19 October 2010, h.15:00 - Sala 301 DEI/A

Identification and Validation a Lithium Battery Reduced Model Based Extended Kalman Filter for Critical Surface Charge Estimation

Carmelo Speltino

Università del Sannio

Abstract:

An averaged electrochemical lithium-ion battery model is identified and validated through experimental data by a 6.8 Ah li-ion battery pack, during charge and discharge experiments. The model is based on an approximation relationship between the averaged Butler-Volmer current and the average solid concentration (in positive and negative electrode) at the interface with the electrolyte phase. The resulting cell-averaged solid diffusion model is then discretized along the radial direction resulting in two sets (negative and positive electrode) of ordinary differential equations. The behavior of the average concentration of the negative electrode is then expressed algebraically with the average positive electrode concentration through the cell Critical Surface Charge (CSC). This last model simplification avoids unobservable conditions and allow the application of an extended Kalman Filter (EKF) from the measured cell voltage and current.
The battery CSC is then estimated using a 4th order EKF based on the averaged model and the performances are shown experimentally versus data collected from a 10 cell 37 V at 6.8 Ah Li-ion battery.

Biography:

Carmelo Speltino received the Laurea degree in Computer Science from the University of Naples "Federico II" and the Ph.D. degree in Automation Engineering from the University of Sannio, where he is currently working holding a post-doctoral scholarship. He also worked at the Automotive Research Center (University of Michigan, Ann Arbor) as visiting scholar.