

Thesis proposal

Thesis title: AI-assisted prognostics and health management for fuel cell electric vehicles.

Description of the thesis project:

Fuel cell electric vehicles (FCEV) has been considered as one of the ideal alternatives of various vehicles thanks to the attractive properties such as high power density, high efficiency and zero on-board emission. Despite the advantages, fuel cells (FCs), as principle power sources in FCEVs, are still suffering from low durability which is considered as the bottleneck of the FCEVs. From some recent studies, it is found that the low FC durability, in most cases, has been due to the system operation issues rather than the problems in the FCs themselves. With this in mind, it is necessary to operate FCs properly and in favour of the FC durability enhancement. Due to the complex physical and chemical processes and the highly uncertain FC operating conditions, the access of FC internal degradation state and the prediction of its evolution, which are two key elements for optimizing FC operation, have been considered as two challenging issues. This PhD project is therefore oriented to developing tools to handle the prognostics and health management (PHM) for FCEVs. Specifically, the objective of the PhD project is twofold: 1) develop AI-assisted self-cognizant tools to identify and predict FC intrinsic degradation indices; 2) develop a control-oriented self-adaptable model for FC systems targeting at durability enhancement control.

This PhD project is a part of project **DEAL** (<https://deal.lis-lab.fr/>) funded by French National Research Agency (ANR). The PhD work will be carried out in two CNRS labelled laboratories: LIS (CNRS 7020) located in Marseille and FEMTO-ST (CNRS 6174) in Belfort.

Keywords: Fuel cells, electric vehicles, prognostics and health management, self-cognizant, model identification, incremental learning, state estimation.

References:

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Scientific fields: automation, electrical engineering, computer science.

Duration: 3 years, flexible starting time between April and October of 2021.

Inscription: Aix-Marseille University (<https://www.univ-amu.fr>)

Host laboratories: LIS (<https://www.lis-lab.fr/>), FEMTO-ST (<https://www.femto-st.fr/>)

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Expected profile of the PhD candidate:

- Graduated or graduating in relevant disciplines (automatic control/electrical engineering/computer science);
- Great academic score;
- Solid background and/or research experiences in automatic control and/or machine learning;
- Great interest in electric vehicles and artificial intelligence;
- Good master of Matlab and Python;
- Solid skills on experimental manipulations (electromechanical systems, power converters, embedded control systems, etc...);
- Fluent English, oral and written communications (meetings, seminars, conferences)
- Self-learning ability, autonomy, initiative.

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