FLOW SIMULATION IN SUPERSONIC COMBUSTION CHAMBER

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Keywords: *Compressible Flow, Reacting Flow, Turbulence.*

This study is aimed at computational modelling of the flow in supersonic combustion chamber [1]. Such simulation requires coupling of several models: basic compressible CFD, turbulence and chemical kinetics. The research is focused on the 2-dimensional case. The computational domain represents the rectangular area with the back-step placed inside (fig.1). There are two injection zones in the chamber: zone A for the fuel and zone B for the air. In 2d model fuel injection should be treated using additional source terms that are realized in OpenFOAM with fvOptions class. Accordingly, the fvOptions terms are added to the turbulence model equations.

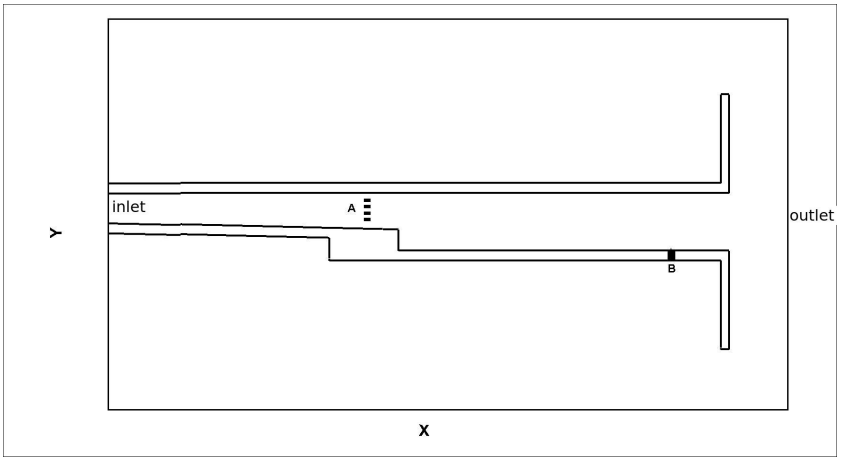

Figure 1

The flow is described with RANS equations, and SST model is chosen for turbulence. Near-wall boundary layers are treated with wall functions for turbulent variables and viscosity. The chemistry model is formulated by the system of reversible reactions for variety of species: H, O, OH, H2O, O2, H2, CO, CO2 and one global irreversible reaction for fuel combustion [2]. In order to account for the non-standard form of global reaction rate dependency, new reaction rate class was implemented.

The basic goal of the study is the cross-validation between in-house computational technology and OpenFOAM. The ReactingFOAM standard solver was modified and used for calculations. Simulations show a good correspondency.

References

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