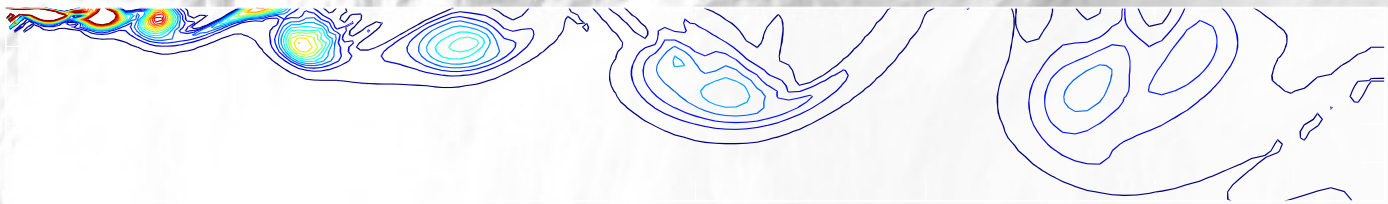

Numerical study of an Advection-Reaction-Diffusion equation in a compressible flow field

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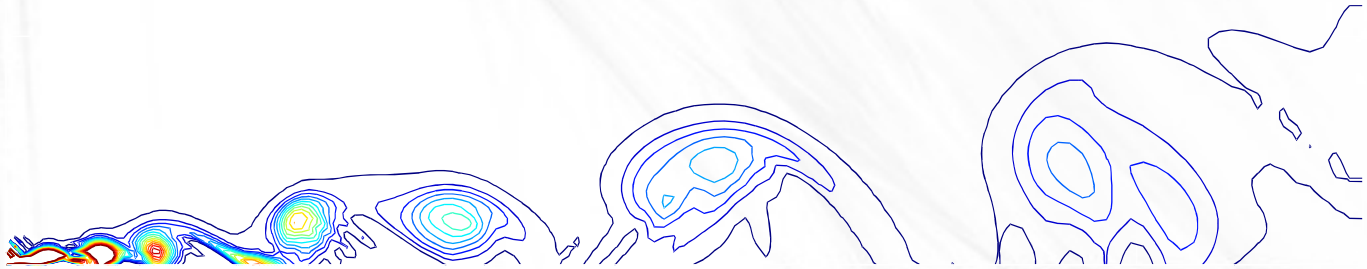

Purpose: Investigate the front flame propagation in combustion process by using simplified ARD models and highlight the role of compressibility

• We have compared different models proposed in literature :

Species conservation

$$\rho\left[\frac{\partial c}{\partial t}+\mathbf{u}\cdot\nabla c\right]=\nabla\cdot(\rho D\nabla c)+f$$

Treat the burnt gases as a species of a binary mixture composed by fresh and burnt air

General Compressible ARD

$$\frac{\partial\theta}{\partial t}+\nabla\cdot(\mathbf{u}\theta)=D_0\nabla^2\theta+f$$

Model typically used for the study of population dynamics

• We have investigated the dynamic of front interface and how it is affected by compressibility and reaction models;

• We have briefly investigated the blow-off phenomenon, when an ignition-like rate of production is applied, the critic initial conditions and the role played by compressibility.

1-D case:

• Analytical velocity field;

• No coupling phenomena;