14th European Intensive Course on Complex Analysis and Applications to Partial Differential Equations

Departamento de Matemática, Universidade de Coimbra and Universidade de Aveiro, Portugal

April 13 to 16, 2009

Goal of the Course

This intensive course follows the eleven held at the Universities of Coimbra and Aveiro from 1995 to 2007 (1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007) and there are plans for intensive courses in the following years. The lecture notes of some of the courses have been published in Coimbra and others are in print.

This intensive course is intended to celebrate the long lasting co-operation between the involved Universities. Students and Lecturers from almost a dozen European countries participated in the past and we hope that this will also continue in the future. We kindly ask all of you which kept in touch with former participants to forward them this message.

This intensive course will have a total of 18 hours of lectures and is at postgraduate level. Lecturers will have time available to discuss with the students. Successfully participating students will get a certificate. This course is organized by the Universities of Coimbra and Aveiro with the same goals as the ones organized under the Socrates/Erasmus Intensive Program of Higher Education, and is opened to all young mathematicians interested in Complex Analysis and its applications.

There will be a ***Workshop*** on "Applications and Generalizations of Complex Analysis" on the 17th and 18th of april 2009.

Schedule of the course

top

Coimbra University				
(room)	april 13 (Pedro Nunes)	april 14 (Pedro Nunes)	april 15 (Pedro Nunes)	april 16 (Pedro Nunes)
Opening session	14h15m-14h30m			
Arno Kuijlaars	14h30m-16h	10h-12h30m	10h-12h30m	10h-12h30m
K.D.T-R McLaughlin	16h15m-17h45m	14h30m-17h	14h30m-17h	14h30m-17h

Abstracts

top

Schedule of the course

Author: Arno Kuijlaars

Title: Riemann-Hilbert methods for orthogonal polynomials

Summary: In this series of lectures I will discuss a recent technique for the asymptotic analysis of orthogonal

polynomials based on the Riemann-Hilbert problem. The technique is known as the Deift-Zhou steepest descent method for Riemann-Hilbert problems, and may be thought of as a nonlinear version of the steepest descent method for integrals. The method will be explained in detail for orthogonal polynomials on the real line. The asymptotic results have implications for eigenvalue statistics of unitary random matrix models which will also be discussed as a motivation. My plan is also to touch upon non-intersecting paths, multiple orthogonal polynomials and tiling problems related to orthogonal polynomials.

Tentative outline of the course

Lecture 1: Unitary random matrix models and determinantal point processes, orthogonal polynomial ensembles and non-intersecting path ensembles

Lecture 2: Orthogonal polynomials on the real line and the Riemann-Hilbert problem for orthogonal polynomials. Airy functions and the Riemann-Hilbert problem for Airy functions. Outline of the steepest descent analysis.

Lecture 3: Equilibrium measures and the first transformations in the Riemann-Hilbert problem

Lecture 4: Final transformations in the Riemann-Hilbert problem. Asymptotics of orthogonal polynomials. Universality in the random matrix model.

Author: K.D.T-R McLaughlin

Schedule of the course

Title: Asymptotic analysis of integrable nonlinear partial differential equations via Riemann--Hilbert methods

Summary: We will learn about a variety of methods aimed at understanding the behavior of solutions of integrable partial differential equations. Some of the material will be based on the first half of the course "Universality" which I taught in Spring 2008. Information for that course is available at the following web address:

http://math.arizona.edu/~mcl/MATH529_Spring08.html

Tentative outline of the course

Lecture 1: We'll start with an example: the asymptotic behavior of a linear constant coefficient partial differential equation. THe main technique: the steepest descent method for the asymptotic analysis of integrals.

Lecture 2: A nonlinear example: The KdV equation, and its solution procedure.

Lecture 3: Overview of direct and inverse scattering theory. Direct scattering theory concerns the 1-dimensional Schr\"{o}dinger equation of quantum mechanics, and inverse scattering theory will be presented using Riemann-Hilbert techniques.

Lecture 4: An example: The emergence of a soliton in the KdV equation as t grows to infinity. Here we will use Riemann–Hilbert techniques in a simple example, which allows us to control error terms and see the fundamental nonlinear phenomenon associated to the KdV equation.

Financial Support

top

Living expenses can be partially covered for some students if they do not have support from their own institution and if there is enough money available.

Registration Form –- Requests should be send to **Ana Foulquié Moreno (foulquie@ua.pt)** with the following data:

top

Name:

Affiliation:

I intend to participate in the Intensive Course: Yes/No

I intend to participate in the Workshop with a communication ___ / without a communication __

Tentative title:

I need an invitation letter: _____; for that purpose, contact me via the e-mail:_____or by fax:_____

I need help with accommodation in Coimbra or Aveiro:_____;

Please send as soon as possible a short abstract of your communication (in Latex, at most 10 lines).

List of Participants

top

Adrien Hardy, Université Catholique de Louvain, Belgium

Afonso Bandeira, Universidade de Coimbra, Portugal

Ana Conceição, Universidade do Algarve, Portugal

Ana Isabel Gonçalves Mendes, Escola Superior de Tecnologia e Gestão do Instituto Politécnico de Leiria, Portugal

Anabela Monteiro Paiva, Universidade da Beira Interior, Portugal

Anabela de Sousa e Silva, Universidade de Aveiro, Portugal

Andre Werner, Ruhr-Universitaet Bochum, Germany

Andrei Martinez-Finkelshtein, Universidad de Almeria, Spain

Cristina Diogo, University of Minho, Portugal

Darío Ramos López, Universidad de Almeria, Spain

Dimitris Pinotsis, Reading University, UK

Dries Geudens, Katholieke Universiteit Leuven, Belgium

Edixon Rojas, Universidade de Aveiro, Portugal

Edmundo José Huertas Cejudo, Universidad Carlos III de Madrid, Spain

Eduardo Godoy, Universidad de Vigo, Spain

Felix Grimme, Ruhr-Universitaet Bochum, Germany

Herbert Duenãs Ruiz, Universidad Carlos III de Madrid, Spain

Joel Moreira, Universidade de Coimbra, Portugal

Jorge A. Borrego Morell, Universidad Carlos III de Madrid, Spain

Joris Verbaenen, Katholieke Universiteit Leuven, Belgium

José Carlos Soares Petronilho, Universidade de Coimbra, Portugal

José Luis Pereira, Universidade do Algarve, Portugal

Kenier Castillo Rodríguez, Universidad Carlos III de Madrid, Spain

Klaas Deschout, Katholieke Universiteit Leuven, Belgium

Kristina Schubert, Ruhr-Universitaet Bochum, Germany

Luis Daniel Abreu, Universidade de Coimbra, Portugal

Luis Enrique Garza Gaona, Universidad Carlos III de Madrid, Spain

Luis Manuel da Silva Cotrim, Escola Superior de Tecnologia e Gestão do Instituto Politécnico de Leiria, Portugal

Márcio Nascimento, Escola Superior de Tecnologia do Instituto Politécnico de Viseu, Portugal

María das Neves Vieiro Rebocho, Universidade da Beira Interior, Portugal

María del Carmen Castro Alférez, Universidad de Almeria, Spain

Martin Bender, Katholieke Universiteit Leuven, Belgium

Pablo Manuel Roman, Katholieke Universiteit Leuven, Belgium

Regina Almeida, UTAD, Portugal

Steven Delvaux, Katholieke Universiteit Leuven, Belgium

Ulises Fidalgo Prieto, Universidad Carlos III de Madrid, Spain

Vítor Sousa, Universidade de Aveiro, Portugal

Organizers

top

Amilcar Branquinho (Departamento de Matemática Universidade de Coimbra)

Ana Foulquié (Departamento de Matemática da Universidade de Aveiro)

Jaime Carvalho e Silva (Departamento de Matemática Universidade de Coimbra)
Maria Isabel Cação (Departamento de Matemática da Universidade de Aveiro)

Support

top

With support from Centro de Matemática da Universidade de Coimbra, UI&D "Matemática e Aplicações" da Universidade de Aveiro, Fundação Para a Ciência e Tecnologia, and the Socrates programme