored in **action-based research**, starting by existing situation diagnosis, in order to propose an academically original and industrially relevant model. The validation and verification of the research is always completed with industrial deployment measuring its efficiency and effectiveness.

Our research is organized around 4 topics:

1. Design of complex systems aims at developing **methods and tools supporting decision-making** with regard to **design of products and organizations**. The focus is on enhancing numerical capabilities and simulation processes for preliminary and early design stages addressing system architecture, system configurations, value engineering, trade space explorations, etc. Design process modeling is therefore a critical issue organized around collaborative design, collaborative simulation, and technology and knowledge transfer.

3. Engineering innovation consists in bridging the gap between business strategy, R&D planning and product roadmaps, innovation processes and conceptual design of architecture solutions. In addition, we work on a structured need seeker innovation methodology, named *Radical Innovation Design®*, for pulling disruptive innovations from the observation of painful usage situations. 2. Design of sustainable systems consists in modeling, measuring and optimizing the environmental and sustainable performance of complex systems to promote and deploy industrial ecology and circular economy. We cover numerous sectors such as heavy industry (eco-designing energy stations or automotive recycling chains), building and construction (introducing user behaviors to simulate energy consumption) or innovative agrifood value chains.

4. Project management consists in developing methods for managing complex design, engineering and infrastructure projects, coping with relations between product, process and organization dimensions. A particular focus is made on modeling, analyzing and making decisions to mitigate potential risks associated with complexity.



Key figures in 2014

26 members 2 research chairs 4 PhDs achieved 14 journal papers 30 conferences

4 PhDs achieved

Yun Ye, "Integrated Decision Support for Architecture & Supplier Identification in Early Complex System Design", China Scholarship Council Wided Sghaier, "Réingénierie des processus de l'EFS : proposition d'une méthode dynamique de re-conception orientée création de valeurs et maitrise de risques", Etablissement Français du Sang

Toufic Zaraket, "Stochastic Activity-based Approach of Occupant-related Energy. Consumption In Residential Buildings", Bouygues Construction **Marie-Lise Moullec**, "A method to support and improve the design of complex systems architectures", Thalès Air Systems **9 faculties:** Bernard Yannou, Gwenola Bertoluci, Jean-Claude Bocquet, François Cluzel, Marija Jankovic, Julie Le Cardinal, Yann Leroy, Franck Marle, Ludovic-Alexandre Vidal

15 doctorates: Audrey Abi Akle, Alborz Bekhradi, Sonia Ben Hamida, Thierry Biard, Emilie Bonnetto, Mathieu Dernis, Tu Anh Duong, Hadi Jaber, Guillaume Lamé, Massinissa Mameri, Denis Olmos-Sanchez, Laura Roa Castro, Göknur Sirin, Julien Ventroux, Thomas Vosgien

2 post-doctorates: Andreas Hein, Toufic Zaraket



Laboratoire Genie Industriel: www.lgi.ecp.fr bernard.yannou@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) 2 +33 (0)1 41 13 13 88



Publications (selection out of 14 journal papers)

Design of complex systems	Holley V., Jankovic M., Yannou B. (2014) 'Physical interface ontology for management of conflicts and risks in complex systems', Concurrent Engineering - Research And Applications (CERA), vol. 22, no. 2, pp. 148-161, doi: 10.1177/1063293X14520760
	Jean C., Jankovic M., Stal-Le-Cardinal J., Bocquet JC. (2014) 'Predictive Modeling of Telehealth System De- ployment. Journal of Simulation', doi: 10.1057/jos 2014.27.
	Canbaz B., Yannou B., Yvars PA. (2014) 'Resolving design conflicts and promoting solidarity in distributed desi- gn', IEEE Transactions on Systems, Man and Cybernetics: Systems, vol. 44, no. 8, pp. 1044-1055, doi: 10.1109/ TSMC.2013.2296275
Design of sustainable systems	Cluzel F., Yannou B., Millet D., Leroy Y. (2014) 'Exploitation scenarios in industrial system LCA', International Jour- nal of Life Cycle Assessment, vol. 19, no. 1, pp. 231-245, doi: 10.1007/s11367-013-0631-z
Innovation engineering	Zimmer B., Le Cardinal J., Yannou B., Piette F., Boly V., Le Cardinal G. (2014) 'A methodology for the development of innovation clusters: Application in the health care sector', International Journal of Technology Management, vol. 66, no. 1, pp. 57-78, doi: 10.1504/JJTM.2014.064017
	Kooli-Chaabane H., Boly V., Yannou B. (2014) 'Monitoring of technology transfer projects in industrial clusters', Journal of Innovation Economics & Management, vol. 13, no. 1, pp. 73-91
Project management	Divine, M., Stal-Le-Cardinal J. (2014) 'How to Manage Virtual Communities and Teams using Adjacencies? A Process based on Functional Analysis and Adaptive Structuration Theory'. International Journal of e-Collaboration (IJeC), volume 10, issue 1, ISBN: 9781466653870
	Marle F., Vidal LA. (2014), «Forming Risk Clusters in Projects to Improve Coordination between Risk Owners». Journal of Management in Engineering, Vol 30, Issue 4.

Collaborations

Academic collaborations

France : Université Technologique de Compiègne, Université Technologique de Troyes, ESTIA, Ecole Centrale de Nantes, Université de Toulon, Supmeca, Mines ParisTech, Lorraine INP, AgroParisTech.

USA : University of Illinois at Urbana-Champaign, Northwestern University, Penn State University, Georgia University of Technology, University of Texas at Austin, Massachusetts Institute of Technology.

Europe : Erlangen-Nürnberg University (Germany), Technical University Munich (Germany), Norwegian University of Science and Technology, The Open University (UK).

Rest of the world : ENIM Monastir (Tunisia).

Invited Professors

Prof. Harrison Kim, University of Illinois at Urbana-Champaign Prof. Claudia Eckert, The Open University

Associated industrial chairs

Sustainable Building and Innovation, **Bouygues Construction**

Measure Procurement Risks in Complex projects, Total

Associated research institutes

IRT-SystemX (automotive, aeronautical & urban complex systems), www.irt-systemx.fr

PSE (Paris-Saclay Energy Efficacity), http://institut-ps2e.com

Profesign Engineering

aboratoire Génie Industriel

Organization of...





Industrial and institutional collaborations



tion/master/genie-industriel



Laboratoire Genie Industriel: www.lgi.ecp.fr bernard.yannou@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) +33 (0)1 41 13 13 88

BOUYGUES

Sustem×

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Decision Aid Research Group in 2014

Research

The *Decision Aid for Goods and Services' Systems* Team (DA) is composed of 22 members among which 8 faculty members, 2 post-docs and 12 PhD students. The permanent members of the team come under the two "CNU sections": *Computer science* (27) and *Computer engineering, automation and signal processing* (61).

Research conducted refers to the scientific fields of Operational Research and Decision Analysis. The focus is related to decision support in operations management, and concerns both systems of goods and systems of services. Scientific issues are positioned at two levels. (i) At an application domain level, research issues are related to performance evaluation and optimization of systems of production and distribution of goods and services. (ii) Conceptual, methodological, procedural and algorithmic issues are tackled to meet application challenges.

The development of methods to optimize various aspects of organizational systems, leading to mobilize, adapt, reformulate or even develop formal tools so to effectively answer to the questions to which decision makers are confronted. These works often lead to developing new concepts, tools and decision support methodologies decision whose validity extends way beyond the application for which they were initially designed.

Our research is structured into three main research projects:

- Service Operations Management (Healthcare systems, Call centers, ...)
- Supply Chain Management (supply chain design and planning, cooperation and competition, flow and inventory management, green supply chain)
- Multiple Criteria Decision Aid (preference modeling and elicitation, multiobjective optimization)

The models and resolutions methods considered in our research refers to Decision Aid/Operational Research: discrete event simulation methods, combinatorial optimization and mathematical programming, game theory, value based and outranking based preference models, argumentation models, preference learning, stochastic models, dynamic programming,...



4 PhDs achieved

Lina Aboueljinane «Evaluation et Amélioration des Performances des Systèmes d'Aide Médicale Urgente: Application au SAMU du Département du Val-de-Marne»

Sena Eruguz «Pilotage de flux et gestion de stock pour des chaînes logistiques multi-étages»

Oualid Jouini "Modèles Stochastiques pour la Gestion des Opérations de Service", HDR (Habilitation à Diriger des Recherches)

Semih Yalcindag "Human Resource Planning Models for Home Health Care Services : Assignment and Routing Problems" Key figures in 2014

23 members 2 Research chairs 4 PhDs achieved 24 journal papers 14 conference papers h-index : 36 (WoS) 642 citations (WoS)

8 faculties: Chengbin Chu, Yves Dallery, Asma Ghaffari, Zied Jemaï, Oualid Jouini, Vincent Mousseau, Wassila Ouerdane, Evren Sahin

13 doctorates: Yu Cao, Maxime Claisse, Karim Ghanes, Oumeima Khaled, Siham Lakri, Jinyan Liu, Shouyu Ma, Tengfei Nei, Jing Peng, Manel Maamar, Massiniss Mameri, Olivier Sobrie, Yueru Zhong

2 post-doctorates: Benjamin Legros, Bahman Rostami-Tabar



Laboratoire Genie Industriel: www.lgi.ecp.fr vincent.mousseau@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) \$\vec{\mathbf{m}}\$ +33 (0)1 41 13 13 88



Publications (selection out of 24 journal papers)

O. Jouini, Z. Aksin and Y. Dallery, "Call center Delay Announcement Using a Newsvendor-Like Performance Criterion Coalition", Production and Operations Management (POM), 2014.

S. Du, T. Nie, C. Chu and Y. Yu, "Reciprocal supply chain with intention", European Journal of Operational Research, 2014, Volume 239, Issue 2, 1 December 2014, Pages 389-402

S. Greco, V. Mousseau and R. Slowinski, "Robust ordinal regression for value functions handling interacting criteria?" European Journal of Operational Research, December 2014, Volume: 239, Issue: 3, Pages: 711-730

A.S. Eruguz, Z. Jemai, E. Sahin, and Y. Dallery, "Optimizing Reorder Intervals and Order-up-to Levels in Guaranteed Service Supply Chains", International Journal of Production Research, 2014, Volume 52, Issue 1, pp 149-164

C. Kouki, Z. Jemai, E. Sahin, and Y. Dallery, "Analysis of a periodic review inventory control system with perishables having random lifetime", International Journal of Production Research, 2014, Volume 52, Issue 1, pp 283-298.

J. Zheng, S.A. Metchebon, V. Mousseau and M. Pirlot, "Learning criteria weights of an optimistic ELECTRE TRI sorting rule", Computers & Operations Research, 2014, Volume: 49, Pages: 28-40

R. Wang, O. Jouini and S. Benjaafar, "Service Systems with Finite and Heterogeneous Customer Arrivals", Manufacturing & Service Operations Management, 2014, Volume: 16, Issue: 3, Pages: 365-380

W. Lei, A. Che and C. Chu, "Optimal cyclic scheduling of a robotic flowshop with multiple part types and flexible processing times" European J. of Industrial Engineering, 2014, Vol.8, No.2, pp.143 - 167

Collaborations

Academic collaborations

France : Université Paris Dauphine, Telecom Bretagne. USA : University of Minnesota,

Europe : Université de Mons (Belgique), Poznan University of Technology, (Pologne), Politechnico di Milano (Italy), University of Catane (Italy), VU University Amsterdam (The Netherlands), University of Coimbra (Portugal), Université du Luxembourg (Luxembourg), Koc University (Turkey)

Rest of the world : ENIT Tunis (Tunisia), SUTD (Singapore).

Invited Professors

Ozgur Ozpeynirci, Department of logistics Management, Izmir University of Economics, Turkey Selin Ozpeynirci Industrial Engineering Department, Turkey

Associated industrial chairs

Supply Chain Carrefour, LVMH, Safran, Sanofi

Manufacturing and Logistic Chair, Faurécia

Associate editors

Eur. Jour. of Decision Processes, IMA Journal of Management Mathematics; Supply Chain Forum, an International Journal

Editorial boards

4OR, International Journal of Information Systems in the Service Sector

Organization of... DA2PL'2014 November 20-21, 2014

Ecole Centrale Paris



la thèse de Wim Van Ackooij, «Chance Constrained Programming with applications in Energy **Management**»

Industrial and institutional collaborations



Our research networks



Prix Robert Faure (Roadef) pour

Laboratoire Genie Industriel: www.lgi.ecp.fr

vincent.mousseau@centralesupelec.fr (head)

delphine.martin@centralesupelec.fr (assistant) +33 (0)1 41 13 13 88

Safety and Risks Research Group in 2014

Research

Aim and Scope

Our team develops new methods, frameworks and modeling architectures, techniques and algorithms, for the safety and risk analysis of complex engineered systems, based on a holistic and systemic viewpoint. The modeling, simulation and optimization methods, frameworks, architectures, techniques and algorithms that we develop, integrate a number of competences for viewing and solving the problems from the different, multidisciplinary system perspectives (topological and functional, static and dynamic, etc.) that are needed, and giving due account to the existing uncertainties. In-house softwares that implement the problem solutions found are developed and applications are done on industrial systems like aircrafts, nuclear power plants, oil and gas systems, automotive and railway transportation systems.

Topics

Our research is organized around 3 main topics:

1. Energy network systems, focusing on modeling, simulation and optimization of electrical network systems. The analysis of these systems cannot be carried out only with classical methods of system decomposition and logic analysis; a framework is needed to integrate a number of methods capable of viewing the problem from different perspectives (topological and functional, static and dynamic, ...), properly treating uncertainties by probabilistic and non-probabilistic methods.

2. Aging and failure processes in components of energy production plants, aiming at assessing component degradation, analyzing and building maintenance solutions, and carrying out system simulation for reliability, availability, maintainability and safety (RAMS) analysis by multi-state physics, Bayesian and Markov chains models, Monte Carlo simulation. A particular focus is on failure prediction and prognostics of critical components, by data-driven approaches, e.g. adaptive artificial neural networks, support vector machines and the like.

3. **Dependable embedded systems**, consisting in developing concepts, methods and tools to design dependable embedded systems, with a special focus on avionic systems. The state-of-the-art Fault Tree assessment tools Aralia (now commercially distributed by Dassault Systemes) and XFTA have been created and are continuously developed and updated.



Key figures in 2014 24 members 2 research chairs 3 PhDs achieved 41 journal papers 24 conferences

3 PhDs achieved

Ronay Ak: Neural network modeling for prediction under uncertainty in energy system applications

Elisa Ferrario: System-of-systems modeling and simulation for the risk analysis of industrial installations and critical infrastructures

Elizaveta Kuznetsova: Microgrid agent-based modelling and optimization under uncertainty

5 faculties: Marc Bouissou, Yanfu Li, Nicola Pedroni, Antoine Rauzy, Enrico Zio 15 PhD students: Benjamin Aupetit, Yiping Fang, Fangyuan Han, Mélissa Issad, Siwar Kriaa, Benoît Lebeaupin, Anthony Legendre, Yanhui Lin, Jie Liu, Xing Liu, Chung-Kung Lo, Rodrigo Mena, Muxia Sun, Pietro Turati, Tairan Wang 3 post-docs: Elisa Ferrario, Elizaveta Kuznetsova, Ionela Prodan 1 engineer: Loic Peletan



Laboratoire Genie Industriel: www.lgi.ecp.fr enrico.zio@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) \$\vec{m}\$ +33 (0)1 41 13 13 88



Publications (selection of 7out of the 41 journal papers published)

Energy network sys- tems	Ferrario, E., Zio, E. (2014) Goal Tree Success Tree–Dynamic Master Logic Diagram and Monte Carlo simulation for the safety and resilience assessment of a multistate system of systems. Engineering Structures. V. 59, pp. 411-433.
	Fang, YP., Pedroni, N., Zio, E. (2014). Comparing network-centric and power flow models for the optimal allocation of link capacities in a cascade-resilient power transmission network. IEEE Systems Journal. doi: 10.1109/JSYST.2014.2352152, ISSN 1932-8184.
	Kuznetsova, E., Li, Y. F., Ruiz, C., Zio, E. (2014). An integrated framework of agent-based modelling and robust optimiza- tion for microgrid energy management. Applied Energy. V. 129, pp. 70-88.
	Li, Y., Ding, Y., Zio, E. (2014). Random Fuzzy Extension of the Universal Generating Function approach for the reliability assessment of multi-state systems under aleatory and epistemic uncertainties. IEEE Transactions on Reliability. V. 63(1), pp. 13-25.
	Lo, CK., Pedroni, N., Zio, E. (2014). Treating uncertainties in a nuclear seismic probabilistic risk assessment by means of the Dempster-Shafer theory of evidence. Nuclear Engineering and Technology. V. 46(1), pp. 11-26.
	Mena, R., Hennebel, M., Li, Y. F., Ruiz, C., Zio, E. (2014). A risk-based simulation and multi-objective optimization fra- mework for the integration of distributed renewable generation and storage. Renewable and Sustainable Energy Reviews. V. 37, pp. 778-793.
	Wang, TR., Mousseau, V., Pedroni, N., Zio, E. (2014). Assessing the performance of a plassification-pased vulnerability analysis model. Risk Analysis, doi: 10.1111/risa.12305, ISSN 0272-4332.
Aging and failure pro- cesses in components of energy production plants	Lin, YH., Li, Y. F., Zio, E. (2014). Fuzzy reliability assessment of systems with multiple dependent competing degradation processes. IEEE Transactions on Fuzzy Systems. V. PP(99), 11 p.
Dependable embedded systems	Cherfi, A., Leeman, M., Meurville, F., Rauzy, A. (2014). Modeling automotive safety mechanisms: A Markovian approach. Reliability Engineering & System Safety. V. 130, pp. 42-49.

Collaborations

Academic collaborations

Europe : ETH Zurich, Liverpool John Moores University, Manchester University, Norwegian University of Science and Technology, Politecnico di Milano, Technical University of Denmark, Universitat Politècnica de València and others.

Rest of the world : Beihang University, City University of Hong Kong, North China Electric Power University, Wuhan University of Technology and others.

Invited professors:

Shubin Si, Northwestern Polytechnical University, China Min Xie, City University of Hong Kong, China

Associated industrial chairs:

Chair on Systems Science and the Energy Challenge, Fondation Électricité de France (EDF), www.ssde.fr Chair Blériot-Fabre, SAFRAN

Associated research institutes:

Paris-Saclay Efficacité Énergétique (PS2E), http://institutps2e.com/

European Commission Joint Research Center (JRC) Ispra, https://ec.europa.eu/jrc/en/about/jrc-site/ispra

Institute de la Science de Risque et Incertitude (ISRI), CentraleSupélec

Laboratorio Analisi di Segnale e Analisi di Rischio (LASAR), Politecnico di Milano, www.lasar.polimi.it





Organization of...

International PhD School:

3rd PhD School on "Vulnerability, Risk and Resilience of Complex Systems" co-organized by Ecole Centrale Paris, Politecnico di Milano and Supélec, 13-17 October 2014 at Supélec, Gif-Sur-Yvette, France.

International workshop:

"Young Researchers in Reliability and Risk Analysis" 26-28 May 2014, Donnafugata, Italy.

International mini-symposium "Critical Infrastructures and Network Systems: Statistical Properties and Modelling for Reliability, Risk, Vulnerability and Resilience Analyses" at the ASCE-ICVRAM-ISUMA 2014 Conference, 6-9 July 2014, University of Liverpool, UK.

Workshop "Risk in complex systems: do we know and have everything we need for assessing them and managing them?", 11 September 2014, at Ecole Centrale Paris, France International conferences:

European Safety and Reliability ESREL 2014 Conference, 14-18 September 2014, Wroclaw, Poland

8th Summer Safety and Reliability Seminar (SSARS), 15 September 2014, Wrocław, Poland.

International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (QR2MSE 2014), Dalian, Liaoning, China, July 22-25, 2014.

Industrial and institutional collaborations



Our research networks





Laboratoire Genie Industriel: www.lgi.ecp.fr enrico.zio@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) \$\vec{m}\$ +33 (0)1 41 13 13 88





Sustainable Economy Research Group in 2014

Research

'Sustainable Economy' (previously known as 'épocc') research aims at articulating economics and managerial issues taking into account both macro and microeconomic levels; and within the scope of sustainability and innovation.

The research is articulated around two major directions:

1) New Models of Economic Growth and Firms' Organization: Here we prioritize modelling of sustainable complex systems (related to energy, management of mineral resources, climate change and other natural resources, economics of growth based on innovations, economics of electro mobility...) in order to propose optimal paths of sustainable growth and to manage in the optimal way the knowledge assets of firms. The methods that are used are quantitative with the optimal control and stochastic modelling, or qualitative with the global value chains approach, etc. After this step of modelling and diagnosing: the question is now HOW to implement such new models of growth into organizations and sectors? This is in line with the second direction.

2) Regulation and Governance of Firms and Organizations: Developing empirical methods for management and working on the properties of incentives and managerial economic tools (level and dynamic, recycling, etc.) for firms and sectors transformation. This direction deals with the issues of innovation incentives and fiscal constraints, public economics and theory of externalities, the strategy and innovation economics, the design of recycling systems, etc. It implies to the well know the characteristics of agents (firms and consumers) and the technologies they use in order to design tools, prices and methods for the 'decentralization' of the optimal results the first line above. In order to do so, 'Sustainable Economy' team members collaborate with both academic and economic institutions : for example firms that innovate radically in the sectors of energy are natural playgrounds for our studies...



Key facts in 2014 18 members

3 chairs 3 chairs 2 Phds Achieved 8 Journals 4 book chapters 26 peer-review conferences

2 Phds Achieved:

B. Shoai Therani, « *Electricity investments and development* of power generation capacities : An approach of the drivers for *investment choices in Europe regarding nuclear energy* », Supervisors : JC. Bocquet, D. Attias and P. da Costa, march 2014, ECP, France.

S. Avril, «Une approche multidisciplinaire à l'introduction des technologies solaires photovoltaïques dans le mix énergétique», Supervisors : JC. Bocquet and P. da Costa, november 2014, ECP, France.

7 Faculties

D. Attias, JC. Bocquet, L. Chi-Vo, P. Da Costa, A. Minzoni, S. Mira-Bonnardel, E. Mounoud. **3 Post-Doctorates** R. Coulomb, M. Fathizahraei, L. Marrauld.

- 8 Doctorates:
- S. Avril, M. Dernis, C. Cany, Yurong Chen, H. Idjis, B. Shoai-Tehrani, M. Senouci,
- W. Tian.



Laboratoire Genie Industriel: www.lgi.ecp.fr pascal.da-costa@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) 2 +33 (0)1 41 13 13 88



2 Best Papers Awards:

M. Fathi Zahraei and E. Mounoud for « Using ANP to design a living system like balanced operating model for intangible services » with A. Minzoni, International Symposium of the Analytic Hierarchy Process 2014, Washington, The USA.

M. Senouci for « A general characterization of neoclassical production functions and an application to physical capital-based growth models » with G. Moysan, 2nd prize of the Augustin Cournot Doctoral Days 2014, Strasbourg, France.

1 Invitation of Nobel:

Invitation to the Lindau Nobel Laureates Meeting for R. Coulomb who was selected to interact with the Nobel Prizes in Economics, Germany, august 2014.

Collaborations

Scientific Network:

England: London School of Economics and Political Science: monthly workshops on Energy Economics. Japan: Research Institute of Innovative Technology for the Earth (RITE).

France: Strate College, ESSEC, Supélec CEA Saclay, Paris School of Economics, University of Montpellier, Toulouse Business School, PS2E Paris Saclay: Institute of Energy Efficiency, Club de l'Orme: the energy experts of Paris Sa-













Member of:

SFM, AIMS, AFSE, EAERE, Association des Economistes de l'Energie: FAEE...
International Scientific Committee of the Conference on the European Energy Market...













Organisation of

International Conference: "Electromobility : Challenging Issues - Chair Armand Peugeot", december 2014, ESSEC, France.

Workshop: "New Mobility : issues and answers of public policies", 25 juin 2014, Supelec, France.



Laboratoire Genie Industriel: www.lgi.ecp.fr pascal.da-costa@centralesupelec.fr (head) delphine.martin@centralesupelec.fr (assistant) 2 +33 (0)1 41 13 13 88



3 Chairs: 2 Research Chairs:

Chair Operational Efficiency by BNP Paribas.



La banque d'un monde qui change

Chair Armand Peugeot on Electromobility and Hybrid Technology by Peugeot-Citroën (with Essec and Supélec).



PSA PEUGEOT CITROËN

1 Patronage: by endowment fund Capitaldon on Sustainable Growth.

Capital Don



WHO'S WHO





Danielle ATTIAS Adjunct Professor danielle.attias@centralesupelec.fr



Gwenola BERTOLUCI Associate professor gwenola.bertoluci@centralesupelec.fr



Jean-Claude BOCQUET Professor jean-claude.bocquet@centralesupelec.fr

Chengbin CHU Professor chengbin.chu@centralesupelec.fr



François CLUZEL Assistant professor francois.cluzel@centralesupelec.fr

Pascal DA COSTA Assistant professor pascal.da-costa@centralesupelec.fr



Yves

DALLERY Professor yves.dallery@centralesupelec.fr



Asma GHAFFARI Assistant professor asma.ghaffari@centralesupelec.fr



Marija JANKOVIC Associate professor marija.jankovic@centralesupelec.fr



Zied JEMAÏ Associate professor zied.jemai@centralesupelec.fr



Oualid JOUINI Associate professor oualid.jouini@centralesupelec.fr



Julie LE CARDINAL Professor julie.le-cardinal@centralesupelec.fr Sustainable Economy

Chair Holder "Electro-mobility" (PSA Peugeot Citroën)

Design Engineering

Design Engineering Sustainable Economy

Decision Aid Chair Holder "Supply Chain Management" (LVMH, Sanofi, Carrefour, Safran)

Design Engineering

Sustainable Economy Head of "Enterprises Sciences" Education Department Head of SE Team

Decision Aid Executive Education

Decision Aid

Design Engineering

Decision Aid

Decision Aid

Design Engineering Head of "Enterprises Sciences" Education Department Electromobility, new business models for Automotiv Industry, Innovavite mobility and Public Policies

Eco-design, Innovation Management, Modelling, Sustainability, LCA, Food Value Chain.

Complex system design, Design process and management, Value chain management, Technico economics of complex systems

Supply Chain, Operations research, Combinatorial optimization, Modelling, Analysis, Optimization, Bin packing, Cutting stock

Eco-design, Innovation engineering, Eco-innovation, Industrial ecology , Life-Cycle Assessment (LCA), Artificial intelligence in design, Design automation

Sustainable Development, Climat, Environment and Energy, Ecosystem Services, Optimal Resources Exploitation, Optimal Pollution, Innovation, Endogenous Growth theories, Semi-endogenous growth, Imperfect Competition

Supply Chain Management, Supply Chain Design, Service Opérations

Decision aid, Supply Chain, Operations research, Decision making modelling and analysis,

Complex system design, System Architecture design, Innovation engineering, Collaborative engineering, Healthcare system engineering

Supply Chain Management, Competition and coordination in supply chain, Inventory Management of perishable items

Stochastic modeling, Service operations management, Call centers, Healthcare systems

Facilitating Decision-Making, Systemic Modeling, Knowledge Management, Choice of actors, Complex System Design, Healthcare System Engineering



Yann LEROY Assistant professor yann.leroy@centralesupelec.fr



LI Assistant professor yanfu.li@centralesupelec.fr

Yanfu

Franck MARLE Professor franck.marle@centralesupelec.fr



Angéla MINZONI Adjunct Professor angela.minzoni@centralesupelec.fr

Sylvie MIRA- BONARDEL Associate professor sylvie.mira-bonardel@centralesupelec.

Eléonore MOUNOUD Associate professor eleonore.mounoud@centralesupelec.fr



Vincent MOUSSEAU Professor vincent.mousseau@centralesupelec.fr

Wassila OUERDANE Assistant professor wassila.ouerdane@centralesupelec.fr



Nicola

PEDRONI Assistant professor nicola.pedroni@centralesupelec.fr



Antoine RAUZY Professor antoine.rauzy@centralesupelec.fr

Evren SAHIN Professor evren.sahin@centralesupelec.fr



Mehdi SENOUCI Assistant professor mehdi.senouci@centralesupelec.fr



pelec fr

Ludovic-Alexandre VIDAL Assistant professor ludovic-alexandre.vidal@centralesu-



Bernard YANNOU Professor bernard.yannou@centralesupelec.fr



Enrico ZIO Professor enrico.zio@centralesupelec.fr **Design Engineering**

Safety and Risks

Design Engineering Chair Holder "Purchasing in complex projects" (Total)

Sustainable Economy Chair Holder "operational excellence" (BNP Paribas)

Chair Holder "operational excellence"

Sustainable Economy

Sustainable Economy

(BNP Paribas)

Decision Aid

Decision Aid

Head of DA Team

Ecodesign, Life Cycle Assessment, Sustainable design, Eco-innovation, Industrial Engineering Life Cycle Engineering, Recycling

Reliability modeling and optimization, uncertainty and risk analysis

Project management, Complex projects, Contracts & procurement, Project risks, Project vulnerability, Complexity modeling, Topological analysis, Propagation analysis, Clustering, Decision-making

Business and industrial anthropology, Design, Gender issues, Simplexity

Innovation strategy Strategic Management

Sustainable Development, Innovation, Management

Multiple criteria decision aid, Preference modeling, Preference elicitation, Spatial decision, Behavioral decision analysis

Multiple Criteria Decision aid, Preference Modeling, Artificial Intelligence, Argumentation theory, Explanation systems

Computational methods, Risk assessment, Safety-critical energy systems, Monte Carlo Simulation, Uncertainty quantification

Reliability Engineering and System Safety, Complex Systems Engineering

Supply Chain Management, Production, Internal Logistics, Operations Management, Service Operations Management, Healthcare Engineering

Economic growth and fluctuations, economic theory, international financial macroeconomics

Project management, Risk management, Complexity, System thinking

Design automation, design methodologies, product development, innovation engineering, ecodesign, artificial intelligence in design, design processes and management

Risk, reliability, safety, resilience analysis and maintenance and asset management of complex systems and critical infrastructures; Monte Carlo simulation methods; Soft computing techniques for meta-modeling; Evolutionary and heuristic techniques for optimization. Energy, nuclear, oil and gas systems.

Safety and Risks

Safety and Risks Chair Holder "Blériot Fabre" (Safran)

Decision Aid Chair Holder "Logistics & Manufacturing" (Faurécia)

Sustainable Economy

Design Engineering

Design Engineering Head of LGI Head of DE Team

Safety and Risks Head of SR Team Chair Holder "Systems Sciences" (EDF)

