

# CFD analysis of Bosch boiler: linear thermo-acoustic stability analysis

## The DYNAF project

This master thesis proposal is part of the DYNAF project. This UT project focusses on the combustion *DYNA*mics and Acoustic oscillations in large industrial *Furna*ces and boilers. In cooperation with industrial partners we analyse the onset and growth of acoustic oscillations in large combustion systems.

These oscillations are called thermo-acoustic instabilities. By an unfortunate coupling of the heat released by the flame and the acoustic properties of the system, a positive feedback loop can form between these to physical properties. If allowed to grow, the resulting (acoustic) pressure waves can become so strong that damage to the equipment can occur.

As it stands, thermo-acoustic instabilities are dealt with as and when it happens using a trial-and-error approach. The aim of the project is to predict whether an oscillation will grow or not, and if so, systematically guide the burner design to a stable point.



Figure 1: Damage caused by thermo-acoustic instabilities.

## Your contribution

As part of the project, a linear thermo-acoustic stability analysis will be done on a boiler of one of the partners, Bosch.

CFD simulations will be performed using the UT FGM combustion model and a RANS or LES turbulence model to describe the turbulent flame. The flame transfer function (FTF) is extracted from the simulation. This describes the response of the flame to upstream velocity oscillations. The FTF is then used as an input to an acoustic network model to predict the stability of the system.

Alternatively, the UT FGM combustion model can be implemented in the open source CFD code SU2, which is also used by Bosch.

This work will be done in close collaboration with engineers from Bosch. Therefore you can, next to doing the research, also build your social and communicative muscle.

Are you interested or do you have any questions? Feel free to come by the office or send us an email.

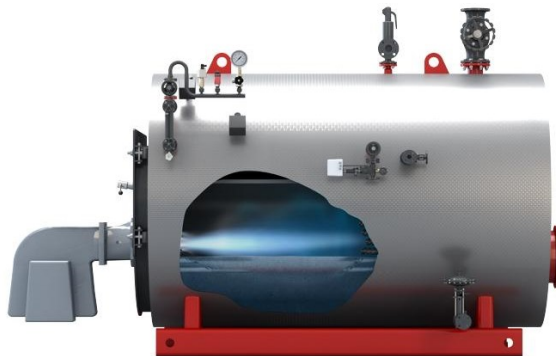


Figure 2: A Bosch steam boiler.

