

Kalman Filter for DAEs applied to Lithium-ion Batteries

Bachelor's Thesis or Master's Thesis

Lithium-ion batteries are used in a wide range of applications as energy storage devices, e.g., in mobile phones, laptops, electric vehicles, or smart grids. When using batteries, it is important to know the state of charge (SoC), which can be used to calculate the remaining energy. Since a direct measurement of the SoC is not possible, estimation techniques need to be applied. One such estimation technique is the Kalman filter. It is a model-based estimation algorithm, that uses measurements to update its prediction.

The original formulation of the Kalman filter is for linear time-invariant dynamic models. However, the provided model of the Lithium-ion cells contains algebraic states as well, rendering the original Kalman filter formulation inapplicable.

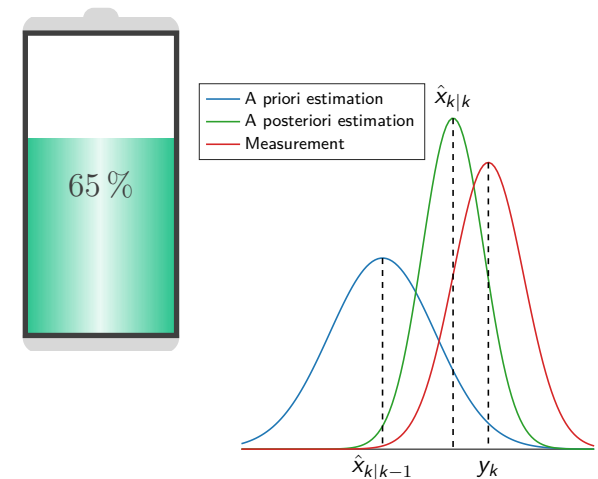
Your tasks will be:

1. Literature review on differential algebraic equation (DAE) systems and Kalman filtering
2. Implementation of the Kalman filter for DAE systems in HILO-MPC¹
3. Use newly implemented Kalman filter algorithm for state-of-charge estimation

Experience with /
knowledge about: Modeling, estimation

Programming skills: Python (good to very good skills required)

Language: English (thesis and presentation), German



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¹ https://www.ccps.tu-darmstadt.de/research_ccps/hilo_mpc/index.en.jsp