Energy management strategy based on prognostics-enabled decision-making for fuel cell hybrid electric vehicles

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Fuel cell hybrid electric vehicle (FCHEV) is gaining momentum in today's automotive market and offers a sustainable solution for the world climate change in the transport sector. However, durability and reliability of the power sources, namely, the fuel cells and the batteries, has been the obstacle for their massive use. Prognostics and health management (PHM) is a recent approach to manage and possibly extend the lifespan of industrial system, in which prognostics is an aspect to provide the current health state estimation and predict the future remaining useful life, and health management is an aspect to take actions to improve the system performance and manage its lifespan based on prognostics knowledge [1]. In this study, an energy management strategy (EMS) based on prognostics-enabled decision-making (PDM) under the PHM framework is propsoed for the studied FCHEV, which provides a solution for the limited lifetime of the power sources The energy management results are plotted in Figure 1, in which it could be seen that the proposed EMS can smooth the fuel cell operation and maintain the battery state-of-charge at a high level, so that the degradation is mitigated and the lifetime of the controlled system is prolonged. The occurrence frequency of the prognostics has also been investigated and analysed in this study.

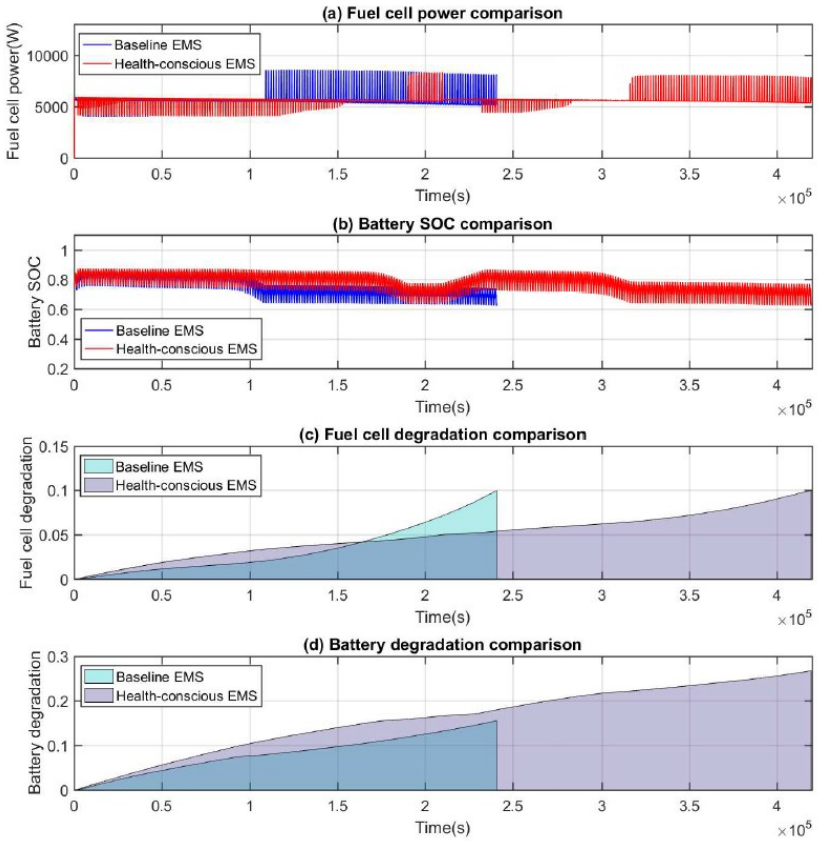

Figure 1: Energy management results: (a) Comparison of fuel cell power; (b) Comparison of battery SOC; (c) Calculation of fuel cell degradation; (d) Calculation of battery degradation.

[1] Balaban, Edward, and Juan J. Alonso. "A modeling framework for prognostic decision making and its application to uav mission planning." Annual conference of the prognostics and health management society. 2013.