Eindhoven University of Technology – TU/e

Introduction to the Lattice Boltzmann Method

Course code – 3E100

In spite of its fairly recent development, the lattice Boltzmann method (LBM) has quickly become a popular and yet powerful tool in fluid dynamics and acoustics. Differently from the traditional methods based on the *Continuum* Theory (e.g. finite volumes, finite elements, finite differences, to name but a few), LBM captures the temporal behaviour of a fluid by means of two basic operations on the particle level, namely the propagation and collision of the fluid particles. Some advantages of LBM include its straightforward approach to complex boundary conditions and the facility to be computed in parallel processing schemes. Moreover, LBM is capable of resolving, in a single computational structure, phenomena involving very different scales, such as the interaction between flow and acoustic fields. This seminar will present an introduction to the LBM theory, discuss essential advantages and limitations of the method, and focus on practical applications involving fluid dynamics and acoustic problems. Based on that, the seminar will be structured according to the following schedule:

Week	Date	Topic	Time	Instructors
1	*September 9*	*Introduction to LBM I: Basics and background*	*10:45-12:30*	*J. Harting*
2	*September 16*	*Introduction to LBM II: Boundary conditions, multiphase flow, examples*	*10:45-12:30*	*J. Harting*
3	*September 23*	*LBM-BGK models in acoustics*	*10:45-12:30*	*A. da Silva*
	September 24	*Practical exercise I*	*8:45-12:30*	*A. da Silva*
4	*September 30*	*Initial and boundary conditions for acoustics*	*10:45-12:30*	*A. da Silva*
	October 1	*Practical exercise II*	*8:45-12:30*	*A. da Silva*
5	*October 7*	*Applications of LBM in aeroacoustic problems*	*10:45-12:30*	*A. da Silva*
	October 8	*Practical exercise III*	*8:45-12:30*	*A. da Silva*

Additional Information:

- All theoretical and exercise lectures will be given in room CC2.21 (entrance through Applied Physics Building, N-Laag).
- For the exercise lectures, students are required to bring their own laptop with Matlab installed. Matlab versions 2006a or latter are recommended.
- Msc students participating to the course including the practical exercises will be granted 1ECTS.
- Students should register before August 31 by Email to: Avraham Hirschberg: A.Hirschberg@tue.nl or Jens Herting: Jens@Harting.ws.