Submittee: Agueh Martial
Date Submitted: 2011-08-03 12:56
Title: Applied Analysis & Applied PDEs
Event Type: Conference-Workshop

Location:
University of Victoria

Dates:
July 12-15, 2011

Topic:
Applied Analysis & Applied PDEs: optimal transportation theory, Navier-Stokes-type equations, and PDEs and waves for the atmosphere and ocean.

Methodology:
Pedagogical mini-courses and research lectures.

Objectives Achieved:
The aim of this workshop was two folds: First, to bring together researchers in the three areas of optimal transportation theory, Navier-Stokes-type equations, and PDEs and waves for the atmosphere and ocean; Second, to inform the participants of the most recent results obtained in the above areas.

Scientific Highlights:
Three mini-courses were given by leading specialists in the above cited fields. Not only did the mini-courses educate graduate students and postdocs on the numerous tools used in these fields, but they also helped other researchers to make new connections with their research areas, and find new techniques to use in them. Therefore, Several new lines of inquiry arose from connections between researchers of the different focus areas. For instance, the ideas of optimal transportation theory may provide new techniques for ensemble climate prediction, and the lectures on the "hurricane embryo" provided new fluid dynamics PDEs that are deserving of rigorous analysis. Also, recent works revealed that optimal transportation theory is useful for the analysis of fluid mechanic equations. A development of such ideas would be of great interest to many researchers in this field. The minicourse by Y. Giga on recent development on the Navier-Stokes equations was mainly devoted to the exposition of a blow up argument to get, by contradiction, global regularity for the Navier-Stokes equations. The lectures on this topic ranged from the boundary layer problem, Liouville type arguments (very useful in the blow up argument described above), rotating fluid, critical quasigeostrophic equations, to the full equation of magneto hydrodynamics. The minicourses by L. Smith and A. Majda described interesting applied math topics on atmospheric science, including both broad expositions and specific new results on three main topics: reduced models for rotating/stratified fluids, models for the hurricane embryo, and minimal PDE models that represent

moisture and convection effects in the tropics. Lectures were also given on the related topics of geophysical turbulence, convective momentum transport, and convectively coupled waves. The minicourse by M. Agueh introduced the optimal transport problem and some of its applications to functional analysis and PDEs. The first lecture of this minicourse gave an overview of the optimal transport problem, (its origin, description, and brief history) and also summarized the most important results on the existence, uniqueness and explicit solutions (in specific cases) to this problem as well as its connection with the famous Monge-Ampere equation. The purpose of this lecture was essentially to present to the non-specialists, some basic information on the optimal transportation which would help them to easily follow the related research lectures presented during the workshop. The remaining two lectures of this minicourse showed some applications of optimal transportion to other research areas, namely in functional analysis where it is used to derive sharp geometric and functional inequalities, and in PDEs where it is used to prove existence, uniqueness and long time asymptotic behavior of certain parabolic diffusion equations of the gradient flow type.

Organizers:
Agueh, Martial, Mathematics and Statistics, University of Victoria; Ibrahim, Slim, Mathematics and Statistics, University of Victoria; Stechmann, Samuel, Mathematics, University of Wisconsin-Madison

---

Speakers:
See attached pdf file.

Links:
http://www.mitacs.ca/events/index.php?option=com_content&view=article&id=169&Itemid=184&lang=en

---

File Uploads:
Additional Upload 1: http://www.pims.math.ca/files/final_report/abstracts2011june29.pdf

---