Energy Storage and Integration Overview

Electric vehicles (EVs) are the future transportation systems due to their cost-effective and environment-friendly nature. The rapid advancement in energy storage technologies, such as lithium-ion (Li-ion) batteries with high energy density, has accelerated the acceptance of EVs in recent years. Battery management systems (BMS) are employed in EV/HEVs to orchestrate the charging and discharging cycles while monitoring the state of charge (SOC) and state-of-health (SOH). The current research on BMS does not account for the time-varying nonlinear behavior of the battery, which significantly limits its capability in predicting SOH accurately. Our lab aims at tackling this limitation by developing an enhanced SOC and SOH dependent parameter varying Equivalent Circuit Model (ECM) of Li-ion battery and self-learning algorithms using neural networks to learn the model with real-time measurements. We will further incorporate faults/stress detection schemes using the self-learning model and experimentally validate them through a prototype.