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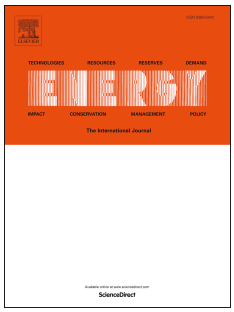

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Dynamic battery equalization with energy and time efficiency for electric vehicles

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Abstract

Battery equalization is a critical technology in energy storage systems, so that each storage cell has equal state. In the application of electric vehicle, equalization circuits and algorithms have been widely studied for the purpose of prolonging driving time, but optimization of equalization efficiency is a difficult task in the battery equalization of electric vehicle. In this paper, an optimization model with a linear form is proposed to incorporate both energy loss and equalization time for an energy-bus equalizer. In the consideration of different working status of electric vehicle, i.e., charging, discharging, and driving, dynamic equalization has been investigated, and a model predictive control approach is proposed to cope with frequent change of working status. According to simulation and experimental results, it can be concluded that energy and time efficiency can be significantly improved during dynamic battery equalization, and that the proposed equalization system is easily implemented with competitive simplicity due to the linearized system model.

Keywords: energy storage system, electric vehicle, battery equalization, energy efficiency, model predictive control

1. Introduction

Energy storage is commonly used in micro grids, energy systems, and electric technologies. In the micro grid, battery storage is required to store the renewable