Increasing precision of shear and acoustic waves for DDH lattice Boltzmann scheme

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The DDH lattice Boltzmann scheme [dH92] has been developed formally with a direct Taylor approach suggested by one of us [Du08] that has conducted to interesting developments for thermal problems [DLT08]. Thanks to intensive use of formal calculus, high order equivalent partial differential equations are obtained for classical two and three-dimensional models.

We use a precise tuning of relaxation parameters characteristic of DDH lattice Boltzmann scheme and the fourth order equivalent equation of D2Q9 and D3Q19 lattice Boltzmann schemes in order to mimic shear waves at a high order of accuracy. Very precise results for linear modes of Stokes problem in a circle and in a sphere will be presented at the Conference.

In a second step of our study, the fourth order equivalent equations of D2Q13 and D3Q27 lattice Boltzmann schemes are used to force theoretically physical shear **and** acoustic waves at a high order of accuracy. Preliminary results for linear flows with periodic boundary conditions show the numerical interest of this approach.

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[Du08] F. Dubois. "Equivalent partial differential equations of a lattice Boltzmann scheme", *Computers and Mathematics with Applications*, vol. 55, p. 1441-1449, 2008.

[DLT08] F. Dubois, P. Lallemand, M. Tekitek. "Using Boltzmann scheme for anisotropic diffusion problems", *FVCA 5 Conference*, Aussois, June 2008.

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