Review of characterization methods for supercapacitor modelling

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This paper focuses on the different types of dynamic systems involving supercapacitors and the options available for implementing supercapacitors into them. Hybrid cars, DSLR cameras, and power tools are all machines which supercapacitors are being integrated into, among many others. Supercapacitors are known for their tremendous ability to deliver power to heavily loaded circuits. Currently SC’s have a power density of 5~15 kW/kg. The drawback is that compared to Li-ion batteries, their energy storage capacity is quite low. Because of this, many SC cells are used in circuits at once, either in series or in parallel.

By comparing values in the table included, which gives the datasheet of capacitance and resistance as found by the suppliers of the SC’s used in the trials by the authors, and the same values as found by the authors, it is clear that the temperature does not play much of a role in the Capacitance of the SC. The capacity variance is around 1~3%. This was the same no matter the supplier or nominal capacitance (3000,1200, 650 F). This is obviously a good feature for SC cells used in cars or machinery that has to operate in unusually warm or cold temperatures.

Three different types of models are compared in this paper. The first is the standard R-C circuit. From experiment the energy density of SC in this circuit is a little of 5Wh/Kg. This is pretty standard for SC in general, but still on the low end. The next models analyzed are the Two R-C Branch model and the dynamic Model. The Two R-C branch consists of one “main” branch where charge and discharge happen. This consists of internal resistors and two capacitors aligned in parallel. The next branch is tasked with charge redistribution, and the last branch auto discharge. This type of configuration takes into account the effect that voltage has on capacitance, which the R-C circuit does not. The dynamic model is much more complicated, and it is very vulnerable to changes in frequency. All three of these models are used in practice, this paper gives a lot of data that I will need to delve into further in the form of graphs and figures.