Model predictive control of battery systems in a microgrid

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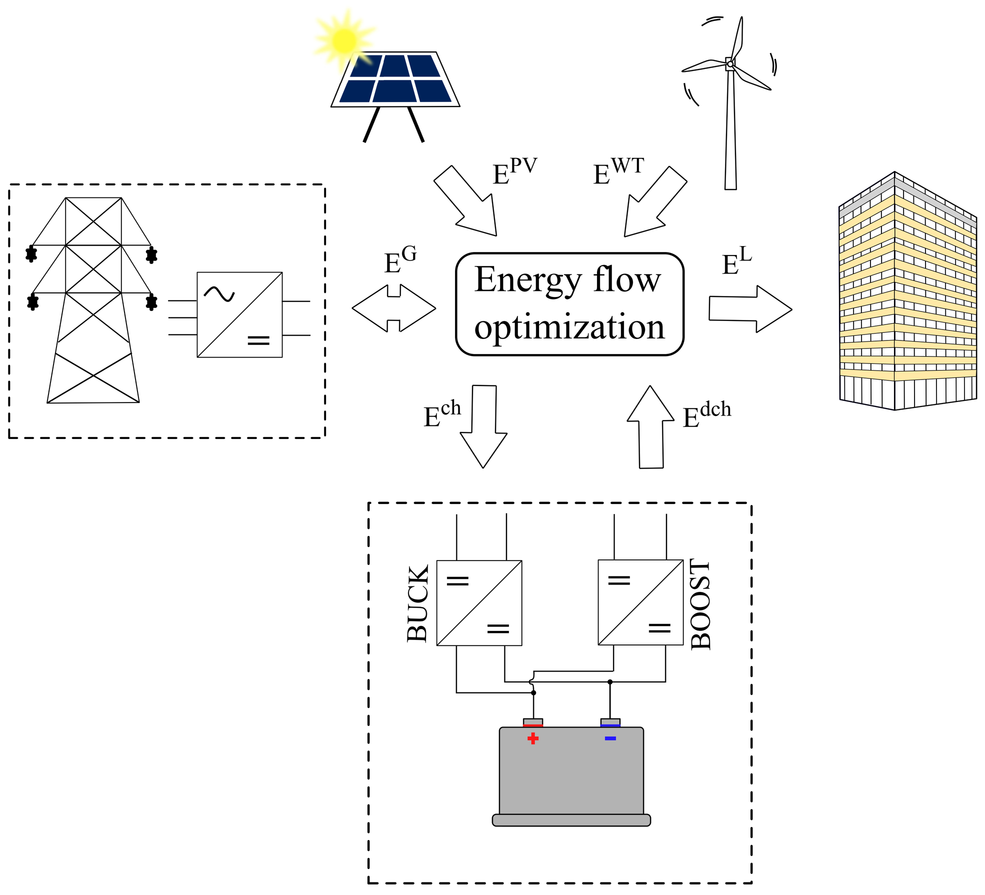
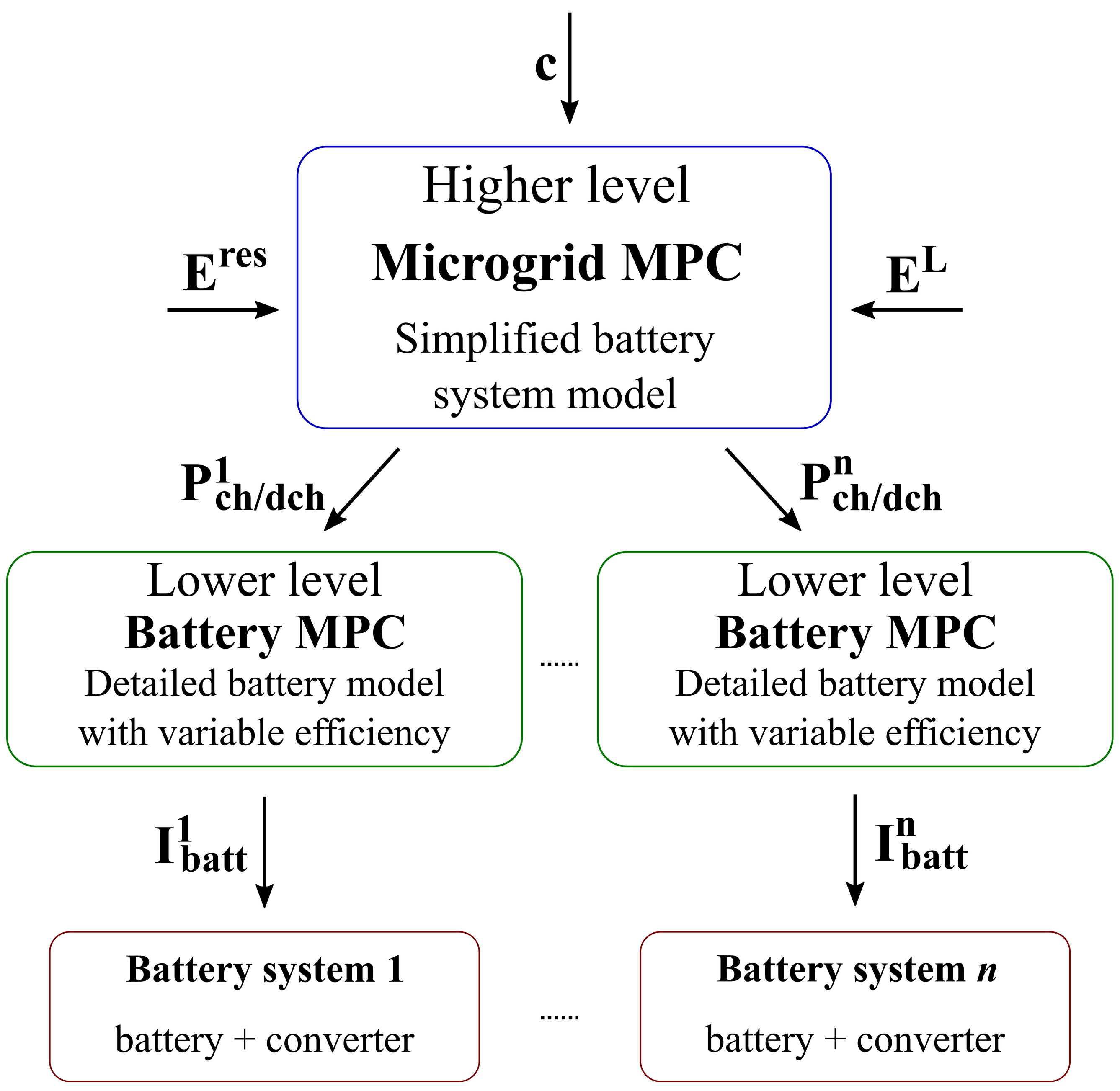
1. Introduction

The research is focused on the control of heterogeneous battery storage systems by taking into account the chemical processes inside a battery that result in variable battery system efficiency and consequently, battery longevity. This is motivated by economic benefits that stem from more efficient control of microgrid components in microgrid optimal power flow problems.



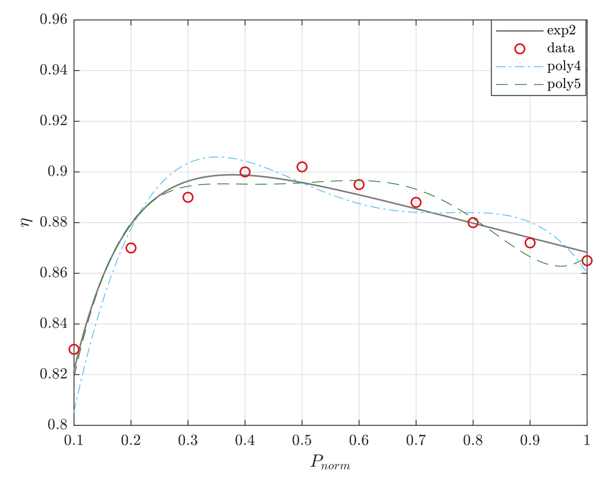
2. Methodology

- Choosing a mathematical model
  - accurate
  - suitable for real-time applications (low complexity)
  - includes variable battery and converter efficiency
- Parameter identification
  - least-squares method
  - nonlinear Kalman filter
- model predictive control (MPC) algorithm
  - higher level - microgrid optimal flow
  - lower level - delivering demanded power flows in the most efficient way



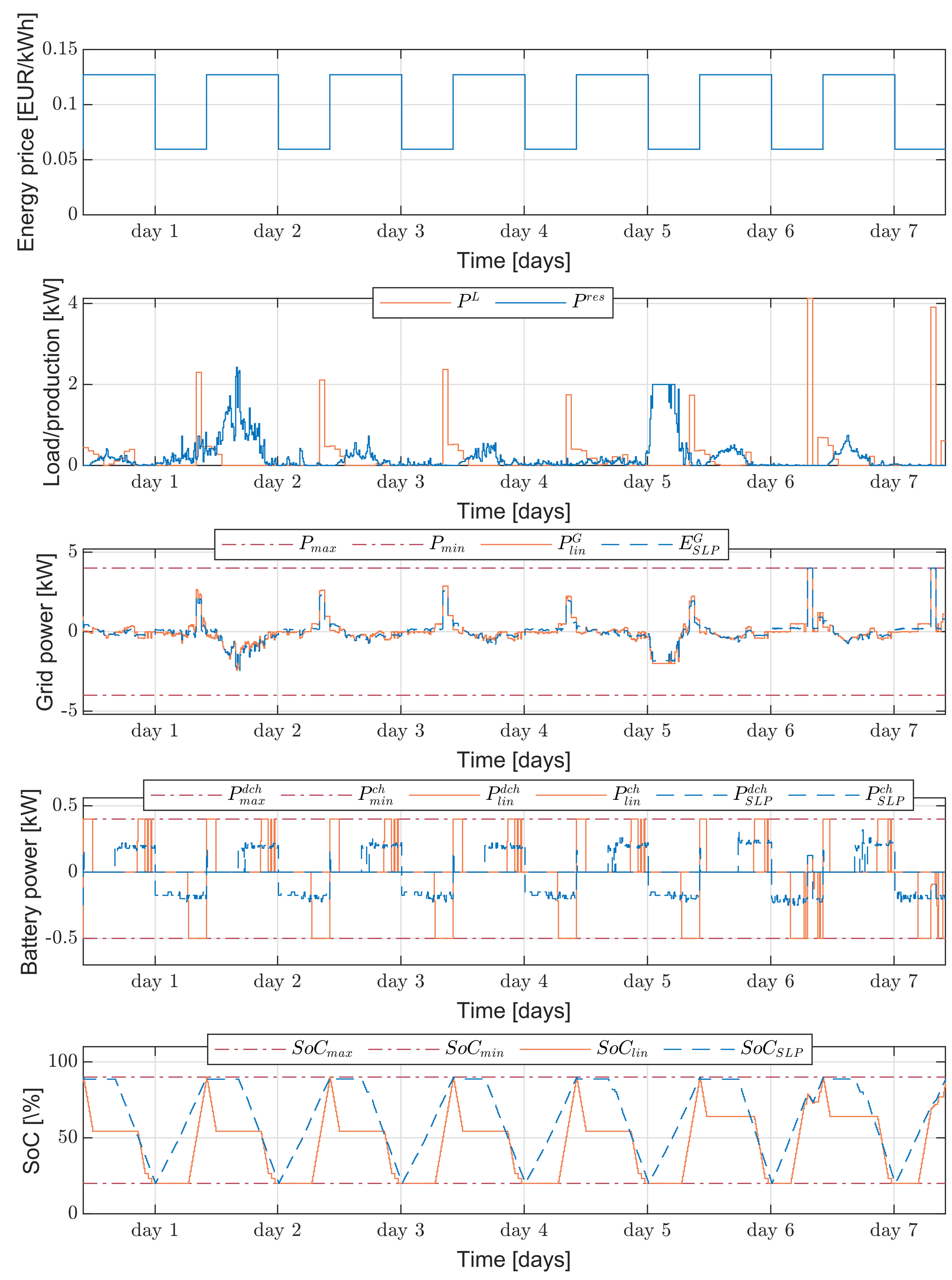
3. Results

Higher level optimal power flow problem results based on a simplified battery model with variable converter efficiency:



	ΣE_{ch} [kWh]	ΣE_{dch} [kWh]
Linear MPC	-12.65	10.20
Nonlinear MPC	-12.59	10.61

- less Watts power consumed for charging
- more Watts of power delivered to the grid
- less stress on batteries due to lower charging/discharging powers



Future work includes identification of variable battery parameters and choosing an appropriate battery model. This model will then be used for the lower level MPC algorithm design.

4. Acknowledgment

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