Title: **On Space-Time Adaptive Schemes for Numerical Solution of PDEs**

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Solutions to systems of PDEs, normally arising from mathematical models of important scientific and technological problems, exhibit a wide range of of spatial and temporal scales. This characteristic imply the need for numerical solution schemes that can adapt to the different temporal-spatial scales and make possible the efficient computation of solutions that are accurate in the smaller scales. Achi Brandt[1] pioneered such schemes by introducing the idea of mutilevel adaptive calculations, commonly known as *Multigrid schemes*, to modern computational analysis.

In this paper, the authors present fully adaptive, finite volume, time-explicit discretizations that includes a multi-resolution strategy which allows the control of the approximation error in space. Finite volume discretization provide for the correct conservation laws in the discrete domain. However in multi resolution schemes the transference of information, fluxes in particular, between scales implies the tracking of localized quantities and its associated errors. In this work the authors opt for evaluating the fluxes only on the adaptive grid.

The Runge-Kutta-Felhberg method is used together with the multi-resolution finite volume scheme for optimal control of the time step. The authors also describe the dynamic tree structure applied to make efficient use of the memory.

Application of the proposed scheme to the linear advection and the viscous Burgers equations is presented. Performance in terms of numerical error norms and efficiency in terms of CPU time and memory requirements, are compared to the numerical solution of the equations on the smaller spatial grid. Results for the multi-resolution scheme and Runge-Kutta-Felhberg method exhibit considerable savings in both, CPU time and memory requirements with respect to the numerical solution carried on the smaller spatial grid.

References

1. Brandt, A., *Multilevel Adaptive Solutions to BoundaryValue Problems*, Math. Comp. 31, pp. 333-390 (1977).