Lehrstuhl für Strömungsmechanik
Forschungsgruppe B2
Strömungen mit chemischen Reaktionen
(Verbrennungstechnik)
Cauerstraße 4, 91058 Erlangen

Master / Bachelor Thesis:

Numerical simulations of the temperature and flow fields within the novel baking oven

Keywords: Numerical simulations, CFD, heat and mass transfer, baking, industrially applied research.

Description of the work:

Average annual production and consumption of the baking goods in Germany is around 83 kg/person. It is easy to calculate that only in Germany, overall annual amount of consumed baking goods is higher than amazing 6.600.000.000 kg/year!

From the total amount of energy required for the baking only 1/3 is used for heating up of the backing product. Rest of the energy dissipates to the surrounding as a heat loss. Therefore, one of the main development demands within the baking industry in the near future is to increase the energy efficiency of the production process. Furthermore, there is also a constant need for innovation in the area of oven design, increase of overall efficiency, reduction of environmental impact, etc.

A novel backing oven, currently under development at Institute of Fluid Mechanics in Erlangen (LSTM) will be, for the first time, equipped with the volumetric ceramic burners instead of conventional ones. This concept is expected to provide some significant advantages compared to the existing, commercially available baking technics, due to the higher thermal radiation output, high controllability and extremely short reaction time of volumetric ceramic burners. Thus, such should offer not only an improved regulation dynamic, that are crucially important for implementation of various baking programs, but also an increased energy efficiency and decreased fuel consumption rate.

Main goal of here proposed research is to determine and quantify influence of the heat irradiated from the burners on temperature distribution within the oven. Student will use known geometry to build models and has to numerically simulate different simple 'planar' oven layouts operating under different initial conditions (powers and air/fuel ratios). These simulations include the simulations of the flow- and thermal field, where both convection, due to the flow of hot combustion gases, and the radiation need to be taken into account. Result of these simulations will give an answer to a question: "which of the tested burner layouts can provides an optimal temperature distribution within the oven?".

Simulations are to be done in ANSYS-CFX software. Obtained results will be validated using the available experimental findings.

Required knowledge:
- (basic) knowledge and interest in Thermodynamics and Fluidmechanics,
- will to learn and work as a part of our team,
- (some) experience with ANSYS-CFX Software,
- interest in industrially applied research.

Contacts:
Franziska Raab, M. Sc. (09131/85-29485, Franziska.Raab@fau.de)
Dr.-Ing. Ana Zbogar-Rasic (09131/85-29493, Ana.Zbogar-Rasic@fau.de)
Dipl.-Ing. Vojislav Jovicic (09131/85-29492, Vojislav.Jovicic@fau.de)