Carolina Dynamics Symposium - Titles and Abstracts

Furman University

Friday, April 5th - Sunday April 7th, 2019

Kevin McGoff, UNC Charlotte

Random Shifts of Finite Type

Abstract:

How does a "typical" dynamical system behave? In this talk, I will discuss some precise answers to this question for the class of systems called shifts of finite type. These systems can be defined by placing finitely many constraints on the orbits that may appear in the system, and we will consider the random systems formed by selecting these constraints according to some probability distribution. Then we will say that a property is "typical" if a random system possesses it with high probability. The main results in the talk will concern several properties that have been shown to be typical for random shifts of finite type. This talk will be accessible to a wide audience, as I will not assume any background knowledge beyond linear algebra and introductory probability.

James Kelly, Christopher Newport University

Topological Entropy of Markov set-valued functions

Abstract:

We introduce a class of set-valued functions called Markov set-valued functions which are a generalization of single-valued, Markov interval functions. It is known for Markov interval functions that many aspects of the dynamics can be analyzed by studying a corresponding symbolic shift space. In particular, the topological entropy of the Markov interval function is known to be equal to the entropy of this associated shift. We construct a similar symbolic shift for Markov set-valued functions, and we show how its entropy relates to the entropy of the set-valued function.

Sam Kaplan, UNC Asheville

Collision in the coorbital three-body problem

Abstract:

The observation of pairs of moons around Saturn which display differing, but stable, orbital properties led to the development of the coorbital model. The model assumes a central mass with two small moons on the same order of mass and with nearly equal radius from the central body. Cors and Hall identified a parameter that determines if the moons simply pass each other or if they switch orbits (also called a horseshoe orbit). There is another range of values for this parameter where the two moons can collide. We look for appropriate coordinates near collision.

Robbie Robinson, George Washington University

Continued fraction normality for the Minkowski ?-function

Abstract:

In 1981, Adler, Kean and Smorodinski constructed a number which continued fraction normal. This number is analogous to the Champernownes 1933 normal number base 10. In particular, it is a generic point for the continued fraction map G with the (absolutely continuous) Gauss measure g. But besides the Gauss measure g, the continued fraction map G also preserves, and is ergodic with respect to, the measure m whose distribution is the notorious Minkowski ?-function F. This function is continuous and strictly increasing, but satisfies F(x)=0 a.e.. We construct a Champernowne/Adler, Kean, Smorodinski style normal number for this measure. The proof uses the normality of the binary Champernowne number and the Kepler tree on the rationals. This is joint work with Karma Dajani and Mathijs de Lepper of Utrecht University, The Netherlands

Drew Ash, Albion College

Bounded Topological Speedups: Entropy and Substitutions

Abstract:

Given a dynamical system (X, T) one can define a speedup of (X, T) as another dynamical system $S : X \to X$ where $S = T^{p(\cdot)}$ for some $p : X \to \mathbb{Z}^+$. In this talk, we will focus on bounded topological speedups. Specifically, we require that our "jump function" p be bounded and hence continuous. Here the motivating question is: what, if anything, can be preserved with the added structure of p being bounded? We will highlight two theorems addressing this question. First, we give upper and lower bounds on how much the entropy of the system (X, S) can increase. Second, we highlight the following result: a bounded speedup of an aperiodic, primitive substitution is conjugate to an aperiodic, primitive substitution, though is never conjugate to the original substitution system. The work presented is joint work with Lori Alvin and Nic Ormes.

Aimee Johnson, Swarthmore College

Speedups and Odometers

Abstract:

In this talk we will review work by M. Cortez on higher dimensional odometers and by D. Ash about topological speedups, touching on results of many others along the way. Then we'll see how these topics can be blended together to give some results about speeding up a higher dimensional odometer.

Cameron Bishop, Wesleyan University

Marked boundary distance rigidity for nonpositively curved cone surfaces

Abstract:

Let M be a manifold with boundary H and Riemannian metric g. The Riemannian metric g induces a distance function on M, and we denote the restriction of this metric to H by $dist_g$. We say that (M, H, g) is boundary distance rigid if for any other Riemannian metric g on (M, H), we have that $dist_g = dist_g$ implies that g is isometric to g.

Boundary distance rigidity has been proven in a number of cases, including the case when M is a disk and g and g are both taken to be negatively curved [Otal, 1990]. Otal showed this using a set of tools similar to those he used when resolving the marked length spectrum rigidity problem for negatively curved surfaces. Otals method has been extended to prove marked length spectrum rigidity for larger classes of metrics, including for nonpositively curved cone surfaces [Constantine]. Recently, Guillarmou and Mazzucchelli extended Otals boundary distance rigidity result to a larger class of negatively curved surfaces with boundary by considering the marked boundary distance function. In this talk I will discuss my work to use the analogy between boundary distance rigidity and marked length spectrum rigidity to establish marked boundary distance rigidity for nonpositively curved cone manifolds.

Nic Ormes, University of Denver

Subsystems of subshifts with linear complexity

Abstract:

In this talk, we will consider subshifts with linear complexity, i.e., subshifts X where the number of words of length n appearing in X is bounded above by a constant times n. We will consider relationships between these bounds and the number of subsystems that X can contain. In the topological category, this means bounds on the number of distinct minimal subsystems of X. In the measure theoretic category, this means bounds on the number of ergodic shift-invariant measures. This is joint work with A. Dykstra and R. Pavlov.

Karl Petersen, UNC Chapel Hill

Tree shift topological entropy

Abstract:

In joint work with Ibrahim Salama, we study the complexity function $p_\tau(n)$ of a labeled tree or tree shift, which counts as a function of n the number of different labelings of a shape of size n. Last year we presented our definition of entropy, our proof that the limit in the definition exists, and our induction and Perron-Frobenius argument that the entropy of a tree shift determined by adjacency constraints dominates the entropy of the associated one-dimensional subshift. Now we have some updates: the limit in the definition of entropy is the infimum, a version of the Pavlov strip technique proves strict inequality with dimension and provides an efficient approximation method, and for tree shifts entropy coincides with intermediate entropy, which stops short of complete subtrees.

Martin Schmoll, Clemson University

Siegel-Veech constants for branched cyclic covers of tori

Abstract:

We present a formula for the quadratic asymptotic constants of the number of periodic cylinders weighted with a power, say alpha, of the area on flat branched cyclic torus covers. The flat structure is obtained by pulling back the canonical euclidean structure on the torus. We particularly confirm statements observed by David Aulicino for area Siegel-Veech constants (those are the asymptotic constants with weight alpha =1) by computer experiments. Aulicinos simulations showed, that the area Siegel-Veech constant is in particular cases (somewhat independent on the number of branch points) simply 1 together with some remarkable multiplicative properties of the formula. We approach these phenomena in the more general context of alpha-Siegel-Veech constants. This is joint work with David Aulicino.

Lori Alvin, Furman University

Characterizing Unimodal maps with odometers

Abstract:

Symbolic dynamics plays an important role in the study of unimodal maps. We explore how a special sequence called the kneading sequence completely determines the dynamical properties of a given unimodal map. We then provide a characterization of all kneading sequences of unimodal maps with embedded odometers.

Jim Wiseman, Agnes Scott College

Varieties of mixing

Abstract:

I'll discuss different topological notions of recurrence, transitivity, and mixing. For each kind, theres a dichotomy result, saying that a transitive map must either be mixing or factor onto some kind of nontrivial periodic/isometric map, but not both. (This is joint work with Ethan Akin.) Time permitting, Ill give necessary and sufficient conditions for upper semicontinuity of the generalized recurrent set (joint work with Olga Bernardi and Anna Florio.)