Design of current profiles resembling drive cycle characteristics for Li-ion battery model estimation

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When estimating the parameters of a Li-ion battery Equivalent Circuit Model (ECM) the Hybrid Pulse Power Current (HPPC) profile is often the signal used for model estimation. Once a model is estimated, a drive cycle current profile is used as a validation signal. A drive-cycle profile, in contrast to a pulse signal, is more dynamic in both the amplitude and frequency bandwidth. As such modelling errors can occur when using HPPC data for parameterisation since the model is optimised over a narrower bandwidth than the validation profile. A signal more representative of a drive cycle, while maintaining a degree of generality, is needed if such modelling errors are to be reduced.

In this presentation a signal design technique is presented whereby superimposing a signal known as a multisine to a base-signal consisting of a charge, rest and discharge segment, a current profile more dynamic in amplitude and frequency bandwidth, and thus more similar to a drive cycle, can be obtained. This signal is defined as a pulse-multisine. The design procedure maintains a generality allowing it to be designed for other drive-cycle profiles. The pulse-multisine signal is intended to be used as a substitute for a HPPC test. Furthermore, the experimentation time, per state- of-charge (SoC) and temperature, for the pulse-multisine is several minutes compared to several hours for an HPPC experiment.