Project 1: Chiller control using machine learning

Chiller control is a multi-variable control problem that typically utilizes classic feed-back control based on PID controllers tasked with protecting the equipment, maximizing the machine efficiency and delivering wanted cooling or heating capacity. As the process under control is highly non-linear, and contains delays, this approach is not always efficient.

The purpose of this thesis project is to explore and evaluate the usage of machine learning control on chiller applications with the end goal of creating a controller that better handles non-linearities and delays of the system than the currently used algorithms.

The controller development will be driven by Modelica models that well capture the non-linearities of the real system.
Modelica is a language for building dynamical models of physical objects. Modelica has its roots in Lund and is now widely used in industry (https://www.modelica.org).

The work will be done at Modelon in Lund with Kristian Tuszynski at Carrier.

Project 2: Chiller diagnostics using machine learning

Chiller problems at a customer site are usually not detected before the machine suffers critical failure and shuts down. The total down time is made worse by the fact that the diagnostics information made available to the service technician is limited which results in many man-hours before the root cause of the problem can be found and addressed.

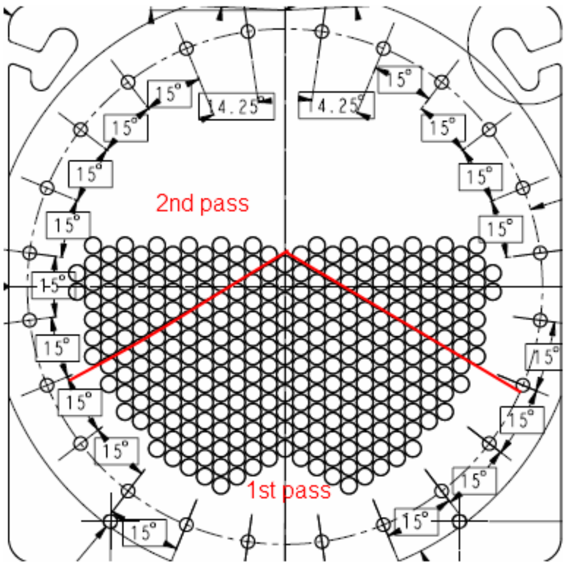
The purpose of this thesis project is to utilize machine learning on a high-fidelity model to develop ways to diagnose the root cause of different problems and find ways of detecting problems before they happen.

The work will be driven by Modelica models that well capture the needed physics of the real system. Modelica is a language for building dynamical models of physical objects. Modelica has its roots in Lund and is now widely used in industry (https://www.modelica.org).

The work will be done at Modelon in Lund with Kristian Tuszynski at Carrier.

Project 3: Capture non-linear behavior using machine learning

Chiller models contain many non-linear components that are difficult to model in a satisfactory way where the physical behavior is well captured over a large set of operating points. Another issue is that these non-linear equations are often computationally expensive to solve and can cause robustness problems when simulating the models.



The purpose of this thesis project is to investigate the possibility to use machine learning to capture complex non-linear efficiency data for compressors that depends on multiple variables.
Additionally, the project also aims to see how complex non-linear physics in a chiller can be captured using machine learning techniques with the end goal to evaluate how unmeasurable physics can be captured and used for control purposes.

The work will be driven by Modelica models that well capture the needed physics of the real system. Modelica is a language for building dynamical models of physical objects. Modelica has its roots in Lund and is now widely used in industry (https://www.modelica.org).

The work will be done at Modelon in Lund with Kristian Tuszynski at Carrier.