Thesis proposal

Thesis title: Intelligent durability enhancement control for fuel cell electric vehicles.

Description of the thesis project:

Battery based electric vehicles (EVs) suffer from long recharging cycle, heavy weight, and limited driving range which have been considered as the essential limits of battery and cannot be perfectly resolved. Compared with battery based EVs, fuel cell (FC) EVs, with shorter repose (recharging) time, lighter weight, less well-to-wheels energy consumption (within the same driving range), have been considered as one of the ideal alternatives of various vehicles. Despite the advantages, FCs, as principle power sources in FCEVs, are still suffering from low durability which is considered as the bottleneck of the FCEVs. Among various solutions, optimizing FC system control is a key factor for improving FC durability. This PhD project aims at improving the durability of FCs applied in heavy-duty vehicles by exploring self-cognizant optimal control. To achieve this, the thesis will generally involve twofold work: 1) develop online learning function for FC system model in consideration of FC degradation and the uncertainty of operating conditions; 2) develop learning-based 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, optimal control, self-cognizant, online-learning, energy management, model predictive control, reinforcement learning.

References:

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Scientific fields: electrical engineering, automation, 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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