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Implementation of a Modelica Library for Simulation of Refrigeration Systems

Torge Pfafferott Gerhard Schmitz
Technical University Hamburg-Harburg, Department of Technical Thermodynamics
Denickestr. 17, 21075 Hamburg

Abstract

The physical modelling and transient simulation of refrigeration systems can be useful within the specification, development, integration and optimisation. Therefore, a model library for vapour compression cycles has been implemented. The library is based on the free Modelica library ThermoFluid and contains basic correlations for heat and mass transfer and pressure drop, partial components for control volumes and flow resistances and advanced ready-to-use models for all relevant components of refrigeration systems like pipes, heat exchangers, compressor, expansion devices and accumulator.

1 Introduction

The modeling and simulation of refrigeration systems is of interest for several problems:

2 Library for refrigeration systems

The aim of the modelling is to implement a library with physical based models of components of refrigeration systems. At the moment the library enables investigations with two refrigerants (CO_2 , R134a). But the realised structure allows the extension of the library by other refrigerants.

2.1 ThermoFluid library

The implemented refrigeration library is based on the free Modelica library ThermoFluid [1], [2], [3]. The ThermoFluid library, especially its base classes and partial components, offers a good base for the modelling of refrigeration systems with respect to the implementation of the three balance equations and the method of discretisation.

3 Transient simulation of a CO_2 -system

In the following, results of the transient simulation of the above mentioned CO_2 -system are presented. The results are compared with data of a start up of the system and following step changes in compressor speed as shown in Figure 1.

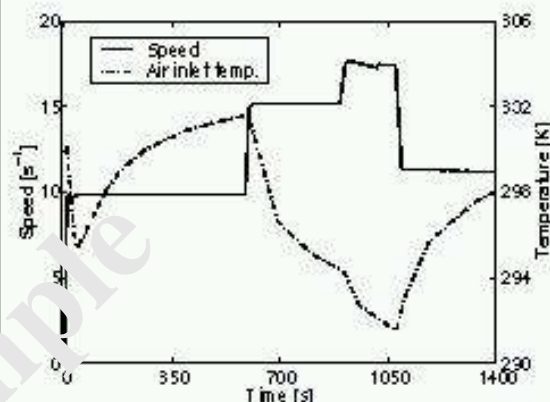


Figure 1: Step changes in compressor speed and run of air inlet temperature at the evaporator in the experiment; set as boundary condition of simulation run

References

- [1] Eborn J. On Model Libraries for Thermo-hydraulic Applications. Lund, Sweden: PhD thesis, Department of Automatic control, Lund Institute of Technology, 2001.
- [2] Tummescheit H. Design and Implementation of Object-Oriented Model Libraries using Modelica. Lund, Sweden: PhD thesis, Department of Automatic control, Lund Institute of Technology, 2002.