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Combining AI with Model based Design: battery State-of-charge estimator using Deep Learning

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Across industries, the growing dependence on battery pack energy storage has underscored the importance of battery management systems (BMS) whose role is to monitor battery state, ensure safe operation and maximize performance. For example, the BMS helps avoid overcharging and over discharging, it manages the temperature of the battery and so on, and it does so by collecting information from sensors on the battery for current, voltage, temperature etc. So, this is a closed-loop system by design.
One of the things that cannot be directly measured but is required for many of these operations is the battery state of charge (SOC). So, this quantity needs to be estimated somehow. One way to solve this problem is using recursive estimation based on a Kalman filter. However, the Kalman filter requires a dynamical model of the battery –which may or may not be accurate –and is very time-consuming. Besides, handling just the algorithm is not enough. Models need to be incorporated into an entire system design workflow to deliver a product or a service to the market. The bridge between engineering and science workflows is one of the most important pieces of such an application. Combining Model-Based-Design with Artificial Intelligence will enrich the model and make collaboration between teams robust and more automated.

We will explore, in detail, the workflow involved in developing, testing, and deploying an AI-based state-of-charge estimator for batteries using Model-Based Design:
- Designing and training deep learning models
- Demonstrate a workflow for how you can research, develop, and deploy your own deep learning application with Model-Based Design
- Integrating deep learning and machine learning models into Simulink for system-level simulation
- Generate optimized C code and Performed Processor-in-the-loop (PIL) test

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