



CARISSMA

Institute of Electric,  
Connected and Secure Mobility



Technische Hochschule  
Ingolstadt

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## Abschlussarbeit

### *Investigation of the aging of lithium-ion batteries (calendar or cycle effect)*

#### **Description:**

A new, innovative and promising trend is to use data-driven and machine learning approaches to capture trends and aging mechanisms in batteries. There is a need for machine learning algorithms that capture the complex and nonlinear physical mechanisms involved in the degradation (cell aging) of lithium-ion batteries and estimate the health of the battery. The PRIMA Batteries project aims to develop data-driven models that can provide reliable predictions for lithium-ion batteries. These models can extend the lifespan and make batteries more sustainable. The heterogeneity of batteries with multiple lifespans and the dynamics of change highlight the difficulty of making diagnostics and forecasts for decision-making in the new value chain. The goal of the proposed thesis is to collect reliable data as well as battery aging models capable of making predictions about the battery condition. In practice, data from different phases of the battery lifetime will be collected and each of these databases will enhance the battery prediction model. Accurately predicting lifespan using early-cycle data would result in lower costs to manufacture, use and optimize batteries and lead to wider EV adoption. Therefore, it is necessary to identify, use and build reliable databases in order to develop suitable models in different life stages and modes with the associated operating conditions.

#### **Your tasks:**

- First phase: development of test procedures, data collection, structuring and imputation of missing data, data cleaning, and inferential statistics.
- Second phase: Develop advanced models: AR, MA, ARMA, ARIMA and ARIMAX processes. Meta-Algorithms: Boosting, AdaBoost and Gradient Boosting, Evolving Fuzzy System, Machine Learning Algorithms (supervised/unsupervised learning, neural networks). Deep Learning Algorithms.
- Third phase: Writing the text document of the thesis, depicting/presenting the results.

#### **Your profile:**

- MatLab or Python experience and knowledge are desirable but not required.
- Basic knowledge of battery systems would be desirable.
- Confident use of MS Office.
- Excellent communication and organizational skills.

#### **Interested? Any questions? - Contact us!**

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