



Institute for Automation and  
Applied Informatics (IAI)

**Earliest start:  
now**

## Master's thesis

# Reinforcement learning for the adaptive control of heat pumps

Keywords: reinforcement learning, optimization, modeling, transfer learning

A high share of renewable energy in the grid requires measures to manage the fluctuations in power generation. One possible measure is to shift electricity demand to times of high generation. As buildings consume 40% of the final energy in the EU, they offer a large potential to shift their energy demand to counteract the intermittent renewable energy generation.

A widely used method to exploit the energy flexibility of buildings is Model Predictive Control, an optimization technique that requires extensive modeling efforts. In a previous work, the behavior of a model predictive controller was emulated with the help of a neural network in order to achieve good control behavior with little modeling effort. The aim of this work is to adapt the existing controller using reinforcement learning (RL) so that the controller can be used in different buildings.

The tasks include the development of a suitable concept for the application of an RL agent based on an existing controller. The performance of the agent is to be investigated in simulation studies. The exact topic can be customized. The thesis will be written in English.

### Tasks:

- Literature research on the current state of the art
- Development of a suitable concept for the application of RL in the building context
- Evaluation of the concept in simulation studies

### Education, experience and skills:

- Field of study: mechanical engineering, mechatronics, computer science
- Knowledge of Matlab and/or Python
- Experience in machine learning/reinforcement learning
- High motivation and ability to work independently

For further information please contact:

- Felix Langner ([felix.langner@kit.edu](mailto:felix.langner@kit.edu))
- Qiong Huang ([qiong.huang@kit.edu](mailto:qiong.huang@kit.edu))