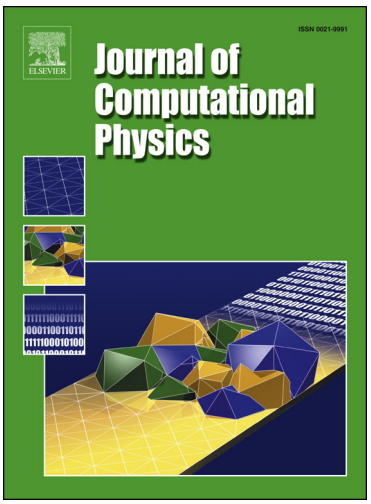
Accepted Manuscript



On the time relaxed Monte Carlo computations for the lid-driven micro cavity flow

M. Eskandari, S.S. Nourazar

PII: S0021-9991(17)30204-8
DOI: http://dx.doi.org/10.1016/j.jcp.2017.03.017
Reference: YJCPH 7221

To appear in: *Journal of Computational Physics*

Received date: 22 August 2016
Revised date: 6 March 2017
Accepted date: 8 March 2017

Please cite this article in press as: M. Eskandari, S.S. Nourazar, On the time relaxed Monte Carlo computations for the lid-driven micro cavity flow, *J. Comput. Phys.* (2017), http://dx.doi.org/10.1016/j.jcp.2017.03.017

On the time relaxed Monte Carlo computations for the lid-driven micro cavity flow

M. Eskandari[a], S.S. Nourazar[a,*]

[a]*Department of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran*

Abstract

In the present study, the first, second and third orders of the TRMC scheme (TRMC1, TRMC2 and TRMC3 schemes) are employed to numerically investigate the lid-driven micro cavity flow with different lid velocities and Knudsen numbers. The simulations cover flow regimes from early slip to early transition regimes ($0.005 \leq Kn \leq 0.1$). Higher order terms in the Wild sum expansion are considered to obtain higher order collisions. The results are compared with those from the standard DSMC method. Comparisons show that among the studied schemes, the results obtained from the TRMC3 scheme have excellent agreement with the ones from the DSMC method. On the other hand, the results of TRMC1 and TRMC2 schemes show deviations compared to those from the DSMC method. The deviations are more pronounced for the velocity distributions. Moreover, the present investigation illustrates that as the Knudsen number increases the accuracy of lower orders of the TRMC scheme improves. It is observed that truncating the Wild sum expansion up to the third order approximation of the TRMC scheme, may be a proper alternative method for the DSMC method in simulating the lid-driven micro cavity problem for Knudsen numbers $0.005 \leq Kn \leq 0.1$ with reasonable accuracy and simplicity in mathematics.

Keywords: Boltzmann equation, direct simulation Monte Carlo, time relaxed Monte Carlo, higher order collision, micro cavity
PACS: 02.70.Tt, 47.11.-j, 51.10.+y

Nomenclature

μ the mean collision frequency, kinematic viscosity

*Corresponding author. Address: Department of Mechanical Engineering, Amirkabir University of Technology, 424 Hafez Ave, Tehran, Iran. P.O. Box 15875-4413, Tel.: +98 (21) 64540

Email addresses: me.eskandari@aut.ac.ir (M. Eskandari), icp@aut.ac.ir (S.S. Nourazar)