Department of Aerodynamics and Fluid Mechanics
Faculty of Mechanical Engineering, Electrical and Energy Systems
Brandenburg University of Technology Cottbus–Senftenberg
Siemens-Halske-Ring 14, D-03046 Cottbus

Brandenburg University of Technology Cottbus - Senftenberg

Offer of Master Project

DEPIK – TEHD: Experimental analysis of the convective flow induced by an effective electric gravity in a cylindrical annulus

Project description:

It is well established that natural convection enhances the transport of heat between a hot surface and a cold one. Indeed, the Earth's gravity acts on the density stratification and produces the Archimedean's buoyancy, which is a source of the convective heat transfer. An equivalent buoyancy mechanism can be obtained by applying a strong alternative electric field to a non-conducting fluid. A Dielectrophoretic Induced Convection (german DEPIK) can then occur, analogously to the classical Rayleigh-Bénard instability, as seen in Figure 1. This system is of main interest for the investigation of geophysical flows or for specially designed heat exchangers.

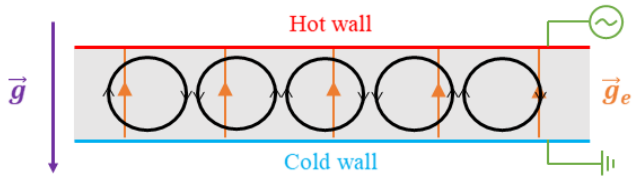

Figure 1: Schematic representation of the convective flow induced by the electric gravity $\vec{g}_e$ in a horizontal rectangular cavity.

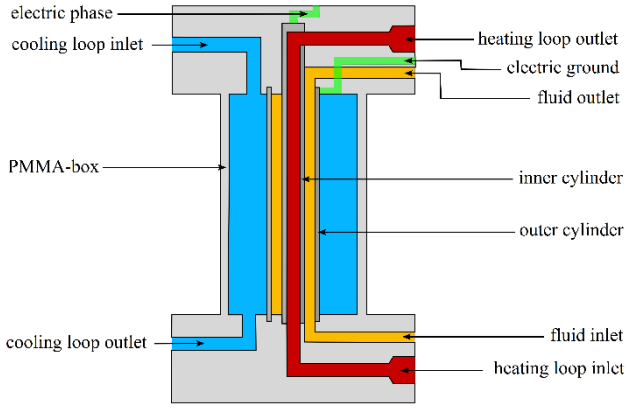

Figure 2: Technical drawing of the cylindrical annulus. The temperature difference is maintained by two distinct fluid loops. A strong alternating electric field is applied in the gap filled with a dielectric fluid.

The main objective of this master project is to identify thermo-convective patterns and to study their emergence and development for different fluids and for different cell orientations. Various visualisation methods can be applied such as Particle Image Velocimetry, Background Oriented Schlieren, or the shadowgraph method. The topic is closely related to fluid dynamics under microgravity research, and the results might be used in the framework of Parabolic Flight Campaigns and of Sounding Rocket (TEXUS) flight.

We are looking for a physics or engineering student to perform laboratory experiments (**Fehler! Verweisquelle konnte nicht gefunden werden.**) and data analysis of thermoelectric convective flows in a differentially heated cylindrical annulus. The candidate will need to familiarize with the scientific research process by studying the bibliography, experimenting, post-treating images and data, analysing and discussing their findings.

Contact person:
Dr. Antoine Meyer
meyer@b-tu.de
BTU Cottbus
AZFD room 2.12

DLR

DFG

Department of Aerodynamics and Fluid Mechanics
Faculty of Mechanical Engineering, Electrical and Energy Systems
Brandenburg University of Technology Cottbus–Senftenberg
Siemens-Halske-Ring 14, D-03046 Cottbus

Brandenburg
University of Technology
Cottbus - Senftenberg

DLR

DFG