Titre de la thèse:

Investigation of different control algorithms for refrigeration cycle and evaluation of technical solutions for automation of refrigerant charge management

Auteur:

Quentin ROEMERS

Section:

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Vincent Lemort

Abstract:

This thesis investigates control system improvements for Hot Gas By-Pass (HGBP) and gas cycle load stands at Copeland Welkenraedt. The current controllers struggle to reach the operating points of compressors efficiently, leading to a waste of time, energy, and resources.

To address these issues, a two-part approach is proposed. First, a data-driven modeling approach utilizing system identification with experimental data is used to represent the HGBP stands numerically. A Multi-Model PID control strategy with a piecewise linear model with gain scheduling is then developed to adjust PID parameters based on the identified model. The possibility of a Multi-Model Model Predictive Control (MPC) algorithm is also explored. The goal is to achieve faster transitions between operating points and reduce test time.

Second, the thesis investigates automatic refrigerant management for the HGBP and gas cycle systems. For the HGBP stands, level sensors are proposed to signal the need for adding or withdrawing refrigerant. A method to calculate the appropriate liquid receiver size is also presented. For the gas cycle stand, a solution suggests the utilization of a tank storing refrigerant with a coiled tube heat exchanger to manage refrigerant based on pressure changes induced by heating or cooling the tank.

The conclusion suggests further research on optimizing data acquisition methods for system identification and comparing different PID tuning techniques.