Universität Stuttgart
Institute of Nuclear Technology
and Energy Systems

Master Thesis

Simulation and Control of a Recuperated Supercritical CO_2 Cycle

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

Objective:

The objective of this work is to finalise the ATHLET model of a recuperated supercritical CO_2 (sCO_2) cycle and to simulate and control the cycle under various boundary conditions.

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, a recuperated sCO_2 cycle with a turbine inlet temperature of 650 °C, as occurs e.g. in solar thermal tower power plants or MMRs ("Micro Modular Reactor"), should be analysed. An existing ATHLET (Analysis of THermal-hydraulics of LEaks and Transients) simulation model is finalised by adapting the size of the components. Then, the model is tested under various boundary conditions by applying different control strategies. Post-processing of the simulation results is conducted with Matlab.

Approach:

- Literature study on operation and control of sCO_2 cycles
- Familiarization with simulation code ATHLET
- Finalization of the model of the recuperated sCO_2 cycle
- Implementation of different control strategies
- Simulations with different boundary 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

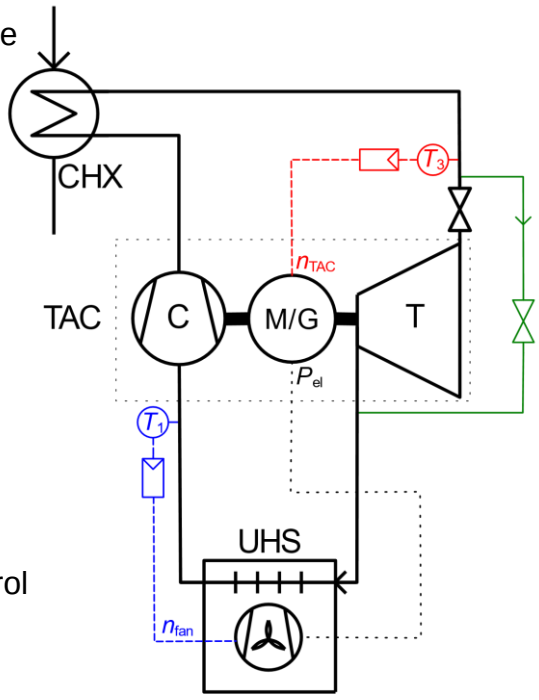

Figure 1: Detailed Layout of a simple sCO_2 cycle including temperature control and a turbine bypass

Start: as soon as possible

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

Date 11.01.2023