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The influence of dynamic impedance of Li-Ion cells on current distribution in energy storage

Abstract:
The article highlights the issue of uneven discharge in energy storage systems composed of multiple strings. These systems are commonly employed in large-scale energy storage facilities, electric buses, and hydrogen-powered vehicles. The problem stems from their series-parallel connection design. These systems consist of series chains of cells with voltages ranging from 48V to 1500V, which are then connected in parallel. The significant distances between individual strings necessitate the use of cable connector that impact the overall impedance of the strings. Another crucial issue arises from the variations in dynamic impedance among individual cells.

The operation of such energy storage systems leads to uneven current distribution, resulting in non-uniform discharge of the individual strings. This issue compromises the energy storage system's efficiency and reduces cell lifespan. The article proposes a solution involving the development of a control algorithm for a dedicated DC/DC converter. This converter's task would be to regulate the impedance of each string and manage current flow throughout the energy storage system. Such a strategy would eliminate discharge unevenness across the strings, directly impacting the enhancement of the energy storage system's efficiency and reliability.

Keywords:
Energy storage, dynamic cell impedance, current asymmetry