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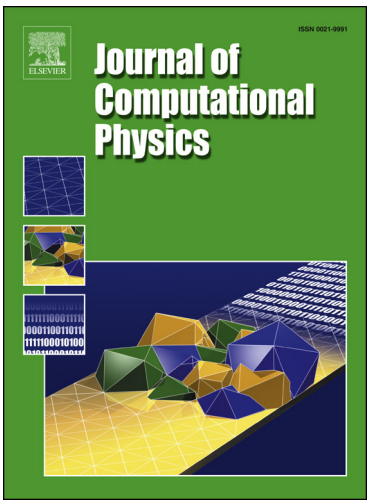

Second-order curved boundary treatments of the lattice Boltzmann method for convection–diffusion equations

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Second-order curved boundary treatments of the lattice Boltzmann method for convection-diffusion equations

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Abstract

In this paper, we present a kind of second-order curved boundary treatments for the lattice Boltzmann method solving two-dimensional convection-diffusion equations with general nonlinear Robin boundary conditions. The key idea is to derive approximate boundary values or normal derivatives on computational boundaries, with second-order accuracy, by using the prescribed boundary condition. Once the approximate information are known, the second-order bounce-back schemes can be perfectly adopted. Our boundary treatments are validated with a number of numerical examples. The results show the utility of our boundary treatments and very well support our theoretical predications on the second-order accuracy thereof. The idea is quite universal. It can be directly generalized to 3-dimensional problems, multiple-relaxation-time models, and the Navier-Stokes equations.

Keywords: Lattice Boltzmann method, Convection-diffusion equations,

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