Problems of combustion are usually mathematically described by a variable-density formulation of the Navier-Stokes equations at low Mach number. Finite volume and finite difference methods have been proposed for large-eddy simulation (LES) of variable-density turbulent flows at low Mach number. Finite element methods, which are often better suited for problems in complex geometries, have so far only been applied to laminar flows of this kind, to the best of our knowledge. We recently proposed an Algebraic Variational Multiscale-Multigrid Method (AVM3) within a finite element framework for LES of turbulent variable-density flow at low Mach number. The G-function approach to turbulent premixed combustion problems is based on the flamelet concept. Within this concept, the flame front is modeled as a sharp embedded interface represented by the iso-surface of a level-set function. Because properties of burnt and unburnt gases vary significantly across the
interface, the flow field renders discontinuous. To account for jumps in the velocity and the pressure field, an eXtended Finite Element Method (XFEM) is applied. Following this idea, we were able to achieve very promising results for laminar premixed combustions problems. Our efforts towards developing extended variational multiscale methods for turbulent premixed combustion will be presented in this talk.

Stichworte: turbulent variable-density ow, premixed combustion, large-eddy simulation, variational multiscale method, algebraic multigrid, extended nite element method

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