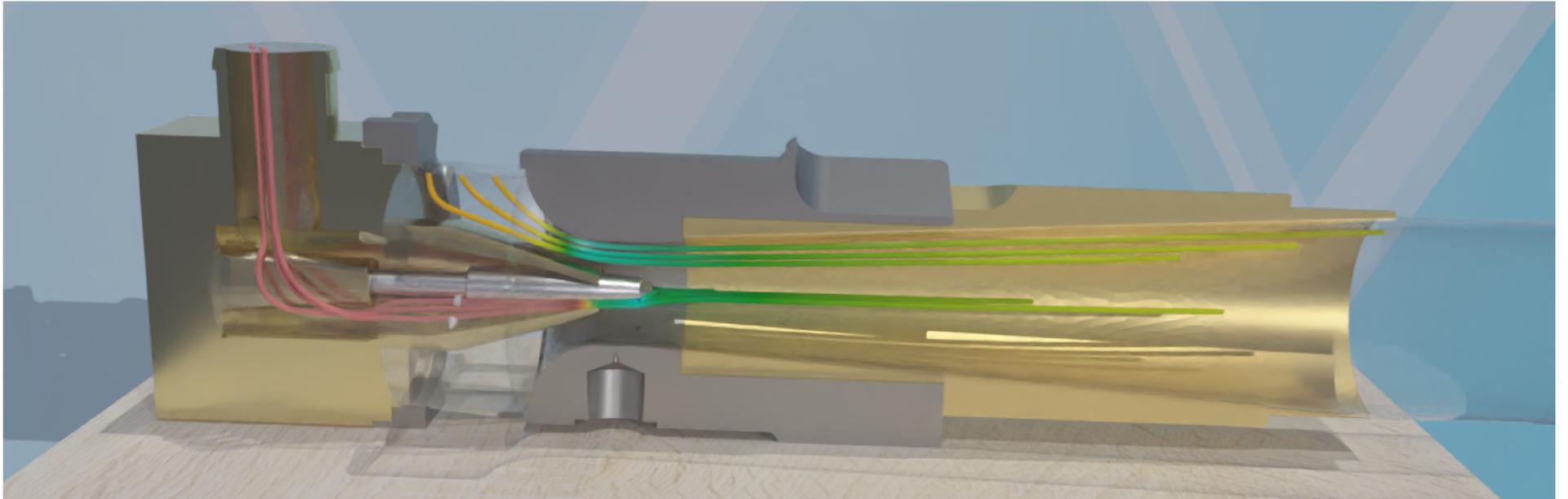


Shape Optimization of a Venturi Mixer for Residential Heating



Prerequisites

Basic knowledge about programming and numerical methods/computational fluid dynamics

Type

Student Research Project or Master Thesis

Language

English

Duration

6 months

Supervisor

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Are you ...

- **... an engineering or math student at RPTU?**

We offer a student research project or a master thesis in the field of optimization and computational fluid dynamics.

- **... interested in working on applications from industry?**

This project is concerned with finding solutions for residential heating appliances that are developed by Bosch Thermotechnology.

- **... interested in an international collaboration?**

This project is done in collaboration with Bosch Deventer (Netherlands). If you are interested, we also offer you the possibility to directly work at the company.

Description

- **What is a Venturi mixer?**

A Venturi mixer is used for mixing gases (see figure above). In the context of a heating appliance it is responsible for mixing, for example, methane and air before the mixture enters the burner region. For a good performance of the system it is important to achieve a target ratio of gases in the mixture and a good mixing quality.

- **How do we optimize the shape of the mixer?**

To improve the performance of the system we alter the shape of the mixer geometry using an iterative optimization procedure. We model the flow solution with the help of the open-source framework SU2. The change of shape is determined with the help of a discrete adjoint approach. Adjoint methods are specific strategies for efficiently calculating the derivative of a function with respect to the shape variables.

- **What research topics are you going to work on?**

In this project we are interested in exploring optimization strategies and the corresponding results for shape optimization of the Venturi mixer. Together with you, we can define an interesting task or research question in the scope of one or more of the following topics:

- Multi-point optimization: Instead of optimizing a single operating condition we consider multiple operating powers of the mixer.
- Multi-objective optimization: We want to improve two or more performance measures (for example mixing quality and ratio of the mixture).
- Robust design: We aim for solutions that also perform well when considering perturbations/uncertainties in specific parameters.

Goals

- Explore and apply workflows for optimization
- Analyze the optimized designs
- Learn about shape optimization with FADO / SU2