OSEM: Knowledge Dissemination within HAN

# Modeling of Heat Pump and Stratified Tank

In the master engineering system (MES) at HAN, the entry study module is system’s modelling. In this module, the students learn how to look at a given process from a system point of view and methodologically build a dynamic model of the process. One of HAN’s focal points are smart regions and sustainability, which reflects on the type of study cases given to thew students (Modelling of solar panels, PVTs, …etc). Modelling of heat pumps and stratified tanks can be a valuable addition to the study material since the models are nonlinear and require the student to combine various aspects of the applied physics courses to build one coherent model.

# Model Predictive Control

Although model predictive control (MPC) strategies have enjoyed success in the industry since the 80s, they are not taught explicitly in the Master of Engineering (MES) course at HAN. Rather, LQR control and Optimal control are taught, which form the theoretical basis of understanding MPC control techniques.

This project gave the researchers at HAN an opportunity to fully develop an MPC and apply it to a given problem. The knowledge gained can be added to the curriculum of MES in the form of classes in the applied control module. The material developed can be used as study case for an application of MPC technique to a contemporary problem.

# Control Implementation Hardware

In the advanced Controller module of the master engineering systems. The students learn – theoretically- various sophisticated control strategies. On implementation level, the students learn how to program controllers on Arduino microcontroller boards. This allows the students to experiment with implementing PID, state feedback, and some nonlinear control strategies. However, for the more computationally demanding control algorithms such as MPC, the students immediately find out that the processing capabilities of Arduino boards are not sufficient.

The next step would be to relegate the Arduino board to take care of the communication with the sensors/Actuators. While having another (more powerful) processor, such as Raspberry Pi to handle the control calculation tasks. This is what was implemented in OSEM.

# Summary:

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| **Topic** | **Study Module** | **Dissemination form** |
| Modelling Heat pump & Stratified Tank | System’s Modelling | Minor Project |
| Model-predictive Control | Applied Control | Guest lecture/ Case Study |
| Control Implementation | Advanced Controller design | Minor Project |
| Model deployment | Big-Data Small-Data | Case study/ Minor project |