Creation of lithium-ion battery ageing datasets for the development and training of data-driven algorithms for estimating SoH and RUL of batteries used in grid services

Salvatore Gianluca LEONARDI - *CNR-ITAE*

Battery energy storage systems (BESS) are one of the main solutions for the criticality of the electricity grid induced by the increased penetration of renewable sources. Indeed, a system capable of rapidly storing and reinjecting electricity into the grid allows for greater grid flexibility, stability and resilience, compensating for the fluctuating nature of renewable sources. However, the capacity of a battery to store or deliver energy decreases over its lifetime due to normal ageing phenomena. Several factors determine the ageing of a battery, including variations in temperature, charging and discharging currents as well as the state of charge (SoC) operational window and the deep of discharge (DoD). Therefore, battery ageing is strongly correlated to battery use, and the accurate estimation of the related state of health (SoH) and the prediction of residual life can be useful for the optimal and safe operation of the system as well as for predicting and planning the best moment to proceed with battery replacement. Furthermore, if used batteries are expected to be employed again in a second application (second-life), the definition of SoH becomes crucial in order to estimate their remaining useful life (RUL). Several approaches are proposed in the literature for the estimation of SoH and RUL. Among these, data-driven techniques are considered one of the most valid tools though they require large amounts of data for training of models. In this communication, starting from the results achieved during previous projects, it will be discussed the ongoing activities concerning the creation of several datasets populated with information related to aged cells according to simulated operational profiles, as representative as possible of first- and second-life use cases of lithium-ion batteries in ancillary grid services. In particular, in addition to the definition of common test protocols useful for providing, by means of experimental tests and in the shortest possible time, as much information as possible for the identification of degradation phenomena induced during battery use, it will presented the approaches for the extraction and homogenization of data collected here or available on online datasets, with the aim of creating a database for the easy access and manipulation of such data for the next development and training of a SoH diagnostic and RUL estimation tool based on data-driven techniques.