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Comparative Study of Lithium-Ion Battery Cell Balancing Strategies for Electric Vehicle Systems in MATLAB

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Abstract: *The performance, longevity, and safety of lithium-ion battery packs used in electric vehicles (EVs) heavily depend on effective cell balancing techniques. This research presents a comparative analysis of various cell balancing strategies implemented through MATLAB simulations. Passive and active balancing methods are examined to evaluate their efficiency, energy loss, balancing speed, and impact on overall pack performance. The study investigates techniques such as resistor-based dissipation, capacitor shuttling, and inductor-based charge redistribution under different operating scenarios. Simulation results reveal the trade-offs between system complexity, cost, and effectiveness for each method. The findings offer practical insights for selecting the most appropriate balancing approach in EV applications, aiming to enhance energy utilization and extend battery life.*

Keywords: Battery modeling, Active cell balancing, Passive cell balancing, Topologies

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