Innovations in FCHEV Power Management: A Fusion of Machine Learning and Physics-Based Models

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Abstract: In the green motor vehicles era, fuel cell hydrogen electric vehicles (FCHEVs) are becoming promising alternatives. Thus, ensuring proper operation of FCHEVs, solely depends on advanced energy management systems (EMS). In this light, this work deeply looks into how combining machine learning and physics-based models can make FCHEVs operate effectively through improved EMS. The study extensively analyzes how machine learning and physics-based models operate together in FCHEV-EMS. It therefore breaks through existing research and identifies insights, challenges, and potential future directions. It also looks closely at how machine learning meets challenges in adapting to real-time and handling changing conditions. To gain better understanding of these issues, the study further recommends innovative ways to integrate machine learning flexibility within precision of physics-based modeling. It therefore reveals intriguing potential for additional study in the world of FCHEV-EMS. It represents, the integration of machine learning and physics-based models as a potent technique to deal with EMS difficulties and accelerate advances in FCHEV energy management. In the end, it outlines significant findings, addressing why this integrated strategy is crucial in making FCHEVs leading worldwide sustainable transportation. Through its comprehensive review and strategic perspectives, this initiative aims to catalyze innovations that actively contribute to the sustainable advancement of FCHEVs.

Keywords: FCHEV, Power Management, Machine Learning, Physics-Based Models, Sustainable Transportation, Research Opportunities;