



Development of adapting dynamic models for large-scale heat pump systems



Motivation

- Increasing share of renewables and district heating
- Large-scale heat pumps are key components
- Updated models required for monitoring, optimization and fault detection



Conditions

- Master's project (Possible to adjust to Bachelor's)
- Experienced supervisors at DTI
- Involvement in cutting-edge R&D projects
- Collaboration with manufacturers and customers possible



Objectives

- Dynamic model for large-scale HP system
- Automated fitting of model parameters
- Demonstration of tools at operating plant



Methods

- Dynamic modelling
- Numerical optimization
- Demonstration at operating plant



Simulation-based optimization of the operation of large-scale heat pump systems



Motivation

- Increasing share of renewables and district heating
- Large-scale heat pumps are key components
- Optimal operation wrt. various services required



Conditions

- Master's project (Possible to adjust to Bachelor's)
- Experienced supervisors at DTI
- Involvement in cutting-edge R&D projects
- Collaboration with manufacturers and customers possible



Objectives

- Dynamic model for large-scale HP system
- Optimization of operating strategy
- Derivation of constructive modifications



Methods

- Dynamic modelling
- Numerical optimization
- Control strategies



Development of a procedure to develop grey-box models for large-scale heat pump systems



Motivation

- Increasing share of renewables and district heating
- Large-scale heat pumps are key components
- Operation optimizations require fast models



Conditions

- Master's project (Possible to adjust to Bachelor's)
- Experienced supervisors at DTI
- Involvement in cutting-edge R&D projects
- Collaboration with manufacturers and customers possible



Objectives

- Dynamic model for HP system
- Methods for reducing numerical complexity without compromising content
- Application of grey-box models for control optimization



Methods

- Detailed dynamic modelling and grey-box modelling
- Numerical optimization
- Control optimization



Economic optimization of heat pump-based steam production systems



Motivation

- Decarbonization of industrial heat supply
- Electricity-based steam production required at 100 °C to 200 °C
- Optimized system design required to exploit technological solutions



Conditions

- Master's project (possible to adjust to Bachelor's)
- Experienced supervisors at DTI
- Involvement in cutting-edge R&D projects
- Collaboration with manufacturers and customers possible



Objectives

- Analysis of suitable equipment
- A simulation tool for optimized system design and cost estimation
- Demonstration of case studies



Methods

- Thermodynamic modelling and economic analysis (Matlab/Python/EES/Excel/VBA)
- Numerical optimization



Development adapting heat exchanger models for large-scale heat pump and refrigeration systems



Motivation

- Increasing share of renewables and district heating
- Large-scale heat pumps are key components
- Sewage water, seawater and air are promising heat sources, but associated with fouling or icing



Conditions

- Master's project (Possible to adjust to Bachelor's)
- Experienced supervisors at DTI
- Involvement in cutting-edge R&D projects
- Collaboration with manufacturers and customers possible



Objectives

- Modelling of fouling process and linking it to measurable parameters
- Implementation of adapting models
- Validation with measurements
- Optimization of cleaning schedule



Methods

- Numerical modelling and optimization
- Model reduction
- Control optimization