

“Magic parameters” revisited *

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In a seminal paper [3] Ginzburg and Adler analyzed the bounce back boundary conditions and showed that it could be made exact to second order relatively Δx (*i.e.* for the Poiseuille flow) if some expression depending on the parameters of the lattice Boltzmann model were satisfied. Thus defining so called “magic parameters” [5].

Using the equivalent equation method that one of us developed [1][2], we analyze a series of situation (1D, 2D) for diffusion problems by anti-bounce back and for linear fluid problems by bounce back method for taking into account boundary conditions. The result is that magic parameters depend on the detailed choice of the moments [4] and on their equilibrium value.

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

[2] Dubois F., Third order equivalent equation of lattice Boltzmann scheme, *Discrete and Continuous Dynamical Systems*, to appear, 2008.

[3] Ginzburg I., Adler, P., Boundary flow condition analysis for the three-dimensional lattice Boltzmann model, *Journal of Physics II France*, vol. 4, p. 191-214, 1994.

[4] d’Humières D., “Generalized Lattice-Boltzmann Equations”, in *Rarefied Gas Dynamics: Theory and Simulations*, vol. 159 of *AIAA Progress in Astronautics and Astronautics*, p. 450-458, 1992.

[5] d’Humières D., Ginzburg I., “Multi-reflection boundary conditions for lattice Boltzmann models”, *Physical Review E*, vol. 68, 066614, 2003.

*Submitted 25 February 2008 to *ICMMES 2008 Conference*, Amsterdam, 16-20 June 2008.