

Factorizable methods for compressible flow computations: Recent developments

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ABSTRACT

The term "factorizable schemes" was coined in the late 90's (see [1]). It describes a discretization scheme for the compressible flow equations such that does not introduce any non-physical coupling between the acoustics and the advection of vorticity factors. Such a method can be regarded as a representative of a general class of the so-called mimetic methods. A scheme that was constructed that strictly obey this requirement on uniform quadrilateral meshes (independently of the cells' aspect ratio and skewness). The assumption (verified by numerical experiments) was that the coupling appearing in the case of non-uniform, though smooth, meshes was negligible from a practical perspective. A version of the scheme for (regular) triangular meshes was also proposed. The benefits of this approach comparing to the standard dimension-by-dimension methods are as follows:

- accuracy and efficiency for the low Mach number flows;
- facilitation for construction of "optimally" efficient fast solvers;
- improved resolution of vortical flow.

In this presentation we shall summarize some developments which took place during the recent years. We shall present a new more general formulation (two- and three-dimensional) based upon more complete theoretical grounds. The new scheme is less sensitive to the grid non-uniformity. Some numerical examples illustrating the performance of the scheme will be presented.

References

- [1] D. Sidilkover, "Factorizable schemes for the equations of fluid flow", *Applied Numerical Mathematics*, 41(3), pp. 423–436, 2002. (Appeared also as ICASE Report No. 99-20, June 1999).