عنوان مقاله:

Buoyancy Term Evolution in the Multi Relaxation Time Model of Lattice Boltzmann Method with Variable Thermal Conductivity Using a Modified Set of Boundary Conditions

محل انتشار:

ماهنامه بین المللی مهندسی, دوره 30, شماره 9 (سال: 1396)

تعداد صفحات اصل مقاله: 9

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خلاصه مقاله:

During the last few years, a number of numerical boundary condition schemes have been used to study various aspects of the no-slip wall condition using the lattice Boltzmann method. In this paper, a modified boundary condition method is employed to simulate the no-slip wall condition in the presence of the body force term near the wall. These conditions are based on the idea of the bounceback of the non-equilibrium distribution. The error associated with the modified model is smaller than those of other boundary condition models available in the literature. Additionally, various schemes to simulate body forces have been studied. Based on the numerical results, the model demonstrating minimum error has been reported. Finally, it has been shown that the present model is capable of simulating the effect of high nonlinearity in the heat transfer equation in the presence of a variablethermal conductivity. This has been accomplished by employing a multi relaxation time scheme to model a Rayleigh-Benard natural convection current in a 2-D domain with high Rayleigh numbers. Previous studies reported that the onset of oscillation occurs at Ra≈30,000 and Pr=6.0. By the modified boundary condition method which is used in this study, the oscillation is removed until at least Ra≈45,000 and Pr=6.0. The results show that applying scheme 3 for the current boundary condition yields the least amount of error compared to the semi-empirical correlation. The Rayleigh-Benard convection problem has been revisited in the presence of a variable thermal conductivity and the simulation results remain stable for flows with a large variation of thermal conductivity (= 0.7) and Rayleigh numbers up to .1,000,000 and Pr=0.7

کلمات کلیدی:

Lattice Boltzmann Method,Boundary Condition,Multi Relaxation Time,Variable Thermal Conductivity,Rayleigh-Benard ,Convection