

2009 Pingree Park Dynamics Workshop

Titles and Abstracts

Speaker: Karl Petersen, Univ. North Carolina

Title: Multidimensional Eulerian adic systems

Abstract: In continuing work with Alexander Varchenko, we study invariant measures of adic (Bratteli-Vershik) systems arising from a walk on a finite directed graph with opposite reinforcement. For the two-dimensional Eulerian system, we derive a formula for generalized Eulerian numbers, which give the path counts between arbitrary pairs of vertices in the Eulerian graph. This yields a new proof of the uniqueness of the fully supported ergodic measure, replacing an earlier method, with Sarah Bailey Frick, of coding paths by linear orders on the natural numbers with one that extends to higher dimensions. While for the higher-dimensional Eulerian systems we do not yet have an explicit formula for path counts, we have obtained exact formulas for limits of ratios of counts which, together with the new approach, are sufficient again to prove unique fully supported ergodicity.

Speaker: Adam Fieldsteel, Wesleyan Univ.

Title: TBA

Abstract: TBA

Speaker: Mariusz Lemanczyk, Nicolaus Copernicus Univ.

Title: Relatively finite measure-preserving extensions and lifting multipliers by Rokhlin cocycles

Abstract: We show that under some natural ergodicity assumptions extensions given by Rokhlin cocycles lift the multiplier property if the associated locally compact group extension has only countably many L^∞ -eigenvalues. We make use of some analogs of basic results from the theory of finite-rank modules associated to an extension of measure-preserving systems in the setting of a non-singular base. It is joint work with T. Austin.

Speaker: Jan Kwiatkowski, Nicolaus Copernicus Univ.

Title: Cylinder transformations over odometers

Abstract: The talk is based on the joint paper with Artur Siemaszko "Discrete orbits for topologically transitive cylindrical transformations", accepted to publication in Discrete and Continuous Dynamical Systems - Serie A.

A cylinder transformation T_f is a skew product of a homeomorphism T of a compact metric space X with a real continuous cocycle $f : X \rightarrow \mathbb{R}$. Namely, T_f is given by the formula

$$T_f(x, r) = (Tx, f(x) + r).$$

Cylinder transformations appeared in H. Poincaré work, where he used them to investigate flows on \mathbb{R}^3 , generated by differential equations. Cylinder transformations have also been investigated by many authors: A. S. Besicovitch

(1951), W. H. Gottschalk and G. A. Hedlund (1955), A.B. Krygin (1975, 1978). M. Lemańczyk and M. Mentzen (2002), M. Mentzen and A. Siemaszko (2004).

In this note we give a few recipes how to construct a topologically transitive cocycle over an arbitrary odometer possessing discrete orbits.

We also give an example of a topologically transitive cylinder transformation in which we are able to describe the ω -limit set of the origin point $(0, 0)$. This set satisfies the following dichotomy:

either its intersection with a fiber is empty or is nowhere dense.

Moreover, in the latter case this intersection is a closed semigroup (which is not a group) being a countable union of compact countable subsets of \mathbb{R} .

Speaker: Matt Foreman, UC-Irvine

Title: Rudolph's Thesis

Abstract: This talk will discuss two ideas relevant to the Classification Problem for ergodic measure preserving transformations: the Borel/non-Borel distinction and the idea of generic transformations.

Measure preserving transformations arise in many different contexts and the collection of ergodic transformations can carry many different topologies. Thus it becomes a natural question as to whether these two ideas are the same in all contexts. Rudolph formulated a meta-thesis conjecturing that they are. The talk will present joint work with Rudolph and Weiss that gives a near complete understanding of Rudolph's Thesis.

Speaker: T. Giordano Univ. Ottawa or C. Skau NTNU

Title: Orbit equivalence and (ordered) K -theory

Abstract: To a dynamical system—either in the measure-theoretic setting or the topological setting—one can associate an operator algebra. The invariants for operator algebras are of (ordered) K -theoretic nature, and this reflects back on the dynamical systems as invariants for orbit equivalence. We will give a survey of this aspect of studying minimal dynamical systems, and we will present some recent results, as well as open problems.

Speaker: Brett Werner, Univ. Denver

Title: Strong orbit equivalence classes of minimal Cantor systems

Abstract: Given a minimal Cantor system (X, T) , we will define what we mean by a strong orbit equivalence (SOE) class of (X, T) . We will then define a metric on this SOE class. After stating some properties of this metric space, we will discuss residuality in the SOE class of a finite rank system.

Speaker: Joe Auslander, Univ. Maryland

Title: Recurrence and compactification of closed relations

Abstract: This is joint work with Ethan Akin. Recurrence in dynamical systems is studied using Lyapunov functions, continuous functions which are non-decreasing on orbits. A point is defined to be a (generalized) recurrent point

if all such functions are constant on its orbit. These (properly) include the non-wandering points, and can be characterized intrinsically using prolongational limit sets. If there are no generalized recurrent points (or more generally such only consist of fixed points) then the Lyapunov functions separate points and so determine a Hausdorff topology. In fact, this “Lyapunov” topology coincides with the given topology. The proof requires an extensive detour into closed relations on locally compact metric spaces, and compactifications of these. The corresponding result is obtained for closed relations, and as a consequence for maps and real flows.

Speaker: Vitaly Bergelson, Ohio State Univ.

Title: Generalized polynomials, translations on nil-manifolds and multiple recurrence

Abstract: Generalized polynomials form a natural family of functions which are obtained from the conventional polynomials by the use of the greatest integer function, addition and multiplication. We shall describe the connections between generalized polynomials and translations on nil-manifolds (joint work with Alexander Leibman) and discuss an extension of Szemerédi’s theorem on arithmetic progressions which involves generalized polynomials (joint work with Randall McCutcheon)

Speaker: Jean-Paul Thouvenot, Paris VI

Title: Entropy preserving K-joinings of K-automorphisms

Abstract: TBA

Speaker: Lewis Bowen, Texas A&M

Title: Entropy theory for actions of free groups

Abstract: I will discuss the f -invariant, which is a measure conjugacy invariant for actions of free groups similar to Kolmogorov’s entropy. I will also discuss Markov chains over free groups and their applications. This talk will have only a small overlap with the talk I gave at the IHS in May.

Speaker: Alexandre Danilenko, ILTPE, Ukraine

Title: Mixing infinite measure preserving transformations and spectral multiplicities

Abstract: Recently we proved that for each subset M of positive integers there is an ergodic infinite measure preserving transformation T whose set of spectral multiplicities is M . Now we refine this fact by showing that T can be chosen mixing (i.e. of zero type). As a byproduct we construct a mixing rank one infinite measure preserving transformation S which is power weakly mixing (i.e. finite Cartesian products of non-zero powers of S are all ergodic). Also, a mixing Poissonian transformation with simple spectrum is constructed. (joint work with V.V. Ryzhikov)

Speaker: Michael Hochman, Princeton Univ.

Title: Dynamics on fractals

Abstract: I'll discuss a class of distributions on fractal measures which exhibit scale and spatial invariance, and relate these to some existing models. I will also describe some applications to geometric problems, particularly involving x_n -invariant measures on the torus.

Speaker: Anthony Quas, Univ. Victoria

Title: Mixing and Perron-Frobenius operators for random compositions

Abstract: TBA