Improving PHM methods for Li-Ion batteries

Topic: Model-based PHM for Li-ion batteries

TITLE: Lithium-ion batteries PHM exploiting **multi-physics digital twin** (DT) and **machine learning** (ML)

RESEARCH BACKGROUND:
To ensure safe and efficient operation, the power batteries of EVs should be controlled on a suitable operative environment, which includes temperature and pressure as well. Therefore, an accurate battery management system (BMS) which mainly rely on the estimation of battery health states including SOC, SOH, RUL and ISC early occurrence is highly required which means, an efficient prognostics and health management (PHM) system

RESEARCH ACTIVITIES:
1. Implementation and development of a **multi-physics digital twin** (DT) of a Li-Ion battery at increasing levels of detail, including electrochemical, thermal and mechanical dynamics capable of simulating healthy, main **degradation and ageing process** in MATLAB, Simulink and COMSOL.
2. Development of a **fast filtering-based algorithms** (e.g., Extended Kalman Filter) which include **new possible measurements** for more accurately estimating the health state of the batteries.
3. Processing of **thermal, electrical and mechanical signals** with **machine learning algorithms** trained mainly based on data simulated offline through the accurate numerical model for Li-ion battery diagnosis and prognosis.

METHODOLOGY: Numerical – (Experimental)

DURATION: 7-9 months

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POSSIBLE COLLABORATIONS:
To be defined