

# Paid Master's Thesis

## Considering Uncertain Electrical Power Surplus in Model Predictive Control of Smart Homes

To dedicated students (m/w/d) of electrical / mechanical engineering, information and computer engineering, or related disciplines we offer the opportunity to write a paid Master's thesis. The thesis will be conducted in cooperation with the Institute of Automation and Control, Graz University of Technology.

### Motivation:

Smart energy management systems for homes increasingly need to consider multiple energy sectors, i.e., electricity, heating and cooling, in order to reach their maximum potential. For example, surplus electricity from photovoltaics (PV) often is stored as heat in a thermal buffer by driving a heat pump or a heating rod. Varying electricity prices already provided by certain tariffs (e.g., aWATTar) and uncertainties in PV yield, however, make deciding on the best starting time and operating strategy difficult. We at BEST have developed a modular framework for energy management applications which answers such questions by formulating and solving an optimization problem. However, this optimization takes time, and systems often need to react quickly to changes in surplus electricity to avoid unwanted import from, or export to, the electricity grid.

### Objectives:

- Investigate existing solutions and typical setpoints for power inverters (minimum / maximum battery charging power) and heating rods / heat pumps
- Deduce setpoints for low-level controllers based on optimization results that guarantee optimal behaviour even when only optimizing at a low sampling rate using, e.g., stochastic optimization
- Test your algorithms in simulations and implement them on a real system

### Your profile:

- Studies in electrical, mechanical or computer engineering or physics
- Ideally with some background in control engineering
- Programming experience with MATLAB, Python or (ideally) Julia

### Our offer:

- Integration into a dedicated team
- Perspective of participation in follow-up projects after successful completion
- Financial compensation based on student staff salary scheme
- Provision of a work place (remote work from home also possible)

**In the interest of diversity, applications from women are especially welcome at BEST!**

### Contact us:

**Dipl.-Ing. Dr. Markus Göllles**  
BEST - Automation and Control  
[markus.goelles@best-research.eu](mailto:markus.goelles@best-research.eu)  
Tel.: +43 5 02378 - 9208

**Univ.-Prof. Dipl.-Ing. Dr. Martin Horn**  
TU Graz – Inst. of Automation and Control  
[martin.horn@tugraz.at](mailto:martin.horn@tugraz.at)  
Tel.: +43 316 873 -7025