Title: **CFD. Conventional and Lattice Boltzmann methods. Study of LBM: Basic theory and applications. Simulation of a fluid in a wind tunnel.**

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The aim of this work is to examine Lattice Boltzmann method (LBM) to see their possible application in Chemical Engineering problems. LBM is considered an efficient alternative method to conventional computational fluid dynamics (CFD) in some fluid dynamics problems, in which conventional numerical methods are limited.

LBM does not rely on numerical resolution of Navier-Stokes equation (NSE) like conventional CFD does. Contrary to CFD, LBM does not need fluid mechanics equations to describe fluid behaviour. Thus, mathematical complexity is reduced, and the efficiency of the method increases.

LBM is based on statistical probabilities of movement of fluid, specifically, particles, in streaming and collision processes. This method is founded, mainly, on the kinetic theory, which will be analysed in depth to understand the basis of the technique. Thus, LBM can describe fluid behaviour without solving

LBM, as CFD have application on Transport Phenomena simulation in fluid flow. In particular, conventional CFD is mainly implemented for industrial, environmental and physiological fluid fields.

Once studied the basis of the main representative methods of either microscopic and mesoscopic level and analysed its concepts entailed, a comparison among conventional CFD and emerging LBM, included in the work, permits simulating fluid behaviour efficiently by choosing the befitted technique. Likewise, limitations and applications of each method will be remarked. Small errors, simple application of the method, extensibility, higher parallelization and small-time procedure are some of the characteristics required for a well suitable method to simulate fluid flows.

Keywords: Lattice Boltzmann method (LBM), computational fluid dynamics (CFD), Navier-Stokes equation (NSE), kinetic theory, statistical probabilities, macroscopic and microscopic scale, Transport phenomena