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Feasibility of using SSTDR to Monitor Battery Cell Degradation

Many electrical systems are reliant on battery cells for power and must incorporate additional circuitry for monitoring the batteries' state of health (SOH). To get a per-cell status, traditional methods require each cell to be wired with monitoring circuitry adding significant cost and complexity to the system design. This paper investigates applying Spread Spectrum Time Domain Reflectometry (SSTDR) to the function of monitoring battery system SOH. This can be done by using SSTDR to test the internal resistance of the string of battery cells for degradation as the battery cells age. By monitoring the cell stack's internal resistance over time with SSTDR signaling and comparing real-time data against the healthy cell stack baseline data, SSTDR can detect the degradation of the individual battery cells and allow for the prediction of impending battery cell failures.

In this paper we investigate methods of overcoming the challenges of using SSTDR to monitor the miniscule internal resistance values and resistance changes of these battery cells as the cells degrade. We also address the challenge of separating the additive reflections from the very small electrical lengths between these individual battery cells. We will do this through the simulation of SSTDR signaling as it monitors a typical stack of battery cells in a battery backup system. The simulation will slowly increase the battery cells' internal resistance as the cells degrade at varying rates. We intend to develop an algorithm, using numerical methods, that will detect, identify, and report the degradation of the individual battery cells by comparing real-time degraded reflection data from the healthy cell baseline reflection data.

Alexander Charters
Computer Engineering Undergraduate Research Assistant
University of Utah
alexcharters45@gmail.com

Paul K. Kuhn
Adjunct Assistant Professor Electrical and Computer Engineering Department
University of Utah
paul.kuhn@utah.edu

Hunter Ellis
Electrical and Computer Engineering Graduate Student
University of Utah
ellishunterd@gmail.com

Dawn Sweeney
Electrical Engineering Undergraduate Research Assistant
University of Utah
sweeneyd20@gmail.com

Marc Fobair
Application Engineer
Solar Winds
Marc.Fobair@solarwinds.com

Joel Harley
Professor Electrical and Computer Engineering Department

University of Florida
joel.harley@ufl.edu

Cynthia Furse
Professor Electrical and Computer Engineering Department
University of Utah
cfurse@ece.utah.edu