KArlsruhe Liquid metal Laboratory

Institut für Strömungsmechanik

Karlsruher Institut für Technologie

Master Thesis

LES of liquid metal flowing in a non-uniformly heated tube

Description

Liquid metals have been recently proposed as heat transfer fluids in concentrating solar power systems. Here, only one half of the tubes' surface is irradiated by the concentrated sunlight, thus resulting in a strongly non-uniform heat flux on the outer wall. As a consequence, the tube walls are subjected to high thermal stresses. A proper thermo-hydraulic, as well as mechanical design of the solar receiver requires then a good knowledge of the local wall temperatures and convective heat transfer coefficients.
In this thesis the candidate will perform a CFD analysis using Large Eddy Simulation (LES) for turbulent forced convection to a liquid metal flowing in a non-uniformly heated tube. Due to their very low Prandtl number, liquid metals have a different heat transfer mechanisms compared with ordinary gases and liquids. The resulting different velocity and temperature scales allow performing a LES for the flow field while with the same grid a DNS for the temperature field. The results should form a database for the validation of RANS models.

Tasks

- LES simulations at different Reynolds numbers and heat flux boundary conditions with OpenFOAM
- Detailed post-processing
- Evaluation and interpretation of the obtained results

Start date

As soon as possible.

Duration

6 months.

Annotations

The thesis will be held at the Karlsruhe Institute of Technology (KIT), Institute of Nuclear and Energy Technologies (IKET) - Campus North or Institute of Fluid Mechanics (ISTM) - Campus South.

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