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VOLTAGE BALANCING ON THE ELECTRICAL ENERGY STORAGE ELEMENTS

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Abstract

In the race to find solutions to store electrical energy, replacing electrochemical storage batteries with super-capacitor batteries can be a solution. Super-capacitors use a double-layer capacitance mechanism to store energy. This means that they have two layers of charged particles, one layer of positive ions and one layer of negative ions, separated by a thin insulating layer. When a voltage is applied to the device, appear an electric field which stores energy, which can be quickly released when needed.
Due to the manufacturing technology, these super-capacitors have a low working voltage (mostly 2.7 V). In order to be used as a direct replacement for established batteries, for example in the automotive industry (about with 12 V electric net), it is necessary to connect these super-capacitors in series. Even if they are from the same technological batch, there are differences, sometimes even significant, between the parameters (in terms of capacity) of these components, the main problem being the asymmetrical distribution of voltage on them. The paper analyses the possibilities of balancing the voltage distribution on the series network of super-capacitors. The results obtained through simulation and experiment showed that it is possible to create circuits that limit the voltage on the super-capacitor to the nominal value, protecting them from over-voltage, and thus ensuring the battery of super-capacitors a maximum life span. The voltage balancing circuit on each super-capacitor acts as a power Zenner diode with the opening threshold at the rated voltage of super-capacitor.
Super-capacitors are used in a wide range of applications, where they can provide a quick burst of energy for high-demand applications. What is important to this energy storage technology it is very friendly with environment because is based on graphite material.

Key words: balancing network, charging time, series super-capacitors, super-capacitor

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