CHAPTER 1

INTRODUCTION

1.Introduction

Many methods have been recently introduced in order to analyze a laminar flow and its modeling of hydrodynamic or aerodynamic removal of particles from the internal surfaces . They have tended to solve physical problems for different geometries in industries and research laboratories . In this case Lattice Boltzmann method (LBM) is one of the newest method that has been vastly studied by a huge number of papers. As a matter of fact, Lattice Boltzmann scheme is one of the numerical techniques that is normally used to solve the equation of turbulent and laminar flow which is represented time –dependent fluid flow [1].

Also it should be noted that, LBM is one of the most effective numerical ways for simulating and modeling complicated physical chemical system with complex geometry. LBM has introduced as a microscopic numerical method and has a certainly effect on simulating fluid flow . In particular, the easy implementation of boundary conditions makes LBM very interesting for the simulation of multiphase flows and specially flow in complex geometries[2].

To solve Lattice Boltzmann equation partial differential must be considered. In this regard partial differential equation presents fluid flow through the space and

time .As a matter of fact ,certain solutions only exist for a few specific cases with simple geometries and suitable boundary conditions. It is certainly true that to obtain simplified equation , the complex phenomena must be ignored. However, nowadays digital computers have rapidly developed and many researchers prefer to use high performance computers in their field of study.

Many papers have been presented Lattice Boltzmann in different groups by researchers and indeed , three groups of them have been broadly developed in their field of studies . First of all different type of fluid flow respect to the fluid regime consist of laminar, turbulent and incompressible flow and therefore, different Reynolds number and changing characteristic of fluid are used by seintic .The second group wants to indicate different geometries and different aspect ratio in 2D and 3D modeling patterns.

Finally last group of papers are clearly represented by engineers which discuss a bout different theoretical ,numerical and experimental methods of solving the equation and simulation fluid flow in different shapes. Moreover, their results are compared by exits ones to show the validation.

Many years ago, the modeling of incompressible Laminar fluid flow inside the different kind of geometries was investigated and there are number of articles published by researchers in entire the world . The current study tends to present the incompressible fluid flow in case of laminar by MRT-LB method for different physical problems such as cavity and channel flow. Furthermore it shows the discrepancy between this numerical modeling with SRT method.

The present work is going to consider the difference between Multi relaxation time and single relaxation time in terms of accuracy and stability in cavity. Moreover , the instability of fluid flow is performed by different meshes and Reynolds numbers.

Since a plotting vortex and streamlines for fluid flow are one of the important concern for scientists ,this study investigates a prediction of vortex structure and different position of vortex with particle trajectory in channel to show clearly this phenomenon .

Also a reattachment area for vortex inside the backward facing step flow is carried out and verified with available benchmark in different time and Reynolds numbers. To extend this work Multi particles with Lattice Boltzmann based on Multi Relaxation Time inside the channel are simulated and then agree well with a existing numerical results.