INTERNSHIP

Commissariat à l'Énergie Atomique et aux Énergies Alternatives
Centre de CADARACHE - Dir/Dpt/Service/Labo : DEN/DTN/STPA/LCIT

SUPERVISOR

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INTENSHIP OBJECT

CFD Numerical Simulation for design and efficiency improvement of a compact heat exchanger

DESCRIPTION OF THE INTERNSHIP / MAIN GOALS

The Nuclear Energy Division of the French Atomic Energy Commission in Cadarache (FR) is one of the most important centers of research and technological development for energy in Europe. Its activities are set around Innovating Nuclear Systems: 4 Generation Nuclear Reactors, ITER Fusion Demonstrator and other several technology platforms for research and development (R&D).

The LCIT Laboratory is involved in R&D studies and Design for the Fast Sodium-Cooled ASTRID Prototype. In this context, compact heat exchangers are developed as an Energy Conversion System.

Despite the complexity of this component, its compactness results in the use of less material that represents an optimal solution in the perspective of civil engineering. In term of safety, they offer a major earthquake resistance and reduce the risk of component failure during nominal operation of the reactor.

The actual performance of the proposed ASTRID heat exchanger needs to be investigated. When designing a high efficiency compact heat exchanger one must consider the inevitable unequal repartition of fluid among the vast number of parallel channels. This maldistribution will deteriorate both thermal and mechanical performances and invalidates the sizing assumptions of previous studies.

Hence, ASTRID heat exchanger design has to be improved in order to provide a low enough imbalance supply between channels to validate bundle sizing.

Many optimized configurations of header and distribution channels have been proposed and their hydraulic and mechanical behavior has been numerically studied using CFD codes. A large experimental program (Velocimetry Laser) has been considered to validate all CFD simulations. The acquisition of the experimental data is currently underway.

The aim of the Internship consists in comparing numerical and experimental data for different optimized configurations of the header design. This work will provide a proper CFD Code Validation and a better understanding of the influence of geometrical and physical parameters on flow distribution. A trustworthy numerical model will help to identify the most performant flow header design for ASTRID heat exchanger.

The CEA will be finally able to propose valid strategies and methods to analyze the problem of flow maldistribution in compact heat exchangers.

ANSYS FLUENT code will be used to carry out CFD simulations.

AREA OF EXPERTISE

Thermo-hydraulic, CFD, Numerical Simulation, Turbulence

KEYWORDS

Innovation Development, Mechanical Design, Code ANSYS et FLUENT

REQUIRED SKILLS

Computer programming languages. *; Code : ANSYS, FLUENT*

Required Degree: Fist Level | Formation: Engineer | Internship: 6 months