Fundamentals of Lattice Boltzmann Methods

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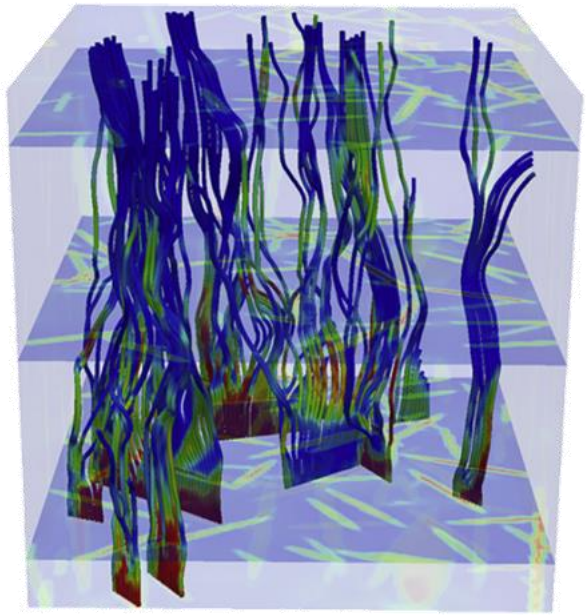

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The lattice Boltzmann method (LBM) is a Poisson-free method for incompressible Navier-Stokes equations, which has been attracting a lot of attention during the last three decades because of its simple numerical algorithm, also suitable for parallel computation, and it is now widely employed in various simulations of unsteady complex fluid flows. It deals with the time evolution of the velocity distribution function of ‘‘artificial” molecules and this makes this approach particularly suitable for complex geometries and their automatic meshing.
In this talk, I will present first an overview of LBM for solving a variety of heat ad mass transfer phenomena: conductive heat transfer; convective heat transfer, turbulence and MHD; radiative heat transfer and multi-component flows. In terms of applications, I will focus on porous media and foams; fuel cells; nanofluids, suspensions and particulates; multiphase flows, emulsions, droplets and micro-flows. As a concluding remark, I will highlight the essential features of this methodology and the possible ways to simplify it even further by revising the artificial compressibility method (ACM) as alternative.