

力学系通信

NO. 20 (1993/10)

予定を大幅に遅れましたが、力学系通信 NO.20 をお送りします。

情報をくださる方が極く僅かという状況が続いております。近況・研究集会・プレプリント情報などを、是非、私宛にお送り下さるようお願いいたします。

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購読者リスト作成アンケートについて

以前より予告しておりましたように、「購読者アンケート」の回答をお送り頂いていない方に対するの送付を今回限りで打ち切らせていただきます。大学の改組が進行する中、所属などが変更になる可能性から未だお送り頂けない方々も多いとは思いますが、取り敢えず現在のデータをお送りくださいますようお願い致します。また、転勤などの変更があった方々も、是非新しいデータをお送りくださいますようお願いいたします。なお、10月17日現在、次の方々からご回答を頂いております(敬称略)。もしお送り頂いているのにリストから洩れている方がいらっしゃいましたら、ご一報ください。

足立 俊明, 阿部 隆次, 石谷 寛, 泉屋 周一, 一楽 重雄, 伊藤 敏和, 伊藤 秀一, 稲葉 尚志,
井上 友喜, 岩井 慶一郎, 印南 信宏, 岡 宏枝, 加藤 和久, 川上 博, 河村 新蔵, 木上 淳,
木坂 正史, 倉田 雅弘, 國府 寛司, 小林 毅, 小室 元政, 酒井 一博, 笹野 一洋, 佐藤 篤之,
三波 篤郎, 柴山 健伸, 白岩 謙一, 鈴木 正昭, 高橋 陽一郎, 辻井 正人, 坪井 俊, 徳永 隆治,
富山 淳, 中島 文雄, 仲田 均, 中根 静男, 永谷 彬, 行木 孝夫, 西沢 清子, 早川 英治郎,
藤村 雅代, 松岡 隆, 松元 重則, 松本 隆, 水谷 忠良, 森 真, 盛田 健彦, 矢野 公一, 山岸 義和,
由利 美智子, 吉永 哲哉

なお、6 ページに「購読者リスト作成アンケートフォーム」をもう一度掲載しておきます。

近況

伊藤秀一氏..... 東京工業大学理学部数学教室に転勤 (93/10)

学会・シンポジウム情報 (国内)

International conference/workshop Geometric study of foliations

1993年11月15日-19日 中央大学駿河台記念館

1993年11月22日-26日 東京工業大学国際交流会館

問い合わせ: 松元重則氏 (日本大学)

力学系研究集会 - 力学系とカオスの国際会議 (数学) プレコンファレンス-

1993年11月30日-12月3日 東京都立大学

問い合わせ: 倉田雅弘氏 (名古屋工業大学)

エルゴード理論とその周辺

1994年1月7日-10日 筑波大学山中共同研修所 (山梨県山中湖村)

問い合わせ: 盛田健彦氏 (大阪大学)

International conference on dynamical systems and chaos

1994年5月23日-27日 東京都立大学

問い合わせ: 白岩謙一氏 (東京理科大学)

学会・シンポジウム情報 (国外)

VII INTERNATIONAL COLLOQUIUM ON DIFFERENTIAL GEOMETRY * Analysis and Geometry in Foliated Manifolds *

SANTIAGO DE COMPOSTELA, SPAIN. JULY 26 - 30, 1994

Organizing Committee, Dpto. de Xeometria e Topoloxia,

Facultade de Matematicas, Universidade de Santiago,

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MSRI の half-year program について

Berkeley の MSRI で、1994-95 年度に次のような half-year program が開催されます。

Complex Dynamics and Hyperbolic Geometry.

A half-year program in the Spring. The focus will be on the following topics:

1. Conformal dynamics in one complex variable
2. Geometry and dynamics of hyperbolic 3-manifolds
3. Dynamics in several complex variables
4. Riemann surfaces and quasiconformal mappings

A principal goal of the program is to foster

the essential unity of these fields.

The program committee consists of: Bodil Branner, Steve Kerckhoff, Mikhail Lyubich, Curt McMullen (chair), and John Smillie.

学会・シンポジウム報告

IHES に滞在中の中根静男氏より、以下のシンポジウム等の報告が寄せられました。巻末に資料を添付しておきます。

Real and complex dynamical systems

June 20 - July 2, 1993 [NATO Advanced Study Institute, Denmark]

LMS Durham symposium on complex dynamics

July 11-21, 1993

Second German-Polish autumn seminar on dynamical systems

Sep. 27 - Oct. 1, 1993 [Archen]

プレプリント情報

([] 内は、所有者 (敬称略))

[笹野 一洋 (富山医科薬科大学数学教室)]

S. van Strien, Real bounds for renormalizable maps

MSRI の行事予定の入手方法

info@msri.org に e-mail を送ることにより、MSRI の行事予定が自動的に e-mail で送られてきます。先ず最初に help という本文一行だけの e-mail を送ってみてください。

非線形科学のプレプリントの掲示板システムについて

柴山健伸氏 (和歌山大学) より、上記のシステムについての情報が寄せられました。詳しくは、以下 (一部省略) をご覧ください。

Help documentation (revised 1993.4.18)

nlin-sys@xyz.lanl.gov
is a fully automated preprint bulletin board (PBB) for nonlinear science
(start date Mar. 5, 1993)

The PBB nlin-sys provides for archiving and distribution in five categories:

CATEGORY	INTERNET ADDRESS
dynamical systems/chaos/ quantum chaos/topological dynamics/cycle expansions/ turbulence/propagation	chao-dyn@xyz.lanl.gov
pattern formation/coherent structures/solitons	patt-sol@xyz.lanl.gov

adaptation/self-organizing
systems/interacting particle
systems/computation theory/
machine learning adap-org@xyz.lanl.gov

computational methods/time series
analysis/signal processing/
wavelets/lattice gases comp-gas@xyz.lanl.gov

exactly solvable systems/integrable
PDEs/integrable ODEs/Painleve
analysis/integrable discrete maps/
solvable lattice models/
integrable quantum systems solv-int@xyz.lanl.gov

[all of the above] nlin-sys@xyz.lanl.gov

For a general description of PBB usage and structure, consult the
announcement (revised 1993.4.18) of nlin-sys obtainable by sending e-mail

To: nlin-sys@xyz.lanl.gov

Subject: get announce

Outgoing mail from nlin-sys and all categories has the username no-reply .
Commands to the system should always be sent to bull-bd@xyz.lanl.gov ,
where bull-bd is one of [nlin-sys cho-dyn patt-sol adap-org comp-gas solv-int]
with the command in the subject field (e.g. Subject: help).
Only one command at a time is accepted. Subscribers automatically receive
a listing of new titles/abstracts in the next preprint notification mailing.

Commands available both for nlin-sys and for bull-bd, where bull-bd is
any of the categories [cho-dyn patt-sol adap-org comp-gas solv-int], include:

listing returns list of available year/month's preprint directories.

[中略]

subscribe [your name]

adds your name to daily distribution list (email address
automatically extracted from return address).

For [your name] substitute your name (any number of words
and initials) as you wish it to appear on distribution list.

<<< note that `suscribe' is not a word >>>

cancel remove user@nodename from daily distribution list

distribution returns full list of email addresses on distribution list

comment forwards mail message for human perusal

get announce returns initial announcement of nlin-sys PBB

get oldnews returns log of past news items on changes in PBB usage

help returns this list of commands

[中略]

OTHER PBBs using the same software, and for which 'cross' is operative, include:

alg-geom@publications.math.duke.edu	(algebraic geometry)
astro-ph@babbage.sissa.it	(astrophysics)
cond-mat@babbage.sissa.it	(condensed matter)
e-mail@xxx.lanl.gov	(e-mail address database)
funct-an@babbage.sissa.it	(functional analysis)
gr-qc@xxx.lanl.gov	(general relativity / quantum cosmology)
hep-lat@ftp.scri.fsu.edu	(computational and lattice physics)
hep-ph@xxx.lanl.gov	(high energy physics phenomenological)
hep-th@xxx.lanl.gov	(high energy physics formal)
nucl-th@xxx.lanl.gov	(nuclear theory)

[以下略]

購読者リスト作成アンケートフォーム

氏名（ふりがな）：

大学・学部・学科：

職名（大学院生の場合は、学年）：

大学住所（〒をお忘れなく）：

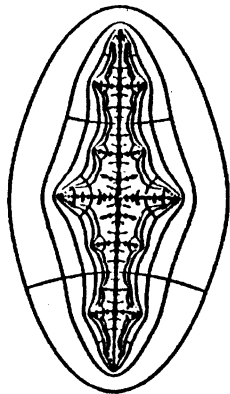
大学電話番号：

e-mail address：

FAX 番号：

自宅住所（〒をお忘れなく：この項目は必ずしも答える必要はありません）：

自宅電話番号（この項目は必ずしも答える必要はありません）：



REAL & COMPLEX DYNAMICAL SYSTEMS

NATO Advanced Study Institute
 Ellerbek, Denmark
 June 20 - July 3, 1993.

Programme.

Day 1. Monday, June 21

9:00 - 10:00. John Milnor: *The interplay between real and complex dynamics.*
 Abstract: A few historic remarks. Some illustrations of relationships, for instance: kneading sequences for real maps and external angles for complex maps, with application to the monotonicity of the real quadratic family; renormalization and tuning for real and complex maps; parameter space and hyperbolic components for real and complex maps.

10:00 - 10:30. Coffee break

10:30 - 11:30. Jean-Christophe Yoccoz: *Hyperbolicity in real and complex dynamics. I.*

Abstract: Stable and unstable manifolds of a hyperbolic periodic point. Compact invariant hyperbolic sets. Stable and unstable foliations of a hyperbolic set. Criteria for hyperbolicity.

11:30 - 13:00. Lunch

13:00 - 15:00. Bruce Kitichens: *Symbolic Dynamics. I.*

Abstract: Shifts and subshifts of finite type. Hyperbolic toral automorphisms. Solenoids and generalized solenoids.

15:00 - 15:30. Coffee break

15:30 - 18:00. Talks given by participants.¹

Day 2. Tuesday, June 22

9:00 - 10:00. Colin Sparrow: *Ordinary differential equations: theory and applications*

Abstract: This lecture will explore, largely by means of examples, the relationship

¹The final programme for afternoon sessions and activities will be decided during the conference. Consult the Bulletin Board for announcements.

between applications, numerical models and numerical experiments, and mathematical theory.

10:00 - 10:30. Coffee break

10:30 - 11:30. Lai-Sang Young: *Non-uniform hyperbolic Theory*

Abstract: Oseledec's Theorem on Lyapunov exponents will be discussed, followed by the local theory of non-uniformly hyperbolic sets (following Pesin). The Lyapunov metric will be introduced, and a sketch of the existence of stable and unstable manifolds. Various examples will be discussed.

11:30 - 13:00. Lunch

13:00 - 15:00. Bodil Branner: *Iteration of complex polynomials.*

Abstract: Filled Julia sets and Julia sets of polynomials. Green's functions, external rays and external arguments. Relation between dynamical plane and parameter plane for complex quadratic polynomials. Kneading sequences for real quadratic polynomials and external arguments for real quadratic polynomials in the Mandelbrot set.

15:00 - 15:30. Coffee break

15:30 - 18:00. Discussions.

Day 3. Wednesday, June 23

9:00 - 10:00. Bruce Kitichens: *Symbolic Dynamics II.*

Abstract: Definition and general facts about topological entropy. An explanation of why it is called entropy. Markov partitions.

10:00 - 10:30. Coffee break

10:30 - 11:30. Viviane Baladi: *Dynamical Zeta functions I.*

Abstract: We describe the analytic properties of the zeta function associated to a dynamical system and a complex weight, by using the theory of Ruelle transfer operators in several settings. We start with the case of subshifts of finite type with a locally constant, or Hölder continuous, weight function. We explain how this applies to Axiom A diffeomorphisms or Axiom A flows using the appropriate machinery of Markov partitions and symbolic dynamics. We mention the result for expanding differentiable maps.

11:30 - 13:00. Lunch

13:00 - 15:00. Marcelo Viana: *Homoclinic orbits and homoclinic bifurcations.*
Abstract: Dynamical consequences of the occurrence of transverse homoclinic orbits. Hyperbolic sets (horseshoes): structure and properties. Stability of hyperbolic sets. Dynamic changes implied by the creation/destruction of homoclinic orbits.

15:00 - 15:30. Coffee break

Evening. Midsummer Eve Party.

Day 4. Thursday, June 24

9:00 - 10:00. Lai-Sang Young: *Entropy, Lyapunov exponents and Hausdorff dimension.*

Abstract: I will prove a formula relating these 3 invariants for diffeomorphisms of surfaces and discuss what the picture looks like in higher dimensions. Necessary and sufficient conditions for smooth conditional measures on unstable manifolds will also be discussed.

10:00 - 10:30. Coffee break

10:30 - 11:30. Adrien Douady: *Monotonicity of entropy of quadratic polynomials.*
Abstract: Connected and locally connected compact sets in the plane; the Carathéodory loop. Conditions for local connectivity of Julia sets of quadratic polynomials. Characterization of entropy of a real quadratic polynomial. Continuity of entropy. Reduction to the case of polynomials with locally connected Julia set. Description of the real external arguments of the Julia set of a real quadratic polynomial in terms of the appropriate external arguments in the Mandelbrot set. Monotonicity of entropy.

11:30 - 13:00. Lunch

13:00 - 15:00. Jean-Christophe Yoccoz: *Hyperbolicity in real and complex dynamics. II.*

Abstract: Stability of compact hyperbolic subsets: hyperbolic continuation. Anosov diffeomorphisms, structural stability. The shadowing lemma. Local product structure. Locally maximal hyperbolic sets. Basic sets.

15:00 - 15:30. Coffee break

15:30 - 18:00. Talks given by participants.

Day 5. Friday, June 25

9:00 - 10:00. Colin Sparrow: *Ordinary differential equations: the study of complicated dynamics.*

Abstract: Theoretical and numerical study of global bifurcations leading to complicated dynamics. Creation of unbounded non-wandering sets by 'gluing' as example.

10:00 - 10:30. Coffee break

10:30 - 11:30. Jean-Christophe Yoccoz: *Hyperbolicity in real and complex dynamics. III.*

Abstract: Spectral decomposition of basic sets. Markov partitions. Shifts and subshifts of finite type. Bernoulli maps. Quadratic maps of the interval. Jakobson's theorem.

11:30 - 13:00. Lunch

13:00 - 15:00. Peter Jones: *Removability problems in the plane.*

Abstract: The John condition and removability. In particular, the John condition for the Julia set of a polynomial which is hyperbolic on its postcritical set. Removability of Cantor sets with the divergence property. Consequences of removability of Julia sets.

15:00 - 15:30. Coffee break

15:30 - 18:00. Discussions.

Day 6. Monday, June 28

9:00 - 10:00. Chris Budd: *The Global Dynamics of Impacting Oscillators.*

Abstract: Studies of vibrating systems which involve sudden impacts naturally lead to dynamical systems with discontinuities. These discontinuities produce a rich variety of nonstandard dynamical behaviour and bifurcations. In this talk we shall consider a simple system of a driven mass on a spring impacting a rigid obstacle and show how this leads to a discontinuous, two dimensional, Poincaré map from the cylinder into itself. We study the geometry of this map using singularity theory, and show how the dynamics of the oscillator is governed by special features of this

geometry. In particular, we demonstrate that both periodic and chaotic motions of the oscillator are possible and show that the form of both the domains of attraction of the periodic motion and the strange attractors of the chaotic motion can be predicted from the geometry of the map. We then show how this work can be generalised to study systems of several oscillators which are coupled together by impacts and discuss the application of these results.

10:00 - 10:30. Coffee break

10:30 - 11:30. Ricardo Perez-Marco: *Small divisor problems. I.*

Abstract: Dynamics near an indifferent fixed point and analytic diffeomorphisms of the circle.

11:30 - 13:00. Lunch

13:00 - 15:00. Sebastian van Strien: *Renormalization, real bounds. I.*

Abstract: Distortion estimates for interval mappings based on the Koebe Principle. Disjointness and distortion of cross-ratios.

15:00 - 15:30. Coffee break

15:30 - 18:00. Discussions.

Day 7. Tuesday, June 29

9:00 - 10:00. Marcelo Viana: *Renormalization, quadratic-like maps, strange attractors.*

Abstract: Return maps associated to homoclinic orbits. Quadratic-like maps: basic properties. Resistent dynamic phenomena in the unfolding of a homoclinic bifurcation: thick horseshoes, strange attractors, etc.

10:00 - 10:30. Coffee break

10:30 - 11:30. Adrien Douady: *Relations between various conjectures concerning the Mandelbrot set.*

Abstract: Review of recent work on the following conjectures:

Local Connectivity of the Mandelbrot set; stability in the complex plane implies hyperbolicity; stability on the real axis implies hyperbolicity; topological conjugacy implies quasi-conformal conjugacy.

11:30 - 13:00. Lunch

13:00 - 15:00. John H. Hubbard: *Complex dynamics in several variables. I.*

Abstract: Examples of complex dynamical systems in at least 2 variables. General facts about the complex Henon mapping, homogeneous polynomials, Newton's method in several variables, Sibony's critically finite maps.

15:00 - 15:30. Coffee break

15:30 - 18:00. Talks given by participants.

Day 8. Wednesday, June 30

9:00 - 10:00. Sebastian van Strien: *Renormalization, real bounds. II.*

Abstract: Creating the Koebe space in the case of renormalizable mappings.

10:00 - 10:30. Coffee break

10:30 - 11:30. Ricardo Perez-Marco: *Small divisor problems. II.*

Abstract: The proof of the Siegel's linearization theorem.

11:30 - 13:00. Lunch

13:00 - 15:00. John Milnor: *Recurrence.*

Abstract: Different types of recurrence, for instance reluctant and persistent critical recurrence. Yoccoz partition of Julia sets of quadratic polynomials which are not infinitely many times renormalizable, and the corresponding partition of the Mandelbrot set.

15:00 - 15:30. Coffee break

Afternoon and evening. Excursion to Louisiana Museum of Modern Art.

Day 9. Thursday, July 1

9:00 - 10:00. Chris Budd: *Grazing Bifurcations in Impacting Oscillators.*

Abstract: A fascinating change in the behaviour of an impact oscillator occurs when a periodic solution (corresponding to a fixed point of the Poincare map) crosses a line of discontinuity of the map as a parameter is varied. In particular we observe (in some circumstances) an immediate bifurcation to chaos with windows of periodic

behaviour which appear much more regularly than those for the logistic map. In this lecture we discuss the nature of this 'grazing' bifurcation and derive a normal form for the behaviour at such a bifurcation. In particular, we calculate the invariant measure of the chaotic behaviour and the location of the periodic windows. The origin of the bifurcation through a sequence of smooth bifurcations will be shown and the occurrence of grazing bifurcations in other more general systems will also be discussed.

10:00 - 10:30. Coffee break

10:30 - 11:30. Viviane Baladi: *Dynamical Zeta functions II.*

Abstract: Continuing our study of weighted dynamical functions, we study two more cases. The first is that of complex dynamics: expanding analytic maps (such as the Gauss map, or other expanding maps occurring in the study of constant negative curvature geodesic flows), where the transfer operator is nuclear in the sense of Grothendieck. (We also mention the recent results for hyperbolic analytic maps.) The second is non-Markovian one-dimensional dynamics, where we discuss two approaches: one with countable, the other with finite symbolic dynamics.

11:30 - 13:00. Lunch

13:00 - 15:00. Mitsuhiro Shishikura: *Renormalization, complex bounds. I.*

Abstract: In these lectures we emphasize the complex part of Sullivan's renormalization theory. We see that if a subsequence of the renormalizations converges then the limit mapping can be extended to the complex plane as a quadratic-like mapping. We study the quasi-conformal deformations of quadratic-like mappings and conclude that they correspond to real-analytic expanding mappings on the circle.

15:00 - 15:30. Coffee break

15:30 - 17:00. Discussions.

20:00 - 21:00. A session on open problems, organized by Adrien Douady.

Day 10. Friday, July 2

9:00 - 10:00. Mitsuhiro Shishikura: *Renormalization, complex bounds. II.*

Abstract: We introduce the theory of Teichmüller space for mappings introduced in the first lecture. Through the study of the the Teichmüller space we obtain the contraction of the renormalization operator.

10:00 - 10:30. Coffee break

10:30 - 11:30. John H. Hubbard: *Complex dynamics in several variables. II.*

Abstract: More detailed study of the complex Henon mapping. The currents which are the analogue of the Brolin measure on Julia sets for polynomials.

11:30 - 13:00. Lunch

13:00 - 15:00. Lai-Sang Young: *Sinai-Bowen-Ruelle measures for strange attractors.*

Abstract: Construction of SBR measures for Axiom A attractors. A discussion of what type of geometric conditions are needed for this construction in the non-uniform setting. An indication of how these geometric conditions are proved for Henon-like attractors.

Closing.