A Comparative Study Between D2Q5 and D2Q9 Lattice Boltzmann Scheme for Mass Transport Phenomena in Porous Media

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Abstract

Characterization of the different transport phenomena through porous media represents a key factor to improving the properties of materials for several applications in different fields such as geological sciences, energy sciences or biological applications. Considering the difficulty of carried out experimental studies in porous media, these phenomena are more feasible to describe when computational tools are applied to compute the involved parameters. In this scenario, the Lattice Boltzmann Method (LBM) appears as a powerful tool to solve different transport phenomena at micro- and meso-scale [1].

The fluid flow behavior, analyzed with LBM, is commonly solved using the D2Q9 scheme. This scheme has shown a reliable solution in fluid flow problems [2]. On the other hand, the mass transport phenomena are recommended to be solved by using the D2Q5 scheme. However, there is no a comparative, detailed and complete study of the impact of using such schemes in porous media. The purpose of this study is to analyze the impact of considering the D2Q5 and D2Q9 LBM scheme in the computation of mass concentration through porous media with different geometrical characteristics. Parameters such as porosity and tortuosity are also considered in this study.

References

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