

CIFRE PhD fellowship with Siemens Digital Industries Software, IFP Energies nouvelles (IFPEN) and AMPERE laboratory

Electrical engineering, electronic engineering,
information engineering

Development of artificial intelligence algorithms to estimate the state of health of lithium-ion batteries from cell to pack level

The electric vehicle market is growing strongly and phenomenal progress is underway, in particular in terms of extending the vehicle's kilometric range. The traction battery is the central organ of these vehicles that dictates this range.

The lifespan of such batteries depends on several environmental factors such as temperature, battery state of charge and power demand. Diagnostic assessments require input on the nature of the lithium-ion battery technology, its different aging mechanisms and its configuration, especially the number of cells in series or parallel, i.e. factors that make the service lifetime extremely difficult to predict. To respond to the complexities surrounding this issue, an artificial intelligence approach, such as "Machine Learning", may well be viable and is the subject of interest in this PhD project.

For this doctoral project, the student will have access to existing test databases (internal to IFPEN or open-source) gathering electrothermal measurements on several technologies of lithium-ion battery cells. Additional experiments using battery test facilities will also be carried out in a battery laboratory from single cells up to a module level. For data mining, artificial intelligence approaches including "machine learning" algorithms, will be employed.

Throughout this PhD, the doctoral student will be responsible for:

Carrying out an extensive literature survey, and keep on top of technological developments related to this field,

- carrying out electrical measurements in the laboratory,
- putting in place the means to automate data-mining,
- proposing new digital methods,
- writing scientific publications in addition to a PhD thesis.

This work requires an aptitude and willingness for processing and analyzing data through the use of computer tools such as Python, R, Matlab, etc. Basic knowledge in electrochemistry and/or electrical engineering, some hands-on experimentation, as well as statistical analysis methods, would be requisite.

Keywords: Artificial intelligence, machine learning, batteries, aging, state of health

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Doctoral School	Ecole doctorale EEA de lyon, https://edeea.universite-lyon.fr/
IFPEN supervisor	Dr MINGANT Rémy, ingénieur de recherche, Electrochemistry and Materials department, Remy.mingant@ifpen.fr
PhD location	IFP Energies nouvelles, Solaize, France and AMPERE, Lyon 1 University, France and Siemens Digital Industries Software, Lyon, France
Duration and start date	3 years, starting in fourth quarter 2021
Employer	Siemens Digital Industries Software, Lyon, France
Academic requirements	Engineer or University Master degree in relevant disciplines
Language requirements	Fluency English, Basic knowledges in French

To apply, please send your cover letter and resume to remy.mingant@ifpen.fr

Siemens Digital Industries Software

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Our solutions help companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation. For more information, see [our website](#).

IFP Energies nouvelles

IFP Energies nouvelles is a French public-sector research, innovation and training center. Its mission is to develop efficient, economical, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, see [our website](#).

IFPEN offers a stimulating research environment, with access to first in class laboratory infrastructures and computing facilities.

Ampère Laboratory

The Ampère Laboratory is a joint research unit of CNRS, Ecole Centrale de Lyon, INSA Lyon, Claude Bernard University of Lyon. Its research activities concern the management and rational use of energy in systems in relation with their environment, see [our website](#).