

Analyse numérique

Mercredi 21 avril 2010 – Salle MAA112 – 16.15 h.

Dr. Yossi **FARJOUN** (Massachusetts Institute of Technology, Cambridge, USA) donnera un séminaire¹ intitulé :

“Solving Conservation Law and Balance Equations by Particle Management”

Abstract

Conservation equations are at the heart of many interesting and important problems. Examples come from physics, chemistry, biology, traffic and many more. Analytically, hyperbolic equations have a beautiful structure due to the existence of characteristics. These provide the possibility of transforming a conservation PDE into a system of ODE and thus greatly reducing the computational effort required to solve such problems. However, even in one dimension, one encounters problems after a short time. The most obvious difficulty that needs to be dealt with has to do with the creation of shocks, or in other words the crossing of characteristics. With a particle based method one would like to avoid a situation when one particle overtakes a neighboring one. However, since shocks are inherent to many hyperbolic equations and relevant to the problems that one would like to solve, it would be good not to “smooth away” the shock but rather find a good representation of it and a good solution for the offending particles. In this talk we will discuss a new particle based method for solving (one dimensional, scalar) conservation law equations. The guiding principle of the method is the conservative property of the underlying equation. The basic method is conservative, entropy decreasing, variation diminishing and exact away from shocks. A recent extension allows solving equations with a source term, and also provides “exact” solutions to the PDE. The method compares favorably to other benchmark solvers, for example CLAWPACK, and requires less computation power to reach the same resolution. A few examples will be shown to illustrate the method, with its various extensions.

Due to the current limitation to 1D scalar, the main application we are looking at is traffic flow on a large network. Though we still hope to manage to extend the method to either systems or higher dimensions (each of these extensions has its own set of difficulties), I would be happy to discuss further possible applications or suggestions for extensions.

Lausanne, le 13 avril 2010/AQ/aa

1. Les séminaires qui ont lieu à la Section de Mathématiques sont annoncés sur Internet à l’adresse <http://www.epfl.ch/cgi-bin/memento/memento>.