# Model-based strategy oriented to PEMFC system prognostic for Bus transportation applications based on EMR formalism.

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Proton exchange membrane fuel cells (PEMFCs) appear nowadays to be a promising solution to face energy transition challenges in automotive applications. In this scenario, PEMFCs lifespan and their remaining Useful Life (RUL) under dynamic operations is currently object of main interest.

This work introduces the fundamentals to design a generic strategy to support PEMFC durability enhancement in case of bus transportation applications. To this purpose, the energetic macroscopic formalism (EMR) is used to represent and model both the stack and the balance of plant (BoP) interactions. Based on power exchanges, each element will be related to another according to the action-reaction principle. The expected model will be able to simulate the system' response under a given load mission profile. Ageing behavior will be also considered in the model development. The model is expected to predict the voltage degradation profile with respect to the operating time and/or the produced energy. The voltage trend will be subsequently exploited by prognostic techniques to evaluate the PEMFC and BOP RUL and support their maintenance. This kind of approach is useful to integrate the existing diagnostic algorithms and support PEMFC makers in control decisions and maintenance scheduling as illustrated below.

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**Figure: Generic strategy fundamentals to support PEMFC durability based on EMR**