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EDITORIAL

Preface for Feature Topic on Advanced Battery Management for Electric Vehicles

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With the growing demand for energy resources and rising environmental risks, the deployment of electric vehicles has been recognized as effective countermeasures to the global energy crisis and climate change. Lithium-ion batteries, thanks to their high efficiency, high energy/power density, and long lifespan, are widely used as critical energy storage devices for electric vehicles. Meanwhile, traction batteries play a deciduous role in the reliability, availability, maintainability, and safety of electric vehicles. Therefore, they should be meticulously designed and managed.

The development of advanced battery management systems has become the forefront of research worldwide. Upgraded modeling, estimation, control, and optimization of battery systems are researched in order to improve the battery performance while guaranteeing its safety. Interdisciplinary knowledge, including electrical engineering, control theory, electrochemistry, AI, and machine learning, needs to be integrated in an appropriate way to seek high-performance battery management.

Four articles have been collected in this feature topic with salient contributions to the field of battery management. The feature topic highlights the most recent advances in battery modeling, health and safety management. The four articles, as listed below, cover the topics of battery fault prognosis and diagnosis, data-driven modeling of the electrode, state of health estimation, and non-invasive characteristic analysis.

Paper Highlight

1. The paper "Internal Short Circuit Detection for Parallel-Connected Battery Cells Using Convolutional Neural Network" by Ziyou Song et al. offers an efficient approach for the diagnosis of internal short circuits of parallel-connected batteries. It is effective to use the surface temperature distribution of batteries as an indicator of the severity of the internal short circuit, and by combing the deep-learning algorithm, the abnormity of the battery can be accurately detected.
2. The paper "Data-Based Interpretable Modeling for Property Forecasting and Sensitivity Analysis of Li-ion Battery Electrode" by Kailong Liu et al. provides a framework to predict the battery electrode properties during the early production stage. By analyzing the key parameters quantitatively during the manufacturing process, this framework fosters the understanding of battery electrodes and promotes optimization in battery electrode design.
3. The paper "An Enhanced Data-Driven Model for Lithium-ion Battery State-of-Health Estimation with Optimized Features and Prior Knowledge" by Jinhao Meng et al. proposes an efficient prognostic approach for battery state of health monitoring. The optimization of feature extraction, as well as a modified kernel function for the Gaussian regression process, can contribute to both higher estimation accuracy and computational efficiency.
4. The paper "Non-invasive Characteristic Curve Analysis of Lithium-ion Batteries Enabling Degradation Analysis and Data-Driven Model Construction: A Review" by Xinhua Liu et al. comprehensively reviews three kinds of battery characteristic curves and the corresponding applications in battery aging. The combination of characteristic curves and data-driven methods for battery state estimation has also been reviewed and discussed.

The publication of this feature topic would not be achieved without the meticulous work and joint efforts of all the authors, reviewers, and editors. We would like to thank all authors, reviewers, and the staff from the editorial office of Automotive Innovation for their hard efforts and support. Sincerely hope this feature topic can inspire more innovative thinkings and promote research and development of next-generation battery management systems.

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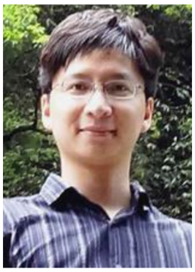
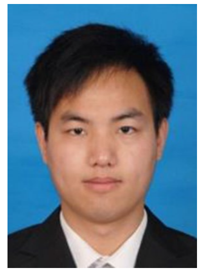
Guest Editors



Xiaosong Hu is a professor with the State Key Laboratory of Mechanical Transmissions, College of Mechanical and Vehicle Engineering, Chongqing University, China. His research interests include modeling and control of alternative powertrains and energy storage systems. Prof. Hu has been the recipient of numerous prestigious awards/honors, including Web of Science Highly-Cited Researcher by Clarivate Analytics, SAE Environmental Excellence in Transportation Award, IEEE ITSS Young Researcher Award, SAE Ralph Teetor Educational Award, Emerging Sustainability Leaders Award, EU Marie Currie Fellowship, ASME DSCD Energy Systems Best Paper Award, and Beijing Best Ph.D. Dissertation Award. He is also an IET Fellow.

Michael Pecht is the founder of the Center for Advanced Life Cycle Engineering (CALCE), University of Maryland, College Park, MD, USA, where he is also a chair professor. He has been leading a research team in the area of prognostics. Prof. Pecht is a professional engineer and an American Society of Mechanical Engineers (ASME) fellow. He has received the IEEE Undergraduate Teaching Award and the International Microelectronics Assembly and Packaging Society (IMAPS) William D. Ashman Memorial Achievement Award for his contributions to electronics reliability analysis. He served as chief editor of the IEEE Transactions on Reliability for eight years and an associate editor for the IEEE Transactions on Components and Packaging Technology.



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