PoPe (Projection on Proper elements): a general and in-depth method for code verification

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Projection on Proper Elements (PoPe) is based on an in-depth analysis of diagnostics which only require minimal modifications of the code tested and a minimal computational overhead. No dedicated simulations are needed since this method can be used in any regimes, including chaotic ones. PoPe is based on the exploration of the bijection between the analytical model implemented in a code and the output of simulations: if the equations recovered from a simulation are equivalent to the ones theoretically implemented in the code, the code is then verified; if not, PoPe gives indication to find and correct the error. The accuracy of PoPe diagnostics also allows to recover the convergence of the numerical methods. The verification of a 2D fluid code TOKAM and a 4D gyro-kinetic code TERESA, both used in plasma physics, are presented.

Block Based Adaptive Mesh Refinement applied to wave breaking

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We present a fast and parallel finite volume scheme on unstructured meshes applied to air/water flow. The mathematical model is based on a three-dimensional compressible low Mach two-phase flows model, combined with a linearized 'artificial pressure' law. This hyperbolic system of conservation laws allows an explicit scheme, improved by a block-based adaptive mesh refinement scheme. The numerical density of entropy production (the amount of violation of the theoretical entropy inequality) is used as an error indicator. This criterion indicates efficiently where the mesh should be refined or coarsened. Moreover, the computational time is preserved using a local time-stepping method. Finally, we show through several test cases the efficiency of the present scheme on some two- and three-dimensional dam-break problems.

Tuesday, October 13th 9:30 AM (coffee offered, talks at 10 AM)
Maison de la Simulation, Digiteo building (565), room 33

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