Interpolation and reconstruction problems correlated to compact schemes

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The numerical treatment of convective and/or diffusive terms has a central role in all the approaches to the Computational Fluid Dynamics. Referring to the semidiscretized approach adopted in LES, many authors proposed a class of implicit Finite Difference formulas, the so called Compact Schemes. In the present work the authors inquired into the class of interpolations one can associate with such formulas. In such a way some new and useful ideas on the functional reconstructions required for the Control Volume method were derived. Indeed for both fully discretized and semi–discretized approaches, cell averaged based local space reconstructions may be required. Therefore a simple theory for univariate and multivariate "compact" reconstruction was considered; specifically for the univariate reconstruction some general and complete results were obtained and applied to both monodimensional transport problems and multidimensional ones where the directional splitting approach was adopted for. The multivariate case results to be more complex and some compact, in optimal sense, reconstructions are proposed and applyed. As a conclusion in this work the problem of optimal matching of contiguous expansions in one or more dimension is stressed and some new generalized matched interpolations and reconstructions are presented. Finally, some relevant aspects of the computational efforts associated to the various approach and the treatment of boundary conditions are discussed.