

# Master Thesis

## Acoustics in rectilinear channels with a sudden expansion

### Purpose:

Acoustic waves interact with sudden expansions, i.e. outlets connected to a plenum. This boundary has a certain transmissivity, causing reflected waves to re-enter the rectilinear chamber. These reflected waves may lead to the development of standing waves in the channel which, if combustion is present, can couple, in a complex manner, with the heat release due to chemical reaction to various thermoacoustics phenomena.

In Computational Fluid Dynamics (CFD) there is often the need to simplify a problem, by i.e. reducing the domain size. An issue when studying thermoacoustic phenomena include neglecting the such a sudden expansion, and imposing a boundary condition to match the physics. This has been a difficult problem which could mean, from an acoustics point-of-view, that the problem is ill-posed. Therefore, more knowledge surrounding acoustics and CFD is needed to further understand this problem.

### Task:

- Use various numerical approach to calculate the acoustics in a channel, i.e.
  - ◆ COMSOL and
  - ◆ OpenFOAM
- Compare the results with different domains, such as those
  - ◆ with a boundary condition imposed to represent the physics of a plenum
    - waveTransmissive (OpenFOAM)
      - Varying the parameters to study their impact on the solution.
  - ◆ with a plenum
    - with different sizes
  - ◆ with a bluff-body
- Perform Proper Orthogonal Decomposition (POD) or Dynamic Mode Decomposition (DMD)