Holomorphic dynamics and related topics
Dynamique holomorphe et sujets reliés
(Org: **Ilia Binder** and/et **Michael Yampolsky** (University of Toronto))

ERIC BEDFORD, Stony Brook University
Basins in holomorphic dynamics

We will discuss the structure of attracting basins and parabolic basins as they arise in the dynamics of holomorphic mappings in two complex dimensions.

ILIA BINDER, University of Toronto
Computability of prime ends and external rays impressions.

I will discuss the question of computability of impressions of computable prime ends and external rays for planar domains with computable complement. While a counterexample in general situation is relatively easy to construct, the dynamical example is much more delicate. I will explain how to find such an example in quadratic family. This is a joint work with C. Rojas and M. Yampolsky.

ALEXANDER BLOKH, University of Alabama at Birmingham
On laminations of degree greater than two

We discuss possible generalizations of Thurston's results on quadratic laminations to laminations of degree greater than 2.

ARACELI BONIFANT, University of Rhode Island
Fjords and Tongues in a Parameter Space for Antipode Preserving Cubic Maps

This talk will describe the topological properties of the "fjords" and "tongues" that appear in the parameter space for antipode preserving cubic maps with a critical fixed point.

ARTEM DUDKO, University of Stony Brook
The Julia set of the Feigenbaum map is poly-time computable

Let F(z) be the Feigenbaum fixed point of the period-doubling renormalization operator. We show that the Julia set of F is computable in polynomial time. The talk is based on a joint work with Michael Yampolsky.

TATIANA FIRSOVA, SUNY Stony Brook

DENIS GAYDASHEV, University of Uppsala
Scaling ratios for Siegel disks

The boundary of the Siegel disk of a quadratic polynomial with an irrationally indifferent fixed point and the rotation number whose continued fraction expansion is preperiodic has been observed to be self-similar with a certain scaling ratio. The restriction of the dynamics of the quadratic polynomial to the boundary of the Siegel disk is known to be quasisymmetrically conjugate to the rigid rotation with the same rotation number. The geometry of this self-similarity is universal for a large class of holomorphic maps.

We describe an estimate on the quasisymmetric constant of the conjugacy, and use it to prove bounds on the scaling ratio λ of the form

$$\alpha^{\gamma} \leq |\lambda| \leq \delta^{s},$$

where s is the period of the continued fraction, and $\alpha \in (0,1)$ depends on the rotation number in an explicit way, while δ, $\gamma \in (0,1)$ depend only on the maximum of the integers in the continued fraction expansion of the rotation number.

IGORS GORBOVICKIS, University of Toronto
Parameterizing rational maps by multipliers of periodic orbits

It was suggested by John Milnor to use the multipliers of the fixed points to parameterize the moduli space of degree 2 rational maps of the Riemann sphere. In this talk we will discus an attempt to use multipliers of periodic orbits as the parameters on the moduli space of degree n polynomial or rational maps. We will show that at its generic point, the moduli space of degree n polynomial maps can be locally parameterized by the multipliers of n-1 arbitrary distinct periodic orbits. This is equivalent to the statement that these multipliers are independent. Further, we will discuss how one could try to generalize the above result to the case of degree n rational maps.

PETER HAZARD, University of Toronto
On Renormalisation of Henon-like Mappings

In the last few years there has been much progress in the renormalisation theory for Henon-like mappings starting with the work of de Carvalho, Lyubich and Martens in the case of period-doubling combinatorics. I will discuss recent results on the structure of the attractor for infinitely renormalisable maps of more general combinatorial types and how this relates to topological models for renormalisability in this setting.

JACK MILNOR, Institute for Mathematical Sciences
Hyperbolic components of rational maps

This will be a discussion of normal forms for hyperbolic components within an appropriate moduli space.

RODRIGO PEREZ, IUPUI
Examples of Rational Maps of $\mathbb{CP}^2$ With Equal Dynamical Degrees and no Invariant Foliation I

We present simple examples of rational maps of the complex projective plane with equal first and second dynamical degrees and no invariant foliation. This is joint work with Scott Kaschner and Roland Roeder.

REMUS RADU, SUNY Stony Brook
A structure theorem for semi-parabolic Hénon maps

Consider the parameter space $\mathcal{P}_\lambda \subset \mathbb{C}^2$ of complex Hénon maps $H_{c,a}(x,y) = (x^2 + c + ay, ax)$, $a \neq 0$, which have a semi-parabolic fixed point with one eigenvalue $\lambda = e^{2\pi i p/q}$. We give a characterization of those Hénon maps from the curve $\mathcal{P}_\lambda$ that are small perturbations of a quadratic polynomial p with a parabolic fixed point of multiplier λ. We prove that there is an open disk of parameters in $\mathcal{P}_\lambda$ for which the semi-parabolic Hénon map has connected Julia set J and is structurally stable on J and J^+. The set J^+ in a bidisk $\mathbb{D}_r \times \mathbb{D}_r$ is a trivial fiber bundle over J_p, the Julia set of the polynomial p, with fibers biholomorphic to $\mathbb{D}_r$. This is joint work with Raluca Tanase.

ROLAND ROEDER, IUPUI
Examples of Rational Maps of $\mathbb{CP}^2$ With Equal Dynamical Degrees and no Invariant Foliation II

We present simple examples of rational maps of the complex projective plane with equal first and second dynamical degrees and no invariant foliation. This is joint work with Scott Kaschner and Rodrigo Perez.

SCOTT SUTHERLAND, Stony Brook University
Dynamics and Root Finding

We discuss the efficiency of Newton's method as a means for locating all roots of a complex polynomial, and show that a modification of it (called a Path Lifting Method) can be made which has good control on the number of steps needed to find approximate zeros.

RALUCA TANASE, SUNY Stony Brook
Semi-parabolic tools for hyperbolic Hénon maps

We discuss some new continuity results for the Julia sets J and J^+ of a complex Hénon map $H_{c,a}(x,y) = (x^2 + c + ay, ax)$. We look at the parameter space $\mathcal{P}_{(1+t)\lambda} \subset \mathbb{C}^2$ of Hénon maps which have a fixed point with one eigenvalue $(1+t)\lambda$, where $\lambda = e^{2\pi i p/q}$ and $t \geq 0$ is sufficiently small. The Hénon map has a semi-parabolic fixed point when $t = 0$ and we use techniques that we have developed for the semi-parabolic case to describe nearby perturbations for positive t. We prove that the parametric region $\{(c,a) \in \mathcal{P}_\lambda : |a| < \delta\}$ of semi-parabolic Hénon maps lies in the boundary of a hyperbolic component of the Hénon connectedness locus. We show that for $0 < |a| < \delta$ and $(c,a) \in \mathcal{P}_{(1+t)\lambda}$, the sets J and J^+ depend continuously on the parameters as $t \to 0^+$. These results can be regarded as a two-dimensional analogue of radial convergence for polynomial Julia sets. This is joint work with Remus Radu.

MICHAEL YAMPOLSKY, University of Toronto
Geometrization of branched coverings of the sphere and decidability of Thurston equivalence

I will discuss a recent joint work with N. Selinger on constructive geometrization of branched coverings of the 2-sphere. I will further describe the connection between geometrization and the general question of algorithmic decidability of Thurston equivalence, and will present a new decidability result obtained jointly with Selinger, which generalizes my previous work with M. Braverman and S. Bonnot.

HEXI YE, University of Toronto
Torsion points and the Lattes family

We give a dynamical proof of a result of Masser and Zannier: there are only finitely many parameters $t \in \mathbb{C}$ for which points $P_t = (2, \sqrt{2(2-t)})$ and $Q_t = (3, \sqrt{6(3-t)})$ are both torsion on the Legendre elliptic curve $E_t = \{y^2 = x(x-1)(x-t)\}$. A key ingredient in the proof is the arithmetic equidistribution theorem on $\mathbb{P}^1$ of Baker-Rumely, Favre- Rivera-Letelier and Chambert-Loir, applied to parameters $t \in \bar{\mathbb{Q}}$ for which a given point $a \in \bar{\mathbb{Q}}$ is preperiodic for the degree-4 Lattes family $f_t : \mathbb{P}^1 \to \mathbb{P}^1$. Our main new results involve complex dynamics and potential theory: (1) for each $c \in \mathbb{C}(t)$, the bifurcation measure μ_c for the pair (f_t, c) has continuous potential across the singular parameters $t = 0, 1, \infty$; and (2) for distinct points $a, b \in \mathbb{C} \setminus \{0,1\}$, the bifurcation measures μ_a and μ_b cannot coincide. We also compute the homogeneous capacity of the bifurcation set for each marked point $c \in \mathbb{C}(t)$.