6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

A projection hybrid FV/FE method for low Mach number flows

A. Bermúdez[1], S. Busto[2], J.L. Ferrín[3] and M.E. Vázquez-Cendón[4]

[1] Instituto de Matemáticas, Universidade de Santiago de Compostela, Facultad de Matemáticas, 15782, Santiago de Compostela, alfredo.bermudez@usc.es

[2] Universidade de Santiago de Compostela, Facultad de Matemáticas, 15782, Santiago de Compostela, saray.busto@usc.es

[3] Instituto de Matemáticas, Universidade de Santiago de Compostela, Facultad de Matemáticas, 15782, Santiago de Compostela, joseluis.ferrin@usc.es

[4] Instituto de Matemáticas, Universidade de Santiago de Compostela, Facultad de Matemáticas, 15782, Santiago de Compostela, elena.vazquez.cendon@usc.es

Keywords: *Low Mach Number Flows, Projection Method, Finite Volume Methods, LADER Approach*

The scope of this talk is to extend the projection hybrid finite volume/finite element method introduced in [1] and [2] to solve compressible low Mach number flows. Starting with a 3D tetrahedral finite element mesh, the momentum equation is discretised by a finite volume method associated with a dual finite volume mesh. A variation on the classical flux function defined by Rusanov scheme is proposed in order to avoid the spurious oscillations originated by the time and space dependency of the density. To attain second order schemes CVC-Kolgan and LADER methodologies are considered (see [4] and [3]). The Galerkin approach used for the computation of the gradients involved in the diffusion term reduces the stencil and the computational cost of the transport-diffusion stage. Concerning the projection stage, the pressure correction is computed by a piecewise linear finite element method associated with the initial tetrahedral mesh. Finally, several test problems are presented to asses the performance of the method.

REFERENCES

[1] A. Bermúdez, J.L. Ferrín, L. Saavedra and M.E. Vázquez-Cendón, A projection hybrid finite volume/element method for low-Mach number flows. *J. Comp. Phys.*, Vol. **271**, pp. 360–378, 2014.

[2] S. Busto, J.L. Ferrín, E.F. Toro and M.E. Vázquez-Cendón, A projection hybrid high order finite volume/finite element method for incompressible turbulent flows. *J. Comp. Phys.*, Vol. **353**, pp. 169–192, 2018.

[3] S. Busto, E.F. Toro and M.E. Vázquez-Cendón, Design and analysis of ADER-type schemes for model advection-diffusion-reaction equations. *J. Comp. Phys.*, Vol. **327**, pp. 553–575, 2016.

[4] L. Cea and M.E. Vázquez-Cendón, Analysis of a Kolgan-type scheme motivated by the shallow water equations. *Appl. Num. Math.*, Vol. **62**, pp. 489–506, 2012.