WEEKLY COLLOQUIUM

Tuesday, 7 March 2006
2:30-3:00 in Goodes 409

Speaker: Dustin Bespalko, M.Sc.(Eng) Student, Mechanical and Materials Engineering, Queen's University

Title: Using the Lattice Boltzmann Method to Solve the Navier-Stokes Equations

Abstract: The Lattice Boltzmann Method (LBM) is a promising new technique for Computational Fluid Dynamics (CFD). The LBM is based on the Boltzmann Equation, which describes the motion of particles in a rarefied gas. It simplifies the Boltzmann Equation by constraining the particles to move on a discrete lattice with a finite set of velocities. The equations are then solved numerically and the resulting flow field can be shown to satisfy the Navier-Stokes Equations (for continuum fluids) when relaxed to the macroscopic limit.

The LBM has a number of advantages over traditional methods for CFD. First, the implementation is simple, which makes it possible to code quickly and efficiently. Second, the LBM uses a straight-forward Cartesian discretisation, and the boundary conditions are generally easy to apply to complex geometries. Finally, the LBM has superior speed since no pressure-velocity coupling is required which generally consumes ~80% of the computation time.

In this presentation, the fundamentals of the LBM will be discussed starting from statistical mechanics and the discrete Boltzmann Equation. Additionally, the implementation and boundary conditions will be presented along with the results from preliminary validation cases.

About the speaker:
Dustin is an M.Sc. student in the department of Mechanical and Materials Engineering working under the supervision of Dr. Andrew Pollard. He graduated in 2004 with a B.Sc. in Mechanical Engineering from the University of Calgary. His research is primarily focused on Direct Numerical Simulation (DNS) of turbulent flow fields.