Research on Complex Dynamics and Related Fields (Celebrating Prof. Shigehiro Ushiki's 60th birthday)

Conference

The following conference is hosted by RIMS (Research Institute of Mathematical Science) of Kyoto University. In this conference, we celebrate Professor Shigehiro Ushiki (Kyoto University, Graduate School of Human and Environmental Studies) 's 60th birthday.

Organizer: Hiroki Sumi (Osaka University)

Date   December 6, 2010, 13:30– December 10, 2010, 12:30.

Place   No. 110 room, Department of Mathematics, Science Building No. 3, Kyoto University. Kitashirakawa-Oiwake cho, Sakyo-ku, Kyoto. (Kyoto city bus, Hyakumanben or Kyodai-Nogakubumae bus stop)

Program and Abstract

December 6

13:30–14:30   Gohei Tanaka (Univ. Tokyo)
Nonlinear information processing with complex-valued neural networks

Abstract: Complex-valued neural networks, described by high-dimensional complex dynamical systems, have been used for information processing in computational intelligence. We first review the history and the framework of complex-valued neural networks. Then we present modifications of the complex activation function based on nonlinearity and its applications.

14:45–15:45   Teisuke Jin (Kyoto Univ.)
Dynamics of the Hénon map: Nevanlinna Theory
Abstract: Some new applications of Nevanlinna theory to the dynamics of the Hénon map.

16:00–17:00   Keisuke Uchimura (Tokai Univ.)
Dynamics of Generalized Chebyshev Maps
Abstract: On slicing of critical measures.

December 7

10:15–10:45   Koh Katagata (National College of Tech.)
Limits of entire functions with respect to some metric

11:00–11:30   Shunsuke Morosawa (Kochi Univ.)
Some questions of Schröder functions

13:30–14:30   Masashi Kisaka (Kyoto Univ., Grad. School of Human and Environmental Studies)
Smoothness of hairs for some transcendental entire functions

14:45–15:45   Hiroyuki Inou (Kyoto Univ.)
Holomorphic index and parabolic renormalization

16:00–17:00	Tomoko Shinohara (Tokyo Metropolitan College of Industrial Technology) Locally maximal invariant set at a fixed indeterminate point

December 8

9:30–10:30	Kohei Ueno (Toba National College of Maritime Technology) Symmetries of Julia sets of polynomial skew products on $\mathbb{C}^2$ Abstract: A Julia set of a polynomial skew product can have symmetries, that is, it can be invariant under some polynomial automorphisms which are conjugate to rotational products. We investigate the structure of the group of symmetries and give a necessary and sufficient condition for the group of symmetries to be infinite.
10:45–11:45	Keiji Oguiso (Osaka Univ.) Entropy of automorphisms of compact hyperKaeler manifolds
13:30–14:30	Hiroki Sumi (Osaka Univ.) Cooperation principle and density of stable systems in random complex dynamics Abstract: We investigate the i.i.d. random dynamics of rational maps and the dynamics of semigroups of rational maps on the Riemann sphere $\hat{\mathbb{C}}$. We show that regarding random complex dynamics of polynomials, generically, the chaos of the averaged system disappears, due to the cooperation of the generators. We investigate the iteration and spectral properties of transition operators acting on the space of (Hölder) continuous functions on $\hat{\mathbb{C}}$. We also investigate the stability and bifurcation of random complex dynamics. We show that the set of stable systems is open and dense in the space of random dynamics of polynomials. Moreover, we prove that for a stable system, there exist only finitely many minimal sets, and each minimal set is attracting. These results correspond to solving a kind of analogy of the famous conjecture "regarding the usual iteration, hyperbolic maps are dense in the space of polynomial maps". Moreover, we prove that the orbit of a Hölder continuous function on $\hat{\mathbb{C}}$ under the transition operator tends exponentially fast to the finite-dimensional space U of finite linear combinations of unitary eigenvectors of the transition operator. Thus the spectrum of the transition operator acting on the space of Hölder continuous functions has a gap between the set of unitary eigenvalues and the rest. Combining this with the perturbation theory for linear operators, we obtain that for a stable system constructed by a finite family of rational maps, the projection to the space U depends real-analytically on the probability parameters. By taking a partial derivative of the function of probability of tending to a minimal set with respect to a probability parameter, we obtain a complex analogue of the Takagi function. For the references, see H. Sumi, *Cooperation principle, stability and bifurcation in random complex dynamics*, preprint 2010, http://arxiv.org/abs/1008.3995, and H. Sumi, *Random complex dynamics and semigroups of holomorphic maps*, to appear in Proc. London Math. Soc., http://arxiv.org/abs/0812.4483.

14:45–15:45   Eric Bedford   (Indiana Univ.)
Linear fractional recurrences as birational maps of 3-space: Periodicities and pseudo-automorphisms of positive entropy
Abstract: We consider the family of 3-step linear fractional recurrences

$$z_{n+3} = \frac{\alpha_0 + \alpha_1 z_n + \alpha_2 z_{n+1} + \alpha_3 z_{n+2}}{\beta_0 + \beta_1 z_n + \beta_2 z_{n+1} + \beta_3 z_{n+2}}, \quad \alpha_i, \beta_i \in \mathbf{C}$$

which induce a family of birational maps $f_{\alpha\beta}$ of 3-space. We say that a birational map is a pseudo-automorphsm if neither f nor f^{-1} has an exceptional hypersurface. By examining the orbits of exceptional hypersurfaces, we see that if $f_{\alpha\beta}$ is a pseudo-automorphism, then f is eqeuivalent to the case $\alpha_2 \neq 0$, $\beta_1 = \alpha_3 = 1$, $\beta_2 = \beta_3 = 0$. We show that the only possible periods for recurrences of this form are 8 and 12.
We show, too, that there is a family of maps of this form which gives pseudo-automorphisms of positive entropy, and we examine the structure of these maps. This is joint work with Kyounghee Kim.

16:00–17:00   Shigehiro Ushiki (Kyoto Univ., Grad School of Human and Environmental Studies)
Exploration of complex Hénon dynamics
Abstract: Complicated entanglements of invariant manifolds are visualized by means of interactive computer graphics. New version of ComplexExplorer, combined with StereoViewer, provides a tool for the investigation of the parameter space and the dynamic space of complex He'non family. (N.B. ComplexExplorer and StereoViewer are graphics software.)

18:00–   Party (celebrating Prof. Ushiki's 60th birthday) Kyoto Univ. Clock Tower Centenial Hall Kokusai-Koryu Hall III

December 9

10:30–11:00   Mitsuhiko Imada (Tokyo Institute of Technology)
Periodic points on the boundaries of rotation domains

11:25–12:25   Shizuo Nakane (Tokyo Polytechnic Univ.)
Postcritical sets and saddle basic sets for Axiom A polynomial skew products on $\mathbb{C}^2$

14:00–15:00   Mitsuhiro Shishikura (Kyoto Univ.)
A case study of an application of Thurston's theorem

15:15–16:15   Tetsuo Ueda (Kyoto Univ.)
Critically finite maps on projective spaces

| 16:30–17:30 | Taro Asuke (Univ. of Tokyo) |

On Fatou-Julia decompositions

Abstract: According to Sullivan's dictionary, Fatou sets and domains of discontinuity (of Kleinian groups) are in a close relationship. Fatou sets can be defined also for non singular holomorphic foliations and they enjoy properties similar to those of Fatou sets (in a usual sense) or domains of discontinuity. In this talk, we will explain that they can be considered as the same object, and that Fatou sets can be defined for other kinds of dynamical systems, e.g., singular holomorphic foliations or 'pseudosemigroups'.

December 10

| 10:15–11:15 | Zin Arai (Hokkaido Univ.) |

Monodromy and bifurcations of the Hénon map

Abstract: In this talk, we study the structure of the parameter space of the Hénon map. We show that the monodromy action is determined by the arrangement of bifurcation curves of periodic points, and using this fact, we prove that odd iterations of the shift map can not appear in the image of the monodromy homomorphism. These results are immediately translated into their "real" counterparts via a theorem relating the monodromy of the complex Hénon map and the pruning front of the real Hénon map.

| 11:30–12:30 | John Hubbard   (Cornell Univ. |

Topological models for complex Henon mappings: the pinched ball model (joint work with Remus Radu and Raluca Tanase)

For the newest version of the program, see the following webpage:

http://www.math.sci.osaka-u.ac.jp/~sumi/cpxdyn10meeting.html.

If you would like to participate in the party (December 8), please send an e-mail with your name, affiliation, and e-mail address, to Hiroki Sumi: sumi(AT) math.sci.osaka-u.ac.jp.
Date: December 4, 2010.