Model Predictive Control of a Fuel Cell

TECHNISCHE UNIVERSITÄT DARMSTADT

Master's Thesis

Due to modern challenges such as limited resources or strict climate protection targets, the development of new mobility concepts is a central area of research. In particular, the development of reliable battery and/or fuel cell powered vehicles is the subject of ongoing research in which efficient optimization-based control strategies are employed. The implementation of optimal control algorithms on the embedded units in the vehicle poses a particular challenge.

In this thesis, a nonlinear and lumped model of a fuel cell will be investigated and implemented in Matlab. The fuel cell will be evaluated in combination with an existing vehicle model.

A model predictive control scheme is to be developed for the model, which allows the fuel cell to be operated in a defined operating area for a predefined route. Different driving scenarios such as stop-and-go traffic or traffic lights are to be addressed by means of time-dependent boundary conditions for the optimization. The control design is to be performed for the nonlinear as well as for a linearized model.

Finally, the model consisting of the fuel cell and vehicle is to be simulated for several driving situations (e.g., different velocity profiles) and the effects on the fuel cell are to be investigated. A comparison of the controllers with each other is to be carried out in order to better estimate a real-time capability (i.e., a comparison of the simulation and computation times).

Basic knowledge in control theory and optimization is required.

Please do not hesitate to contact me if you have any further questions!

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