Seminar & Events Bulletin: Student Analysis

01-01-2013 to 06-30-2013

Thursday, January 17, 2013	
5:10pm-6:00pm	**Student Analysis** -- () *Organizational Meeting* -- 3096 East Hall

Thursday, January 24, 2013	
5:10pm-6:00pm	**Student Analysis** -- Matt Jacobs (University of Michigan) *The Prime Number Theorem* -- 3096 East Hall

Thursday, January 31, 2013	
5:10pm-6:00pm	**Student Analysis** -- Purvi Gupta (University of Michigan) *Deconstructing the Infinity Laplacian* -- 3096 East Hall

Thursday, February 07, 2013	
5:10pm-6:00pm	**Student Analysis** -- Derek Wood (University of Michigan) *Strichartz Estimates* -- 3096 East Hall

Thursday, February 14, 2013	
5:10pm-6:00pm	**Student Analysis** -- () *No Talk* -- 3096 East Hall

Thursday, February 21, 2013	
5:10pm-6:00pm	**Student Analysis** -- Rafe Kinsey (University of Michigan) *How to Prove Existence of Nonlinear PDE* -- 3096 East Hall

Thursday, February 28, 2013	
5:10pm-6:00pm	**Student Analysis** -- Joe Roberts (University of Michigan) *Ill Posed Problems* -- 3096 East Hall

Thursday, March 07, 2013	
5:10pm-6:00pm	**Student Analysis** -- () *No Talk (Spring Break)* -- 3096 East Hall

Thursday, March 28, 2013	
5:10pm-6:00pm	**Student Analysis** -- Jeff Calder (University of Michigan) *A Hamilton-Jacobi equation for the continuum limit of non-dominated sorting* -- 3096 East Hall

Thursday, April 11, 2013	
5:10pm-6:00pm	**Student Analysis** -- Jeremy Hoskins (University of Michigan) *TBA* -- 3096 East Hall

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Abstracts

Student Analysis
Thursday, January 17, 2013, 5:10pm-6:00pm
3096 East Hall
()
Organizational Meeting

Student Analysis
Thursday, January 24, 2013, 5:10pm-6:00pm
3096 East Hall
Matt Jacobs (University of Michigan)
The Prime Number Theorem

The prime number theorem (PNT) is the most important result of analytic number theory. The PNT states that the growth of the prime counting function is asymptotic to the logarithmic integral function li(x). A concrete program to attack PNT was first outlined by Riemann in his amazingly influential 1859 paper "On the number of primes less than a given magnitude". The proof was finally completed independently by Hadamard and de la Valle-Poussin in 1896. Though we now have many different proofs of the prime number theorem, the original proof stands out for its beauty and transparency. The proof is notable for combining many different techniques from both real and complex analysis. I will give a detailed outline of the proof and try to explain what I think are the key ideas.

Student Analysis
Thursday, January 31, 2013, 5:10pm-6:00pm
3096 East Hall
Purvi Gupta (University of Michigan)
Deconstructing the Infinity Laplacian

What is common between the optimal Lipschitz extension problem and a game of tug-of-war? One connection is via the infinity Laplacian --- a fully non-linear degenerate elliptic second-order partial differential operator that is obtained as a limit of 'generalized' Laplacians. In this talk, we will first describe the interpolation problem that motivated the study of this operator and then switch gears to see a game-theoretic interpretation of the associated Dirichlet problem. The talk will be elementary, and despite the topic, there will be very little PDE (we won't integrate by parts even once).

Student Analysis
Thursday, February 07, 2013, 5:10pm-6:00pm
3096 East Hall
Derek Wood (University of Michigan)
Strichartz Estimates

Strichartz estimates are powerful tools used in the study of dispersive partial differential equations. They were initially obtained by R. Strichartz using Fourier restriction theorems and a duality argument. They have since been generalized and used extensively. Our focus will be on the Strichartz estimates for the wave equation. We will outline their proof, and apply them to prove a small data global existence result.

Student Analysis
Thursday, February 14, 2013, 5:10pm-6:00pm
3096 East Hall
()
No Talk

Student Analysis
Thursday, February 21, 2013, 5:10pm-6:00pm
3096 East Hall
Rafe Kinsey (University of Michigan)
How to Prove Existence of Nonlinear PDE

My talk will be a relatively elementary introduction to basic concepts in nonlinear (time-dependent) PDE. I'll discuss the basic paradigm we use to prove local-in-time well-posedness: we prove an "a priori" inequality (often called an "energy inequality") and then we use it to prove existence of solutions for a short period of time. These proofs often involve taking tools from the machinery of functional analysis (things like contraction mappings, Banach-Alaoglu, etc.). I'm going to discuss this basic conceptual setup, with a few simple examples, and then survey different specific approaches to proving local existence. Time permitting, I'll then say a few words about global existence.

The talk should be accessible to people without much PDE background. (But, for those with more PDE background, I'll try to include some more subtle issues about the delicacies of proving well-posedness in more difficult cases.)

Student Analysis
Thursday, February 28, 2013, 5:10pm-6:00pm
3096 East Hall
Joe Roberts (University of Michigan)
Ill Posed Problems

In PDE, a problem consists of one or more partial differential equations along with boundary and/or initial data. A well posed problem has a unique solution that depends continuously on the data in some suitable topology. An ill posed problem is then a problem in which at least one of existence, uniqueness, or continuous dependence fails to hold. Obtaining existence and uniqueness usually means finding the right number of conditions to impose, while obtaining continuous dependence usually means finding the right kinds of conditions to impose. I'll go over some classical examples of ill posed problems demonstrating some different ways things can go badly. The talk will be accessible to those without much knowledge of PDE's.

Student Analysis
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3096 East Hall
()
No Talk (Spring Break)

Student Analysis
Thursday, March 28, 2013, 5:10pm-6:00pm
3096 East Hall
Jeff Calder (University of Michigan)
A Hamilton-Jacobi equation for the continuum limit of non-dominated sorting

Given a finite partially ordered set, one can arrange the points in the set into layers in the following way. The first layer is the set of minimal elements with respect to the partial order. The second layer is obtained by removing the first layer, and finding the minimal elements in what remains. Further layers are obtained recursively by repeatedly removing the set of minimal elements. When applied to points in Euclidean space with the usual partial order this algorithm is called non-dominated sorting. It is a fundamental algorithm in multi-objective optimization and has connections to many important problems in combinatorics and probability. In this talk I will sketch the proof of a new result which shows that the layers obtained by non-dominated sorting of random points in Euclidean space converge almost surely, in the large sample size limit, to the level sets of a function which satisfies a Hamilton-Jacobi equation in the viscosity sense. The talk will be at a basic level and will be accessible to all graduate students.

Student Analysis
Thursday, April 11, 2013, 5:10pm-6:00pm
3096 East Hall
Jeremy Hoskins (University of Michigan)
TBA