

Wen-Ching Winnie Li, The Pennsylvania State University

Title: Ramanujan graphs, Ramanujan hypergraphs and Number Theory

Abstract: Ramanujan graphs are regular graphs whose nontrivial eigenvalues are small in absolute value. They have broad applications in computer science. In particular, their good expanding property makes them efficient communication networks. Ramanujan hypergraphs are higher dimensional analogs of Ramanujan graphs.

Explicit constructions of Ramanujan graphs and hypergraphs use deep results in automorphic forms and number theory. On the other hand, different constructions of Ramanujan graphs lead to interesting results in number theory. In this survey talk, starting from a real world problem, we shall introduce the subjects and explore the interplay between combinatorics and number theory.

Stephane Louboutin Institut de Mathematiques a Luminy, France

Title: Simple proofs of the Siegel–Tatuzawa and Brauer–Siegel theorems

Abstract: We give a simple proof of the Siegel–Tatuzawa theorem according to which the residues at $s=1$ of the Dedekind zeta functions of quadratic number fields are effectively not too small, with at most one exceptional quadratic field. We then give a simple proof of the Brauer–Siegel theorem for normal number fields which gives an asymptotic for the logarithm of the product of the class number by the regulator of number fields.

Min Kang, North Carolina State University

Title: Interface Growth Models in Tropical Algebra Perspective.

Abstract: We present a general class of deposition models generated by linear operators in the tropical algebra of the configuration space. The property enables the immediate derivation of a microscopic Hopf–Lax variational formula which leads to a law of large numbers for the interface under Euler scaling. Several well-known examples will be given (ballistic deposition, the interface associated to totally asymmetric simple exclusion process). If time allows, we will also discuss velocity fluctuations in asymmetric simple exclusion with disorder and how this microscopic Hopf–Lax formula comes into picture there.

Hee Oh, California Institute of Technology

Title: Counting rational points of bounded height

Abstract: A fundamental problem in modern arithmetic geometry is to describe the set of rational points of a projective variety in terms of geometric invariants. One of the main conjectures in this area formulated by Manin in late eighties predicts the asymptotic of the number of rational points of bounded height for Fano varieties. I will discuss a recent proof of Manin's conjecture for the case of the wonderful compactification of semisimple algebraic groups, based on the mixing property of adelic groups (joint work with Gorodnik and Maucourant).

Yong-Geun Oh, University of Wisconsin & Korea institute of Advanced studies

Title: Topological extension of Calabi invariants and non-simpleness of the area preserving homeomorphism group of the disc.

The algebraic structure of the groups of volume preserving diffeomorphisms, symplectic diffeomorphisms or measure preserving homeomorphisms were well studied by the beginning of 80's thanks to the work of Thurston, Banyaga and Fathi respectively.

There is one case which has remained a mystery since then.

This is the case of area preserving

homeomorphisms in dim 2 (especially for the case of the sphere) where the symplectic geometry and the measure preserving dynamical systems meet.

In particular, the simpleness question on the group of area-preserving homeomorphisms on the sphere or on the disc has been open since Fathi's proof for the case of dimension greater than equal to 3.

In this talk we will explain our recent proof of non-simpleness of the area preserving homeomorphism group of the disc. The proof uses, in an essential way, the Lagrangian intersection theorem in symplectic geometry,

together with a de Rham current, which we call the Calabi current associated to each topological Hamiltonian flow. We will mention several open problems which can be easily stated during the talk.

YoungJu Choi, POSTECH

Title: Values of L-functions outside of critical strip

It is classical result how to get the values of L-functions of

cusps in the critical strip. This note represents a first attempt to get the values of L -functions outside the critical strip. To date much less is known about these values than about the values inside the critical strip. In fact, some of the known results disprove what we might expect to be the case by analogy with the theory of values of L -functions inside the critical strip.

Heekyung Youn, University of St. Thomas, St. Paul, Minnesota

Title: Curriculum and Mathematics of Actuarial Science

Abstract

The first part of the presentation will provide an overview of Actuarial Science as an undergraduate degree program. The University of St. Thomas undergraduate curriculum, which is typical, will be presented along with the certification requirements of the US professional societies: the Society of Actuaries and the Casualty Actuarial Society. The types of work actuaries perform will be examined in relation to the academic curriculum.

In the second part of the presentation, we will sample a few topics in actuarial mathematics. Two or three insurance products will be priced with some computational details and other products will be discussed with implications to certain mathematical disciplines. The topics will include compound interest theory, life contingencies, statistics, credibility theory, and financial mathematics.

Jae Min Baek, Arizona State University

Title: Students' Thinking and Mathematics Education Research

Abstract: There are several foci in research on mathematics education, such as students' thinking, teacher education, equity issues, assessment, etc. Students' mathematical thinking has been one of the main foci in the research community that has provided a basis for theories and practices. This presentation shares a research model that puts children's

mathematical thinking on the center, and discusses children's strategies for whole number operations and their algebraic thinking. It also talks about its broad impacts on research on teaching and teacher education.