Universität Stuttgart
Institute of Nuclear Technology
and Energy Systems

Bachelor or Master Thesis

Analysis of Different Control Methods for the Cooler of a Supercritical CO_2 Cycle

Prof. Dr.-Ing. Jörg Starflinger
Institute of Nuclear Technology and
Energy Systems

Objective:

The objective of this work is to apply and analyse various control methods for the cooler of a supercritical CO_2 (sCO_2) cycle.

Background:

sCO_2 is a promising working medium for various next-generation applications, both in the field of renewable and conventional power generation (project sCO2-flex, SOLARSCO2OL, ShunShot, Misha) and in residual heat removal (project sCO2-4-NPP).

Within the scope of this work, the control of the cooler of the sCO_2 cycle is analysed in detail. Controlling the cooler is challenging since it operates close to the critical point of CO_2, where the thermodynamic properties exhibit a highly non-linear behaviour.

Applying Matlab and the simulation code ATHLET (Analysis of THermal-hydraulics of LEaks and Transients), the cooler is modelled based on existing models and tools. Afterwards, different approaches for the control of the cooler are implemented and tested over a wide range of conditions.

Approach:

- Literature study on sCO_2 coolers (focusing on control)
- Familiarization with the existing code and tools
- Implementation of different control approaches
- Test of these approaches over a wide range of conditions
- Thesis preparation and presentation

Requirements:

- Fundamentals of thermodynamics, fluid dynamics and control
- Experience in programming preferably in Matlab
- Interest in simulation and control
- Analytical thinking and self-initiative

Figure 1: Air-cooled sCO_2 heat exchanger at the sCO_2 test loop in Essen, Germany

Start: as soon as possible

Contact: Dipl.-Ing. Markus Hofer
Pfaffenwaldring 31 • 70569 Stuttgart
hofer@ike.uni-stuttgart.de
+49 (0) 711 685-60855

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Date 26.10.2023