FICHE NAVETTE: DOCTORANTS IDEX

SECTOR **:** Higher Education Institution

LOCATION: France, Grenoble

RESEARCH FIELD: Industrial Engineering, Mechanical engineering, Control engineering

RESEARCHER PROFILE:
  □ *First stage researcher,*

INSTITUTION: **Univ. Grenoble Alpes, University of Innovation**

One of the major research-intensive French universities, Univ. Grenoble Alpes**1 enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL*2). The vibring ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ". This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

* ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

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[1] Univ. Grenoble Alpes

SUBJECT DESCRIPTION:

In the framework of the CDP CIRCULAR (https://www.communaute-univ-grenoble-alpes.fr/circular-732721.htm), a thesis in the field of diagnosis is proposed (WP2). This call for PhD candidature, concerns the modelling and performance evaluation applied to the Lithium Ion batteries case study.

The CIRCULAR project aims at developing reliable circular industrial systems able to transform post-used products into new added-value products to prolong their life and ensure more sustainability [0]. In those systems, adapted diagnostic and prognostic technics are essential to control the product obsolescence. But the technological heterogeneity of the products, with various lives, as well as the dynamics of change, accentuates the difficulty to the establish diagnosis and prognostics for making decision in the new value chain. The aim of proposed thesis is to provide reliable sensor networks as well as information retrieval modules to develop as accurate as possible a diagnosis and a health prognosis of the studied system. Information system, data collection and data integration will be considered for this.

In practice, the required data are not always available to establish such kind of diagnostic / prognostic and their use is often confronted with difficulties related to the following characteristics:

a. **Heterogeneity**. The data often come from different products life phases and each of those data is likely to add value to the process of diagnosis and prognosis. It is therefore necessary to identify and use each data into the appropriate models, in relation to the different life stages and modes with operating conditions attached to it.

b. **Geographical and environmental influences**. The behaviour of the monitored systems can change according to their environment and operating conditions, which may change each significantly during the lifetime of the device. This problem may introduce significant perturbations in terms of prognostic and therefore in the economic plan.

c. **Quantitative insufficiency**. Some data, essential to the establishment of decision models can be rare or censored. Therefore, the effects of the censured data and the disruption of the decision models will be carefully considered.

Developments in this thesis will be structured into four main phases.

- The first phase is devoted to the characterization of the requirements and essential metrics for the diagnosis of the studied system. Particular attention will be given to the information system, data collection and data integration which will include sensor networks reliability through proper architecture [7, 8]. Concerning the particular application, it will be necessary to identify the sensitive data allowing evaluating the state of health of the batteries.

- The second phase involves the integration of data. We aim to integrate data from different sources (sensors, information from experience feedback (REX)) to develop models of reliability and degradation by taking into account factors related to operating conditions, operating modes and environmental influence parameters [1, 2, 5, 6,11].

- Construction and modelling knowledge is the third phase. In this context, it is necessary to formalize the reuse of knowledge, which is one of the scientific challenges.

- The fourth phase involves the use of various data (sensor, REX) for prognosis and state of health control [3, 4, 9, 10]. This is a fundamental function to planning the reconfiguration for reuse or disassembly.

References

[1] Brissaud D., Zwolinski P. The Scientific Challenges for a Sustainable Consumption and Production Scenario: The Circular Reuse of Materials for the Upgrading and Repurposing of Components, CIRP LCE Conference, Mar 2017, Kamakura, Japan. Procedia CIRP, Volume 61, pp.Pages 663-666, 〈10.1016/j.procir.2016.11.148〉

[2] Bect P., Simeu-Abazi Z., Maisonneuve P-L., Pero M., Demerliac B. – "Personalized learning algorithm for diagnosis: application to aircraft" COMADEM 11, 24th International Congress on Condition Monitoring and Diagnostics Engineering Management, May 30 – June 1st, Stavanger, Norway.

[3] Bect P., Simeu-Abazi Z., Maisonneuve P-L., Pero M., Mermoz E., Viniacourt F. – "Normal signature characterization for system health assessment: Application to helicopter" PHM 11, IEEE Prognostics and System Health Management, May 24-25, 2011, Shenzhen, China.

[4] Gascard E., Simeu-Abazi Z., Younes J. « Exploitation of Built in test for diagnosis by using Dynamic Fault Trees: Implementation in Matlab Simulink», ESREL 2011, October 2011.

[5] Gascard, E.; Simeu-Abazi, Z., "Modular Modelling for the Diagnostic of Complex Discrete-Event Systems", IEEE Transactions on Automation Science and Engineering, no.99, pp.1,23, 2013.

[6] Ghelam S., Implémentation d'une fonction de maintenance prédictive appliquée aux systèmes avioniques, Thèse de l'université Joseph Fourier : 2006.

[7] Lefebvre A., Contribution à l'amélioration de la testabilité et du diagnostic de systèmes complexes : Application aux systèmes avioniques, 2009, Thèse de l'université Joseph Fourier, Grenoble.

[8] Karray H., Chebel-Morello B., Zerhouni N. « A component based system for S-maintenance. 9th IEEE International Conference on Industrial Informatics, INDIN'11. 26-29 juillet 2011 / Caparica, Lisbonne (Portugal) vol. 1 - pp. 1-8

[9] Karray M.H., Chebel-Morello B., Zerhouni N. A Formal Ontology for Semantics in Maintenance Platforms, Applied Ontology Journal: Vol7, N°3, 2012 ISBN1570-5838 (Print) ISBN 1875-8533 (Online) pp 269-310 IOS Press

[10] Medjaher K., Tobon-Mejia D. A., Zerhouni, N. Remaining useful life estimation of critical components with application to bearings, IEEE Transactions on Reliability 61 (2), 292 – 302. 2012.

[11] Simeu-Abazi Z., Lefebvre A. A methodology of alarm filtering by using dynamic fault tree, Reliability Engineering & System Safety - Volume 96, Issue 2, Pages 257-266. 2011.

[12] SAVARD C. Amélioration de le Disponibilité Opérationnelle des Systèmes de Stockage de l'Énergie Électrique Multicellulaire, 2017 Thèse de l'INSA de Lyon.

Candidate profile

Diploma from an engineering University/School, in one of the following field:
— Mechanical engineering,
— Industrial engineering,
— Control engineering,
— Manufacturing systems design.
— Data scientist

Skills on one or more of the following topics:
— Modelling and design of production systems
— Decision-making / Decision Support Systems
— Uncertainty modelling and evaluation
— Data processing
— Performance evaluation
— Simulation of industrial systems

ELIGIBILITY CRITERIA

Applicants:

- must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration),

Applicants will have to send an application letter in English and attach:
- Their last diploma
- Their CV
- A short presentation of their scientific project (2 to 3 pages max)
- Letters of recommendation are welcome.

Address to send their application: zineb.simeu-abazi@grenoble-inp.fr, Peggy.Zwolinski@grenoble-inp.fr

SELECTION PROCESS

Application deadline: **1 June 2018** at 17:00 (CET)

Applications will be evaluated through a three-step process:

1. Eligibility check of applications in 4 June 2018
2. 1st round of selection: the applications will be evaluated by a Review Board 6 June 2018. Results will be given in 15 June 2018
3. 2nd round of selection: shortlisted candidates will be invited for an interview session in Grenoble on June 2018. (if necessary)

TYPE of CONTRACT: temporary-3 years of doctoral contract

JOB STATUS: Full time

HOURS PER WEEK: 35

OFFER STARTING DATE: 01/10/2018

APPLICATION DEADLINE: 30/11/2018

Salary: between 1768.55 € and 2100 € brut per month (depending on complementary activity or not)

Financements de la thèse : si co-financements, préciser la durée de chacun des financements et l'organisme ou l'institution partenaire