LATTICE BHATNAGAR-GROSS-KROOK MODEL FOR THE NUMERICAL SIMULATION OF MISCIBLE FLUID FLOW IN A MINI CHANNEL

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Abstract

Lattice Boltzmann Method (LBM) offers an exceptionally powerful tool for the computation of solute transport in discrete pore and/or solid systems. LBM is viewed from the particle perspective where collisions, streaming and particle-particle and/or particle-surface interactions constitute the entire conceptual framework. Lattice Boltzmann modeling with Bhatnagar-Gross-Krook approximation constitutes the Lattice-Bhatnagar-Gross-Krook (LBGK) model. Bhatnagar-Gross-Krook uses single time relaxation scheme (i.e., heat transfer, mass transfer and momentum transfer takes place at the same time rate).

A LBGK model for simulating miscible fluid flow in a mini channel is developed. As a starting step the single component single-phase flow in the channel has been simulated and validated with the analytical solution for a fully developed velocity profile. Then the method is extended for miscible fluid flow like salt solution and water in the channel with different entry conditions. The model used to incorporate inter particle potential is the Shan-Chen model. There is a provision provided in the code developed for incorporating mixing length. The parameters that are studied in this analysis include inlet velocity, inlet concentration, angle of inclination of the two channels at the inlet, etc. The density and velocity profiles with respect to distance from inlet are plotted. The results obtained are to be validated with the experimental results. The effect of grid sizes also studied during the present study.

References

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