

## AN ABSTRACT OF A THESIS

# MODELING GASEOUS FLOW THROUGH MICROCHANNELS USING A LATTICE BOLTZMANN METHOD

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**Master of Science in Chemical Engineering**

Gas and liquid microflows are encountered in many applications of Micro-Electro-Mechanical Systems (MEMS). To date, there is no satisfactory theoretical explanation for the observed behavior of the flows of fluid, even in simple planar microchannels. Due to their small sizes, conventional continuum approaches may not be appropriate for simulation of the flow characteristics of MEMS. Understanding the physics of such flows is an important element in designing, fabricating and operating MEMS, for which microchannels are basic elements. The lattice Boltzmann Model (LBM) has developed as a promising new method for flow simulation. This approach uses simplified kinetic models which can incorporate the essential physics of microscopic or mesoscopic process so that the macroscopic averaged properties are consistent with observed behavior for gaseous flows. The deviation from continuum is accounted for by rarefaction and compressibility effects. Rarefaction phenomena causes slip flow. Slip flow can be simulated by the LBM by increasing the value of the relaxation time  $\tau$ . This was confirmed by using different theoretical and analytical approaches. A relation between  $\tau$  and Knudsen number  $Kn$  was demonstrated.

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CERTIFICATE OF APPROVAL OF THESIS

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