2016 - 2017

Calendrier / Calendar

MONTREAL

Date Heure/Time : Le vendredi 5 mai 2017 - 16:00

Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

Conférencier/Speaker : Gerard Freixas, Institut de Mathématiques de Jussieu

Titre/Title : From the geometry of numbers to Arakelov geometry

Resume/Abstract :
Arakelov geometry is a modern formalism that extends in various directions the geometry of numbers founded by Minkowski in the nineteenth century. The objects of study are arithmetic varieties, namely complex varieties that can be defined by polynomial equations with integer coefficients. The theory exploits the interplay between algebraic geometry and number theory and complex analysis and differential geometry. Recently, the formalism found beautiful and important applications to the so-called Kudla programme and the Colmez conjecture. In the talk, I will first introduce elementary facts in Minkowski’s geometry of numbers. This will provide a motivation for the sequel, where I will give my own view of Arakelov geometry, by focusing on toy (but non-trivial) examples of one of the central theorems in the theory, the arithmetic Riemann-Roch theorem mainly due to Bismut, Gillet and Soulé, and generalizations. I hope there will be ingredients to satisfy different tastes, for instance modular forms (arithmetic aspect), analytic torsion (analytic aspect) and Selberg zeta functions (arithmetic, analytic and dynamic aspects).

Date Heure/Time : Le vendredi 21 avril 2017 - 16:00

Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

Conférencier/Speaker : Aaron Naber, Northwestern University

Titre/Title : Introduction to the Energy Identity for Yang-Mills

Resume/Abstract :
In this talk we give an introduction to the analysis of the Yang-Mills equation in higher dimensions. In particular, when studying sequences of solutions we will study the manner in which blow up can occur, and how this blow up may be understood through the classical notions of the defect measure and bubbles. The energy identity is an explicit conjectural relationship, known to be true in dimension four, relating the energy density of the defect measure at a point to the bubbles which occur at that point, and we will give a brief overview of the recent proof of this result for general stationary Yang Mills in higher dimensions. The work is joint with Daniele Valtorta.

Date Heure/Time : Le vendredi 7 avril 2017 - 16:00

Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

Conférencier/Speaker : Gabor Szekelyhidi, University of Notre Dame

Titre/Title : Kahler-Einstein metrics

Resume/Abstract :
Kahler-Einstein metrics are of fundamental importance in Kahler geometry, with connections to algebraic geometry, geometric analysis, string theory amongst other fields. Their study has received a great deal of attention recently, culminating in the solution of the Yau-Tian-Donaldson conjecture, characterizing which complex manifolds admit Kahler-Einstein metrics. I will give an overview of the field, including some recent developments.

Date Heure/Time : Le vendredi 31 mars 2017 - 16:00

Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

Conférencier/Speaker : Tatiana Toro, University of Washington

Titre/Title : PDEs on non-smooth domains

Resume/Abstract :
In these lectures we will discuss the relationship between the boundary regularity of the solutions to elliptic second order divergence form partial differential equations and the geometry of the boundary of the domain where they are defined. While in the smooth setting tools from classical PDEs are used to address this question, in the non-smooth setting techniques from harmonic analysis and geometric measure theory are needed to tackle the problem.
The goal is to present an overview of the recent developments in this very active area of research.

Date Heure/Time : Le vendredi 17 mars 2017 - 15:30
Lieu/Venue : McGill University, Burnside Hall, 805 Sherbrooke Ouest, salle 1205
Conférencier/Speaker : Sayan Mukherjee, Duke University
Titre/Title : Inference in Dynamical Systems
Resume/Abstract :
We consider the asymptotic consistency of maximum likelihood parameter estimation for dynamical systems observed with noise. Under suitable conditions on the dynamical systems and the observations, we show that maximum likelihood parameter estimation is consistent. Furthermore, we show how some well-studied properties of dynamical systems imply the general statistical properties related to maximum likelihood estimation. Finally, we exhibit classical families of dynamical systems for which maximum likelihood estimation is consistent. Examples include shifts of finite type with Gibbs measures and Axiom A attractors with SRB measures. We also relate Bayesian inference to the thermodynamic formalism in tracking dynamical systems.

Date Heure/Time : Le vendredi 10 mars 2017 - 16:00
Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, 2920 Chemin de la Tour, salle 6254
Conférencier/Speaker : Louigi Addario-Berry, Université McGill
Titre/Title : Probabilistic aspects of minimum spanning trees
Resume/Abstract :
One of the most dynamic areas of probability theory is the study of the behaviour of discrete optimization problems on random inputs. My talk will focus on the probabilistic analysis of one of the first and foundational combinatorial optimization problems: the minimum spanning tree problem. The structure of a random minimum spanning tree (MST) of a graph G turns out to be intimately linked to the behaviour of critical and near-critical percolation on G. I will describe this connection, and present some results on the structure, scaling limits, and volume growth of random MSTs. It turns out that, on high-dimensional graphs, random minimum spanning trees are expected to be three-dimensional when viewed intrinsically, and six-dimensional when viewed as embedded objects. Based on joint works with Nicolas Brouin, Christina Goldschmidt, Simon Griffiths, Ross Kang, Gregory Miermont, Bruce Reed, Sanchayan Sen.

Date Heure/Time : Le vendredi 24 février 2017 - 16:00
Lieu/Venue : CRM, Université de Montréal, Pavillon André-Aisenstadt, 2920 Chemin de la Tour, salle 6254
Conférencier/Speaker : Frithjof Lutscher, Université d'Ottawa
Titre/Title : Spreading phenomena in integrodifference equations with overcompensatory growth function
Resume/Abstract :
The globally observed phenomenon of the spread of invasive biological species with all its sometimes detrimental effects on native ecosystems has spurred intense mathematical research and modelling efforts into corresponding phenomena of spreading speeds and travelling waves. The standard modelling framework for such processes is based on reaction- diffusion equations, but several aspects of an invasion can only be appropriately described by a discrete-time analogues, called integrodifference equations. The theory of spreading speeds and travelling waves in such integrodifference equations is well established for the "mono-stable" case, i.e. when the non-spatial dynamics show a globally stable positive steady state. When the positive state of the non-spatial dynamics is not stable, as is the case with the famous discrete logistic equation, it is unclear how the corresponding spatial spread profile evolves and at what speed. Previous simulations seemed to reveal a travelling profile in the form of a two-cycle, with or without spatial oscillations. The existence of a travelling wave solution has been proven, but its shape and stability remain unclear. In this talk, I will show simulations that suggest that there are several travelling profiles at different speeds. I will establish corresponding generalizations of the concept of a spreading speed and prove the existence of such speeds and travelling waves in the second- iterate operator. I conjecture that rather than a travelling two-cycle for the next-generation operator, one observes a pair of stacked fronts for the second-iterate operator. I will relate the observations to the phenomenon of dynamic stabilization.

Date Heure/Time : Le vendredi 10 février 2017 - 16:00
Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker : Mark Powell, UQAM
Titre/Title : Knot concordance
Resume/Abstract :
I will introduce the knot concordance group, give a survey of our current understanding of it and discuss some relationships with the topology of 4-manifolds.
Date Heure/Time : Le vendredi 20 janvier 2017 - 16:00
Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker : Christopher Skinner, Princeton University
Titre/Title : The Birch–Swinnerton Dyer Conjecture and counting elliptic curves of ranks 0 and 1
Resume/Abstract : This colloquium talk will begin with an introduction to the Birch–Swinnerton-Dyer conjecture for elliptic curves — just curves defined by the equations $y^2=x^3+Ax+B$ — and then describe recent advances that allow us to prove that lots of elliptic curves have rank zero or one.

Date Heure/Time : Le vendredi 2 décembre 2016 - 16:00
Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker : Gui-Qiang G. Chen, University of Oxford
Titre/Title : Partial differential equations of mixed elliptic-hyperbolic type in mechanics and geometry
Resume/Abstract : As is well-known, two of the basic types of linear partial differential equations (PDEs) are hyperbolic PDEs and elliptic PDEs, following the classification for linear PDEs first proposed by Jacques Hadamard in the 1920s; and linear theories of PDEs of these two types have been well established, respectively. On the other hand, many nonlinear PDEs arising in mechanics, geometry, and other areas naturally are of mixed elliptic-hyperbolic type. The solution of some longstanding fundamental problems in these areas greatly requires a deep understanding of such nonlinear PDEs of mixed type. Important examples include shock reflection-diffraction problems in fluid mechanics (the Euler equations) and isometric embedding problems in differential geometry (the Gauss-Codazzi-Ricci equations), among many others. In this talk we will present natural connections of nonlinear PDEs of mixed elliptic-hyperbolic type with these longstanding problems and will then discuss some recent developments in the analysis of these nonlinear PDEs through the examples with emphasis on developing and identifying mathematical approaches, ideas, and techniques for dealing with the mixed-type problems. Further trends, perspectives, and open problems in this direction will also be addressed.

Date Heure/Time : Le jeudi 1 décembre 2016 - 15:30
Lieu/Venue : Room 1205, Burnside Hall, 805 Sherbrooke West
Conférencier/Speaker : Richard Samworth, University of Cambridge
Titre/Title : High-dimensional changepoint estimation via sparse projection
Resume/Abstract : Changepoints are a very common feature of Big Data that arrive in the form of a data stream. We study high-dimensional time series in which, at certain time points, the mean structure changes in a sparse subset of the coordinates. The challenge is to borrow strength across the coordinates in order to detect smaller changes than could be observed in any individual component series. We propose a two-stage procedure called 'inspect' for estimation of the changepoints: first, we argue that a good projection direction can be obtained as the leading left singular vector of the matrix that solves a convex optimisation problem derived from the CUSUM transformation of the time series. We then apply an existing univariate changepoint detection algorithm to the projected series. Our theory provides strong guarantees on both the number of estimated changepoints and the rates of convergence of their locations, and our numerical studies validate its highly competitive empirical performance for a wide range of data generating mechanisms.

Date Heure/Time : Le vendredi 25 novembre 2016 - 16:00
Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker : Maksym Radziwill, McGill University
Titre/Title : Around the Möbius function
Resume/Abstract : The Moebius function plays a central role in number theory; both the prime number theorem and the Riemann Hypothesis are naturally formulated in terms of the amount of cancellations one gets when summing the Moebius function. In recent joint work with K. Matomaki the speaker showed that the sum of the Moebius function exhibits cancellations in "almost all intervals" of increasing length. This goes beyond what was previously known conditionally on the Riemann Hypothesis. The result holds in fact in greater generality. Exploting this generality one can show that between a fixed number of consecutive squares there is always an integer composed of only "small" prime factors. This is related to the running time of Lenstra's factoring algorithm. I will also discuss some further developments: the work of Tao on correlations between consecutive values of Chowla, and his application of this result to the resolution of the Erdos discrepancy problem.
Date Heure/Time : Le vendredi 4 novembre 2016 - 16:00
Lieu/Venue : CRM, Pavillon André-Aisenstadt, 2920 chemin de la tour, salle 6254
Conférencier/Speaker : Philippe G. LeFloch, Université Pierre et Marie Curie, Paris 6
Titre/Title : The nonlinear stability of Minkowski space for self-gravitating massive fields
Resume/Abstract :
I will review results on the global evolution of self-gravitating massive matter in the context of Einstein's theory as well as the f(R)-theory of gravity. In collaboration with Yue Ma (Xian), I have investigated the global existence problem for the Einstein equations coupled with a Klein-Gordon equation describing the evolution of a massive scalar field. Our main theorem establishes the global nonlinear stability of Minkowski spacetime upon small perturbations of the metric and the matter field. Recall that the fully geometric proof by Christodoulou and Klainerman in 1993, as well as the proof in wave gauge by Lindblad and Rodnianski in 2010, both apply to vacuum spacetimes and massless fields only. Our new technique of proof, which we refer to as the Hyperboloidal Foliation Method, does not use Minkowski's scaling field and is based on a foliation of the spacetime by asymptotically hyperboloidal spacelike hypersurfaces, on sharp estimates for wave and Klein-Gordon equations, and on an analysis of the quasi-null hyperboloidal structure (as we call it) of the Einstein equations in wave gauge.

Date Heure/Time : Le vendredi 28 octobre 2016 - 15:30
Lieu/Venue : Room 1205, Burnside Hall, 805 Sherbrooke West
Conférencier/Speaker : Jerry Lawless, University of Waterloo
Titre/Title : Efficient tests of covariate effects in two-phase failure time studies
Resume/Abstract :
Two-phase studies are frequently used when observations on certain variables are expensive or difficult to obtain. One such situation is when a cohort exists for which certain variables have been measured (phase 1 data); then, a sub-sample of individuals is selected, and additional data are collected on them (phase 2). Efficiency for tests and estimators can be increased by basing the selection of phase 2 individuals on data collected at phase 1. For example, in large cohorts, expensive genomic measurements are often collected at phase 2, with oversampling of persons with “extreme” phenotypic responses. A second example is case-cohort or nested case-control studies involving times to rare events, where phase 2 oversamples persons who have experienced the event by a certain time. In this talk I will describe two-phase studies on failure times, present efficient methods for testing covariate effects. Some extensions to more complex outcomes and areas needing further development will be discussed.

Date Heure/Time : Le vendredi 21 octobre 2016 - 16:00
Lieu/Venue : CRM, Pavillon André-Aisenstadt, 2920 chemin de la tour, salle 6254
Conférencier/Speaker : Ivan Corwin, Columbia University
Titre/Title : Integrable probability and the KPZ universality class
Resume/Abstract :
I will explain how certain integrable structures give rise to meaningful probabilistic systems and methods to analyze them. Asymptotics reveal universal phenomena, such as the Kardar-Parisi-Zhang universality class. No prior knowledge will be assumed.

Date Heure/Time : Le vendredi 14 octobre 2016 - 16:00
Lieu/Venue : CRM, Pavillon André-Aisenstadt, 2920 chemin de la tour, salle 6254
Conférencier/Speaker : Jean-Philippe Lessard, Université Laval
Titre/Title : Rigorously verified computing for infinite dimensional nonlinear dynamics: a functional analytic approach
Resume/Abstract :
Studying and proving existence of solutions of nonlinear dynamical systems using standard analytic techniques is a challenging problem. In particular, this problem is even more challenging for partial differential equations, variational problems or functional delay equations which are naturally defined on infinite dimensional function spaces. The goal of this talk is to present rigorous numerical technique relying on functional analytic and topological tools to prove existence of steady states, time periodic solutions, traveling waves and connecting orbits for the above mentioned dynamical systems. We will spend some time identifying difficulties of the proposed approach as well as time to identify future directions of research.

Date Heure/Time : Le vendredi 30 septembre 2016 - 16:00
Lieu/Venue : UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115
Conférencier/Speaker : Liam Watson, Université de Sherbrooke
**Titre/Title:** Notions of simplicity in low-dimensions

**Resume/Abstract:**
Various auxiliary structures arise naturally in low-dimensions. I will discuss three of these: left-orders on the fundamental group, taut foliations on three-manifolds, and non-trivial Floer homological invariants. Perhaps surprisingly, for (closed, connected, orientable, irreducible) three-manifolds, it has been conjectured that the existence of any one of these structures implies the others. I will describe what is currently known about this conjectural relationship, as well as some of the machinery — particularly in Heegaard Floer theory — that has been developed in pursuit of the conjecture.

**Date Heure/Time:** Le vendredi 16 septembre 2016 - 16:00

**Lieu/Venue:** Université Concordia, Library Building, 1400 de Maisonneuve O., salle LB-921.04

**Conférencier/Speaker:** B.L.S. Prakasa Rao, CR Rao Advanced Institute, Hyderabad, India

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**Titre/Title:** Statistical Inference for fractional diffusion processes

**Resume/Abstract:**
There are some time series which exhibit long-range dependence as noticed by Hurst in his investigations of river water levels along Nile river. Long-range dependence is connected with the concept of self-similarity in that increments of a self-similar process with stationary increments exhibit long-range dependence under some conditions. Fractional Brownian motion is an example of such a process. We discuss statistical inference for stochastic processes modeled by stochastic differential equations driven by a fractional Brownian motion. These processes are termed as fractional diffusion processes. Since fractional Brownian motion is not a semimartingale, it is not possible to extend the notion of a stochastic integral with respect to a fractional Brownian motion following the ideas of Itô integration. There are other methods of extending integration with respect to a fractional Brownian motion. Suppose a complete path of a fractional diffusion process is observed over a finite time interval. We will present some results on inference problems for such processes.

**Date Heure/Time:** Le vendredi 16 septembre 2016 - 16:00

**Lieu/Venue:** UQAM, Pavillon Président-Kennedy, 201, ave du Président-Kennedy, salle PK-5115

**Conférencier/Speaker:** Nick Trefethen, University of Oxford

**Titre/Title:** Cubature, approximation, and isotropy in the hypercube

**Resume/Abstract:**
The hypercube is the standard domain for computation in higher dimensions. We describe two respects in which the anisotropy of this domain has practical consequences. The first is a matter well known to experts (and to Chebfun users): the importance of axis-alignment in low-rank compression of multivariate functions. Rotating a function by a few degrees in two or more dimensions may change its numerical rank completely. The second is new. The standard notion of degree of a multivariate polynomial, total degree, is isotropic — invariant under rotation. The hypercube, however, is highly anisotropic. We present a theorem showing that as a consequence, the convergence rate of multivariate polynomial approximations in a hypercube is determined not by the total degree but by the [term Euclidean degree], defined in terms of not the 1-norm but the 2-norm of the exponent vector $\|\mathbf{k}\|_{\infty}$ of a monomial $x_{1}^{k_{1}} \cdots x_{d}^{k_{d}}$. The consequences, which relate to established ideas of cubature and approximation going back to James Clark Maxwell, are exponentially pronounced as the dimension of the hypercube increases. The talk will include numerical demonstrations.