

**Liu, Fang; Weiping, Shi**

**Numerical solutions of two-dimensional Burgers equations by lattice Boltzmann method.**

(English) [Zbl 1221.76165](#)

*Commun. Nonlinear Sci. Numer. Simul.* 16, No. 1, 150-157 (2011).

Summary: The two-dimensional Burgers' equations with two variables are solved numerically by the lattice Boltzmann method. The lattice Bhatnagar–Gross–Krook model that we use can recover the macroscopic equation with the second order accuracy. Numerical solutions for various values of Reynolds number, computational domain, initial and boundary conditions are calculated and validated against exact solutions or other published results. It is concluded that the proposed method performs well.

**MSC:**

**76M28** Particle methods and lattice-gas methods

Cited in **9** Documents

**65M75** Probabilistic methods, particle methods, etc. for initial value and initial-boundary value problems involving PDEs

**Keywords:**

Burgers equations; lattice Bhatnagar; Gross; Krook model; Reynolds number; irregular curved domain

**Full Text:** [DOI](#)

**References:**

- [1] Bahadir, A.R., A fully implicit finite-difference scheme for two-dimensional burgers' equation, *Appl math comput*, 137, 131-137, (2003) · [Zbl 1027.65111](#)
- [2] Benzi, R.; Succi, S.; Vergassola, M., The lattice Boltzmann equation: theory and applications, *Phys rep*, 222, 145-197, (1992)
- [3] Burger, J.M., A mathematical model illustrating the theory of turbulence, *Adv appl mech*, 1, 171-199, (1948)
- [4] Chen, S.; Doolen, G.D., Lattice Boltzmann method for fluid flows, *Annu rev fluid mech*, 30, 329-364, (1998) · [Zbl 1398.76180](#)
- [5] Cole, J.D., On a quasilinear parabolic equations occurring in aerodynamics, *Quart appl math*, 9, 225-236, (1951) · [Zbl 0043.09902](#)
- [6] Duan, Y.; Liu, R., Lattice Boltzmann model for two-dimensional unsteady burgers' equation, *J comput appl math*, 206, 432-439, (2007) · [Zbl 1115.76064](#)
- [7] Dawson, S.P.; Chen, S.; Doolen, G.D., Lattice Boltzmann computations for reaction – diffusion equations, *J chem phys*, 98, 1514-1523, (1993)
- [8] Filippova, O.; Succi, S.; Mazzocco, F.; Arrighetti, C.; Bella, G.; Hänel, D., Multiscale lattice Boltzmann schemes with turbulence modeling, *J comput phys*, 170, 812-829, (2001) · [Zbl 1012.76073](#)
- [9] Fletcher, C.A.J., Generating exact solutions of the two-dimensional burgers' equation, *Int J numer methods fluids*, 3, 213-216, (1983) · [Zbl 0563.76082](#)
- [10] Guo, Z.; Zheng, C.; Shi, B., Non-equilibrium extrapolation method for velocity and pressure boundary conditions in the lattice Boltzmann method, *Chin phys*, 11, 366-374, (2002)
- [11] Guo, Z.; Zheng, C.; Shi, B., An extrapolation method for boundary conditions in lattice Boltzmann method, *Phys fluid*, 14, 2007-2010, (2002) · [Zbl 1185.76156](#)
- [12] Ladd, A.C.J., Numerical simulations of particle suspensions via a discretized Boltzmann equation, *J fluid mech*, 271, 285-309, (1994), 311-339
- [13] Qian, Y.H.; Succi, S.; Orszag, S.A., Recent advances in lattice Boltzmann computing, *Annu rev comput phys*, 3, 195-242, (1995)
- [14] Shi, B.; Guo, Z., Lattice Boltzmann model for nonlinear convection – diffusion equations, *Phys rev E*, 79, 016701, (2009)
- [15] Shi, W.; Shyy, W.; Mei, R., Finite difference-based lattice-Boltzmann method for inviscid compressible flows, *Numer heat transfer B*, 40, 1-21, (2001)
- [16] Soliman, A.A., On the solution of two-dimensional coupled Burgers equations by variational iteration method, *Chaos solitons fractals*, 40, 1146-1155, (2008) · [Zbl 1197.65203](#)
- [17] Succi, S.; Foti, E.; Higuera, F., Three-dimensional flows in complex geometries with the lattice Boltzmann method, *Europhys lett*, 10, 433-438, (1989)
- [18] Young, D.L.; Fan, C.M.; Hu, S.P.; Atluri, S.N., The eulerian – lagrangian method of fundamental solutions for two-dimensional unsteady Burgers equations, *Eng anal bound elem*, 32, 395-412, (2008) · [Zbl 1244.76096](#)

- [19] Zhang, J.; Yan, G., Lattice Boltzmann method for one and two-dimensional Burgers equation, Phys A, 387, 4771-4786, (2008)  
· [Zbl 1426.90026](#)
- [20] Zu, Y.; Yan, Y.; Shi, W.; Ren, L., Numerical method of lattice Boltzmann simulation for flow past a rotating circular cylinder with heat transfer, Int J numer methods heat fluid flow, 18, 766-782, (2008)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.