ADAPTIVE TECHNIQUES APPLIED TO WELL-BALANCED SCHEMES FOR SHALLOW WATER FLOWS

ROSA DONAT, ANNA MARTÍNEZ-GAVARA, **PEP MULET**

Well-balancing is a property that enables numerical schemes to accurately capture quasi steady-state flows governed by conservation laws with source terms [2, 3, 5, 6]. These schemes are typically based on shock-capturing technology and their computational cost can be large if high accuracy in the approximated solution is required.

Structured adaptive mesh refinement [1] is a technique that is widely used in CFD for its computational savings and simplicity. We propose a structured adaptive mesh refinement algorithm for the efficient simulation of shallow water flows via the hybrid second order scheme introduced in [4]. We analyze the well-balancing properties of the resulting scheme and the multiresolution implementation of wet/dry front treatments.

References

[1] Berger MJ, Oliger J., Adaptive mesh refinement for hyperbolic partial differential equations. Journal of Computational Physics 1984; 53:484–512.

[2] Bermúdez A, Vázquez M.E., Upwind methods for hyperbolic conservation laws with source terms. Computers and Fluids 1994; 23(8):1049–1071.

[3] Bouchut F., Nonlinear Stability of Finite Volume Methods for Hyperbolic Conservation Laws and Well-balanced Schemes for Sources. Birkhäuser: Basel, 2004.

[4] Martinez-Gavara A. Donat R., A hybrid second order scheme for shallow water flows. Journal of Scientific Computing 2011, 48:241–257.

[5] Greenberg JM, LeRoux AY., A well-balanced scheme for numerical processing of source terms in hyperbolic equations. SIAM Journal on Numerical Analysis 1996; 33:1–16.

[6] LeVeque RJ., Balancing source terms and flux gradients in high-resolution Godunov methods: the quasi-steady wave-propagation algorithm. Journal of Computational Physics 1998; 146:346–365.