| Research Paper

Adaptive Passive Cell Balancing of Battery Management System for an Electric Vehicle Application

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Abstract

The battery pack powers the electric motor in a battery-operated electric vehicle. To achieve the required power, the cells are connected in series and parallel combinations to form a battery pack. The battery pack is monitored using the battery management system. During the charging and discharging process, imbalance occurs in the cells due to intrinsic and extrinsic properties of the battery chemistry. This cell imbalance induces problems, such as an under-discharge, over-charge, increase in charging time and reduction in battery lifecycle. The passive and active balancing technique is employed to balance the individual cells in the battery pack. In this paper, the adaptive passive cell balancing is performed for a battery pack of six series-connected Li-ion cells of rating 3.6 V, 4 Ah under ideal, charging, discharging and drive cycle conditions using MATLAB/Simscape. In this proposed adaptive passive cell balancing methodology, a dynamic resistance is selected based on the threshold values to balance the individual cells in the battery pack. For this battery pack, the proposed design achieves 34% reduction in balancing time, 17% reduction in energy loss, and 14% reduction in power loss under ideal conditions. The experimental verification is also done and shows that the balancing time is about 2400 s. The capacity fade factor of the battery pack is also analyzed.