Topics in Optimal Transportation

May 23, 2013

Short description

The theory of Optimal Transportation goes back to the pioneering works of Monge in 1781 and Kantorovich in 1939 on the mathematical theory of "optimal relocation of resources" (which earned Kantorovich the nobel price in economics). Since then it has become a classical subject in analysis, probability, economics and optimization. More recently it gained extreme popularity when many reseachers in different areas of mathematics realized that this theory was strongly linked to their subject. In particular, the work of Brenier in the late 80's paved the way towards a towards a beautiful interplay between the theory of Optimal Transportation and PDEs, fluid mechanics, geometry, probability and functional analysis. From a PDE point of view the theory of Optimal Transportation offers various variational approaches to equations involving the real Monge-Ampère operator - which is the protype for a fully non-linear partial differential operator - and it has lead to spectacularly transparant proofs of fundamental inequalities in geometric analysis (log Sobolev type inequalities, Prekopa-Leindler type inequalities, isoperimetric inequalities, ...). There is also a wide spectrum of recent applications of the mathematical theory ranging from image processing to dynamical metereology. The course will be based on Villani's excellent book "Topics in Optimal Transportation" (Graduate Studies in Math. Vol. 58, AMS, 2003) but it will be complemented by material which highlights connections to research areas of particular local relevance.

Aim of the course

After finishing the course the student will have a working knowledge on the fundamentals of Optimal Transportation and will be able to link it to his/her research, when possible. A general aim of the course is also to open the door for cross fertilization between different local research subjects, in particular at the Department of Mathematics. For example, very recently new connections have emerged betweeen Optimal Transportation and the research in the local Complex Analysis group. These links involve the theory of Dissipative PDEs and Interacting Particle Systems, wich in turn have close connections to the reseach carried out in the local Kinetic Theory group. There are also interesting links with the local research on (Combinatorial) Optimization, as well as Numerical

Analysis. In a broader perspective cross fertilization with other research groups at Chalmers, involving applications of the theory can also be expected.

Course organizers

Robert Berman

Teachers

Robert Berman (and a few lectures by Klas Modin)

Lectures

Two double lectures a week during one "läsperiod"

Target participants

Master students, graduate students, post docs and local staff

Credits: 7,5 (ECTS)