❀ Mathematical Society of Japan

2016 Annual Meeting

Titles and Short Summaries of the Talks

March, 2016

at University of Tsukuba

2016 Mathematical Society of Japan
ANNUAL MEETING

Dates: March 16th (Wed)–19th (Sat), 2016

Venue: Area 1 and Area 3, University of Tsukuba
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	Bldg. 3A 3A204	Bldg. 3A 3A402	Bldg. 3A 3A403	Bldg. 1C 1C310	Bldg. 1D 1D201	Bldg. 1D 1D204	Bldg. 1E 1E102	Bldg. 1E 1E203	Bldg. 1E 1E303
16th (Wed)	Algebra 9:30–12:00 14:15–16:50	Statistics and Probability 9:30–12:00	Functional Equations 9:30–12:00 14:15–16:15	Found. of Math. and History of Math. 10:00–11:20 14:15–16:00	Geometry 9:30–12:00 14:15–16:30	Topology 10:00–11:55 15:30–17:10	Applied Mathematics 10:30–12:00 14:30–16:00	Complex Analysis 9:45–11:45 14:15–15:05	Functional Analysis 10:00–12:00
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MSJ Prizes Presentation (Bldg. 1H, 1F 1H101) · (15:00–15:20)
Plenary Talks (Bldg. 1H, 1F 1H101) MSJ Spring Prize Winner · · · · · · · · · · · · · (15:30–16:30)
Mikiya Masuda (Osaka City Univ.) · · · · · (16:40–17:40)
Official Party (University Hall) · (18:00–20:00)

	I	II	III	IV	V	VI	VII	VIII	IX
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19th (Sat)	Algebra 9:30–12:00 14:15–15:45	Statistics and Probability 9:50–12:00 14:15–16:10	Functional Equations 9:30–12:00 14:15–15:45	Real Analysis 9:30–12:00 14:15–15:00	Geometry 9:00–10:45		Applied Mathematics 10:00–12:00 14:15–15:45	Infinite Analysis 9:30–12:00 14:15–15:15	
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Plenary Talks

March 17th (Thu)   Bldg. 1H, 1F 1H101

MSJ Spring Prize Winner $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ (15:30–16:30)

Mikiya Masuda (Osaka City Univ.)   Toric topology $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ (16:40–17:40)

Summary: Around 1970, a very beautiful and successful theory called toric geometry was established by Demazure, Miyake-Oda, Mumford and others. Toric geometry connects two different mathematical fields: algebraic geometry (toric varieties) and combinatorics (fans and convex polytopes). It also provides new insight and unexpected applications, e.g. an application by R. Stanley to a longstanding problem called g-conjecture about characterization of face numbers of simplicial convex polytopes. Around 1980, equivariant symplectic geometry was developed and its close relation to toric geometry was recognized, especially through the celebrated Atiyah-Guillemin-Sternberg convexity theorem.

Motivated by this success story, a new mathematical field called toric topology is emerging and rapidly developing. Toric topology is a new topological discipline concerned with a class of problems on the borders between the topology of torus actions, commutative and homological algebra, toric geometry, combinatorics and equivariant symplectic geometry etc. In this talk I overview the development of toric topology.

Featured Invited Talks

March 16th (Wed)

Conference Room V

Qing-Ming Cheng (Fukuoka Univ.)   Geometry of λ-hypersurfaces of the weighted volume-preserving mean curvature flow $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ (13:00–14:00)

Summary: In this talk, we introduce mean curvature flow and mean curvature type flow, which is called the weighted volume-preserving mean curvature flow.

A self-shrinker of the mean curvature flow is a self-similar solution of the mean curvature flow. On the other hand, it can be seen a critical point of the weighted area functional from the view point of variations. We give a definition of a weighted volume, which is preserved by the weighted volume-preserving mean curvature flow. Thus, we consider variations of the weighted area functional, which preserve the weighted volume. A critical point of the weighted area functional for the weighted volume-preserving variations is defined a λ-hypersurface of weighted volume-preserving mean curvature flow.

We study geometry of λ-hypersurfaces of weighted volume-preserving mean curvature flow. First of all, many examples of compact embedded λ-hypersurfaces of weighted volume-preserving mean curvature flow are constructed. Secondly, complete λ-hypersurfaces are studied. The results on complete self-shrinkers of mean curvature flow due to Huisken (J. Diff. Geom., 1990) and Colding-Minicozzi (Ann. of Math., 2012) are generalized to complete λ-hypersurfaces of weighted volume-preserving mean curvature flow. We also define a $\mathcal{F}$-functional and study $\mathcal{F}$-stability of λ-hypersurfaces. Furthermore, lower bound growth and upper bound growth of the area for complete and non-compact λ-hypersurfaces are also studied.

Conference Room VII

Guest Talk from the Japan Society for Industrial and Applied Mathematics

Tetsuya Sakurai (Tsukuba Univ.)   Large-scale simulation and data analysis using quadrature-type eigensolver $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ (13:00–14:00)

Conference Room VIII

Toshiyuki Sugawa (Tohoku Univ.)   Geometry and analysis of Schwarzian derivative $\cdots\cdots\cdots\cdots$ (13:00–14:00)

Summary: In this talk, we will survey the Schwarzian derivative from its birth to several recent extensions in various contexts. The Schwarzian derivative of a nonconstant meromorphic function $f(z)$ of a complex variable is defined as $f'''(z)/f'(z) - 3(f''(z)/f'(z))^2/2$. This quantity looks a little complicated but has unexpectedly many and deep applications in a wide variety of fields in Mathematics including Conformal Geometry, Mathematical Physics, Teichmüller theory, Dynamical Systems as well as Function Theory.

We start the talk with a historical account of the Schwarzian derivative and then present a couple of applications as examples. Especially, we will explain how the Schwarzian derivative is used to construct the Bers embedding of the Teichmüller space.

In the second half, we will mention possible generalizations or extensions of the Schwarzian derivative. In particular, we will present our recent higher-order analogues of the Schwarzian derivative of holomorphic maps between Riemann surfaces equipped with a conformal metric and projective structure.

March 18th (Fri)

Conference Room II

Akio Suzukawa (Hokkaido Univ.)   Multivariate survival analysis based on shared frailty models
. . . .   (13:00–14:00)

Summary: Multivariate survival data occur in many areas, including medicine, biology, engineering, and economics. Shared frailty models are random effects models for analyzing multivariate survival data. They are closely related to dependence modeling based on Archimedean copulas. In this paper, we discuss about the shared frailty models and their extensions.

Conference Room IX

Jiro Sekiguchi   ♭   Free divisors and differential equations · · · · · · · · · · · · · · · · ·   (13:00–14:00)
(Tokyo Univ. of Agri. and Tech.)

March 19th (Sat)

Conference Room I

Satoshi Wakatsuki (Kanazawa Univ.)   Dimension formulas of Siegel modular forms · · · · · · · · · · · ·   (13:00–14:00)

Summary: The purpose of this talk is to discuss dimension formulas for spaces of Siegel modular forms. In particular, we give a dimension formula for spaces of Siegel cusp forms of general degree. The trace formula is one of the main tools to study the dimensions. In 1975, T. Shintani gave a formula which expresses a small part of the geometric side of the trace formula by special values of Shintani zeta functions for spaces of symmetric matrices at non-positive integers. To be precise, it is the contribution of unipotent elements corresponding to the partitions $(2^j, 1^{2n-2j})$, where n denotes the degree and $0 \leq j \leq n$. After that, several Japanese researchers conjectured that the other contributions will vanish and Shintani's formula means the dimension itself. In this talk, we report that the conjecture was solved affirmatively and the dimensions are expressed by the special values. In 1995, T. Ibukiyama and H. Saito discovered an explicit formula of the Shintani zeta functions. Their formula shows that the special values are described by the Bernoulli numbers, that is, they are rational numbers and computable. Therefore, our formula provides numerical values of dimensions.

Conference Room III

Shigeaki Koike (Tohoku Univ.)   On ABP maximum principle ·   (13:00–14:00)

Summary: I will show a proof of the celebrated Aleksandrov-Bakelman-Pucci maximum principle and its parabolic version by Krylov-Tso. This maximum principle is a nice tool to connect point-wise estimates with integrations.
I start by the simplest case and arrive at the complete version. I hope to give some applications and extensions.

Foundation of Mathematics and History of Mathematics

March 16th (Wed)   Conference Room IV

10:00–11:20

1   Toshio Harikae (Osaka Sangyo Univ.)   Solid figures in ancient China $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we discuss the deference of several solid figures in the mathematical books written in the Qin–Han period.

2   Makoto Tamura (Osaka Sangyo Univ.)   Chants in math books of the Qin and the Han Dynasties in China $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: The book *Shu of the Qin Dynasty housed at Yuelu Academy*, the *Suanshu slips of the Qin Dynasty housed at Peking University*, and the *Zhangjiashan bamboo slips Suanshushu of the Han Dyansty* are mathematical books in ancient China. They were textbooks for middle officers, and most of their problems are on calculation of tax, area, and so on. However one of the *Litian* problems of the *Suanshu housed at Peking University* was incomprehensible in such a way. In this talk, we show it is a type of chants for memorizing a conversion constant compared with the *Litian* problems of the *Shu housed at Yuelu Academy* and *Zhangjiashan Suanshushu*.

3   Shunzi Horiguchi   Handwriting analysis of Chinese characters in the picture scroll of kiku-
        (Niigata Sangyo Univ.)   genpou betsuden ichimaki-hihachiji and 1000 characters of ten bodies written by Koutaku Hosoi $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We do the handwriting analysis of Chinese characters in the picture scroll of kikugenpou betsuden ichimaki-hihachiji and 1000 characters of ten bodies written by Koutaku Hosoi. As a result, we find that the handwritings of both are similar very much. Therefor, it is supposed that Hosoi wrote the picture scroll.

4   Mitsuo Morimoto   A modern transcription of the side writing method in the *Taisei Sankei*
        (Yokkaichi Univ./Sophia Univ.*) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: The *Taisei Sankei* (1683–1711) is an encyclopedic work on mathematics by Seki Takakazu, Takebe Kata'akira and Takebe Katahiro. To express algebraic equations they use the so-called side writing method. In our enterprise to translate the work into English, we have encountered a problem of transcription of the side writing method, which is a generalization of the celestial element method developed in Song China. The *Taisei Sankei* is written in Classical Chinese, which follows vertical lines, while English as well as other modern languages are composed along horizontal lines. The side writing method is basically a vertical notation, which is required to be transcribed horizontally in English translation.

5   Mitsuo Morimoto   On the last problem of Volume 19, the Taisei Sankei $\cdots\cdots\cdots\cdots\cdots$ 15
        (Yokkaichi Univ./Sophia Univ.*)

Summary: Volume 19 of the *Taisei Sankei* contains 15 problems of algebraic equations of one or several unknowns, which are treated thoroughly using notation of the side writing method. The last problem is concerned with a system of eight algebraic equations with eight unknowns, which can be easily reduced to a system of four algebraic equations with four unknowns. The authors reduce this system to an equation of one unknown by means of Seki Takakazu's theory of elimination using, among others, the determinant of a 5×5 matrix.

5   Foundation of Mathematics and History of Mathematics

11:20–11:50   Mathematics History Team Meeting

14:15–16:00

6   Shigeru Masuda   Poisson's paradigm in *A Study of Mathematical Physics* (*Un Traité de*
(Res. Workshop of Classical Fluid Dynamics)   *Physique Mathématique*) · 15

Summary: We discuss Poisson's paradigm which is consisted of the books in 1831, 1833 and 1835, namely, on the capillary action, on the mechanical problems and on the heat theory, which are his last works by the book style in life, and within five years of Fourier's death in 1830, in the rivalry to Fourier, Poisson works his heavy theories including essential mathematical topics against Fourier in heat theory and Navier in fluid dynamics, namely, in these book, Poisson mentions the mathematical conclusions as the finishing strokes to complete his academic paradigm in the wave mechanics, the fluid mechanics and the heat theory. We think his works finally rank with the Lagrange's *Méchanique analytique* and the Laplace's *Méchanique céleste*.

7   Shigeru Masuda   The theories and equations of heat come from Fourier and Poisson
(Res. Workshop of Classical Fluid Dynamics)   · 15

Summary: We discuss Fourier's book and Poisson's books on the heat problems. Poisson's is one of his last works in life, and after five years of Fourier's death, in the rivalry to Fourier, Poisson works his heat theory including essential mathematical topics against Fourier in heat theory and Navier in fluid dynamics, namely, in these books, Poisson mentiones the mathematical conclusions as the finishing strokes of his academic activities in the fluid dynamics and heat theory.

8   Michiyo Nakane   Why do we believe that Euler began algebraic analysis? · · · · · · · · · · · · · 15

Summary: In Japan, we have such a legend that Euler began algebraic analysis though he never named his theory so. In Cauchy's Cours d'Analyse: Analyse algébrique, Cauchy wrote an introductory course of analysis was called as algebraic analysis noting Fourier's analysis lectures. It is German translator's introduction of Cauchy's book that Euler began algebraic analysis. Teizi Takagi accepted this description and wrote his famous Kaiseki-gairon. It is an origin of the legend.

9   Ken Saito   (Osaka Pref. Univ.)   Euclid's *Elements* and the concept of prime factorization · · · · · · · · · · · · 15

Summary: The question is often asked whether Euclid proved the uniqueness of prime factorization. However, the question itself is wrong, for Euclid did not have the concept of prime factorization; at least he failed to use this concept where it would have greatly simplified the proof. Through the examination of the arguments in the proposition concerning the perfect number (IX.36), I will show that this proposition is proved by preparing ad hoc lemmas, in the lack of general concept of prime factorization.

10   Koichiro Ikeda   (Hosei Univ.)   A remark on non-saturated generic structures · 15

Summary: The generic construction is a new method that was invented by Hrushovski, and has given various interesting structures. Many of them are saturated structures, but it is not well known what kind of properties non-saturated generic structures have. In this talk, we focus on non-saturated generic structures whose theories have finite closures, and want to explain their properties.

11   Hirotaka Kikyo   (Kobe Univ.)   On constructions of countable projective planes · · · · · · · · · · · · · · · · · · · 15

Summary: We present some observations on constructions of infinite projective planes. Projective planes are incidence structures of points and lines. We can consider them as bipartite graphs. Any projective plane obtained as a generic structure of an ab initio type amalgamation class contains no finite projective planes as its substructures except that of order 2 or 3. Any finite or countable bipartite graph with no 4 cycles can be expanded to a countable projective plane. There is a countable projective plane which contains any finite projective plane as a substructure. We also discuss problems relating to these results.

16:15–17:15   Talk Invited by Section on Foundation and History of Mathematics

Byunghan Kim (Yonsei Univ.)   The Lascar groups and the 1st homology groups in model theory

Summary: Given a complete type p over an algebraically closed set in any complete theory T, one can define the 1st homology group $H_1(p)$ of p depending on the choice of an independence relation satisfying symmetry, transitivity, and extension.

(For example, if any two sets are assumed to be independent over any set, then this full independence relation obviously satisfies the 3 axioms. Of course there is a non-trivial such relation for rosy theories too.) We show that regardless of the choice of the independence relation, $H_1(p)$ is always the same. More precisely, there is the canonical epimorphism from the Lascar Galois group of p to $H_1(p)$, and $H_1(p)$ is G/K where G is the group of automorphisms of p and K is the normal subgroup of G fixing each orbit of the realizations of p under the action of the derived subgroup of G. This is a joint work with Jan Dobrowolski and Junguk Lee.

<div align="center">

March 17th (Thu)   Conference Room IV

</div>

10:00–11:30

12   Takashi Oyabu   ♭ Diff(M): Physics, and other 5 talks $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 5

Summary: (1) Physical laws are described by differential equations===diffeomorphism: physics====DIFF(M)-physics:

(2) Philosophy of mathematics: We interprete aut(R)::epistemology in mathematical philosophy: sein:::==idea theory:

(3) Entropy concept in mathematics is introduced :::2ND law of thermodynamics:: H=δdA$\sum(\mu i)$Ui: theory of H-theorems: dH/dt=<0====→0:

(4) Galois theory and geometry: Gllois geometry: K(V)$\hookrightarrow$=K(V): Galois group::□G:Γ):

(5) A history of thermodynamics: Clausius::Boltzmann:Gibbs::Onsager::::Prigogine:::→Equibrium thermodynamics and non equibrium thermodynamics

(6) Representation::induced representation:L2(M)=$\oplus$dim$\pi(\Gamma)\pi$ M=ΓG:G/Γ:compact

13   <u>Yasuhiko Omata</u> (Tohoku Univ.)   Dickson's lemma and weak Ramsey theory $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Florian Pelupessy (Tohoku Univ.)

Summary: Dickson's lemma, originally used in algebra, in particular for showing Hilbert's basis theorem, is nowadays commonly used in termination proofs in computer science. The weak Paris–Harrington theorem for pairs was originally used as an easy intermediate version in showing lower bounds for the Paris–Harrington theorem for pairs. We provide simple constructions which show that witnesses of one of these statements can be expressed explicitly as witnesses of the other. As a consequence these statements are equivalent over RCA_0^*. Additionally our construction provides an explicit formula for weak Ramsey numbers and tight upper bounds for the weak Paris–Harrington theorem derived from those for Dickson's lemma.

14   Daisuke Ikegami (Tokyo Denki Univ.)   Boolean valued second order logic $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In the research of second order predicate logic, the following two semantics are mainly considered; full semantics (or Tarski semantics) and Henkin semantics. Full semantics can express much more things than the standard semantics for first order logic, but it is very complicated and hard to analyze while Henkin semantics for second order logic is essentially the same as the standard semantics for first order logic.

In this talk, we propose another semantics for second order logic which is called "Boolean valued semantics". We investigate the basic properties of this semantics and compare it with full semantics. This is joint work with Jouko Väänänen.

15 Sakaé Fuchino   (Kobe Univ.)   On reflection numbers of some topological and combinatorial properties
. . . . 15

Summary: We discuss about partial solutions of Galvin's Conjecture and Hamburger's Problem, and present some results on the reflection numbers related to these problems.

16 <u>Makoto Kikuchi</u> (Kobe Univ.)   On the element-of relation and the inclusion relation in set theory $\cdots$ 15
Joel David Hamkins (CUNY)

Summary: We proved that in the universe $(V, \in)$ of set theory, there is a definable relation $\in^*$, different from $\in$, such that $(V, \in^*)$ is isomorphic to the original universe $(V, \in)$ and that the corresponding inclusion relation $\subset^*$ is identical to the usual inclusion relation $\subseteq$. It follows from this fact that the element-of relation cannot be defined in terms of the inclusion relation in set theory. We proved also that if $(V, \in^*)$ is a model of set theory and $\subseteq^*$ is identical to $\subseteq$, then $(V, \in^*)$ is isomorphic to $(V, \in)$.

17 Masanao Ozawa (Nagoya Univ.)   Order of reals in quantum set theory: Difference of its operational
meaning for the different choices of conditionals $\cdots$ 15

Summary: In quantum logic there are three well-known candidates for conditional: the Sasaki conditional, the contrapositive Sasaki conditional, and the relevance conditional. A fundamental problem is to show how the choice affects the probabilistic interpretation of quantum theory. Here, we attempt such an analysis through quantum set theory. We construct models of quantum set theory based on the above conditionals and consider equality and order between reals in those models. We show that the truth values of the equality are the same, whereas those of the order significantly depend on the underlying conditional. We characterize their operational meanings by joint probability for successive projective measurements. Those characterizations will play an important role in applications of quantum set theory to quantum physics.

11:30–12:00   Research Section Assembly

13:15–14:25

18 Takahiro Seki   (Niigata Univ.)   The decidability of some non-associative substructural logics $\cdots$ 15

Summary: Associativity (of fusion) is regarded as one of the important structural rules. Recently, some studies on non-associative substructural logics have been developed. In this talk, we show that some non-associative substructural logics are decidable using a Gentzen-style formulation.

19 Yoshihito Tanaka   Axioms of S4.3 in $\mathcal{EL}$ and their algebraic models $\cdots$ 15
        (Kyushu Sangyo Univ.)

Summary: In this report, we introduce two sets $\mathcal{A}_{S4.3}$ and $\mathcal{B}_{S4.3}$ of concept inclusions of $\mathcal{EL}$ which axiomatize modal logic S4.3, and discuss their algebraic models. The standard semantics for $\mathcal{EL}$ is equivalent to complete atomic completely additive Boolean algebras with operators (CA) model, but a natural algebraic semantics defined from the logical connectives of $\mathcal{EL}$ is semilattices with operators (SLO) model. We show that the sets of SLOs defined by $\mathcal{A}_{S4.3}$ and $\mathcal{B}_{S4.3}$ are not equal, while the sets of CAs defined by them are equal. We also prove that SLO model and CA model are not equivalent when either $\mathcal{A}_{S4.3}$ or $\mathcal{B}_{S4.3}$ of axioms are assumed. This is a joint work with S. Kikot, A. Kurucz, F. Wolter and M. Zakharyaschev.

20 Kenshi Miyabe   (Meiji Univ.)   Mass problem of randomness notions $\cdots$ 15

Summary: We study Muchnik degrees and Medvedev degrees of randomness notions, which can be seen as subsets of the Cantor space. In order to separate the randomness notions, we need detailed information of Turing degrees and uniformity.

Summary: The notion of probability plays an important role in almost all areas of science and technology. In modern mathematics, however, probability theory means nothing other than measure theory, and the operational characterization of the notion of probability is not established yet. In our former work, based on the toolkit of algorithmic randomness we presented an operational characterization of the notion of probability. Algorithmic randomness is a field of mathematics which enables us to consider the randomness of an individual infinite sequence. We used the notion of Martin–Loef randomness with respect to Bernoulli measure to present the operational characterization, in particular, to finite probability spaces. In this talk, we present an operational characterization of the notion of probability to an arbitrary discrete probability space whose sample space is countably infinite.

Algebra

March 16th (Wed)   Conference Room I

9:30–12:00

1 Toshio Sumi   (Kyushu Univ.)   On the real radical of determinantal ideals of matrices defined by certain
<u>Mitsuhiro Miyazaki</u>   tensors $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
            (Kyoto Univ. of Edu.)
Toshio Sakata   (Kyushu Univ.)

Summary: In studying tensor rank over the real number field, we used the theory of determinantal ideals over a commutative ring. We developed a theory on the determinantal ideal of a matrix defined by a tensor in order to pursue our study of tensor rank which is interesting in its own right. In this talk, we report our result.

2 <u>Takafumi Shibuta</u> (Kyushu Univ.)   Computation of the standard basis of modules based on Matlis duality
Shinichi Tajima (Univ. of Tsukuba) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Let R be a ring of power series over a field. In this talk, we give an algorithm for computing the standard basis of a module M which is a submodule of a free R-module F such that F/M has finite length. The algorithm is based on Matlis duality.

3 Yusuke Suyama (Osaka City Univ.)   The Ehrhart polynomial of a 3-dimensional simple integral convex
    polytope $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: For a simple integral convex polytope P of dimension d, Pommersheim gave a method for computing the $(d-2)$-th coefficient of the Ehrhart polynomial of P by using toric geometry. In this talk, we give a formula for the Ehrhart polynomial of P of dimension 3 by applying this method.

4 <u>Akiyoshi Tsuchiya</u> (Osaka Univ.)   Normal Gorenstein Fano polytopes arising from partially ordered sets
Takayuki Hibi   (Osaka Univ.)   and the Ehrhart polynomials $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Kazunori Matsuda (Osaka Univ.)

Summary: Richard Stanley introduced the order polytope $\mathcal{O}(P)$ and the chain polytope $\mathcal{C}(P)$ arising from a finite partially ordered set P, and showed that the Ehrhart polynomial of $\mathcal{O}(P)$ is equal to that of $\mathcal{C}(P)$. In this talk, we will introduce study on Ehrhart polynomials of three normal Gorenstein Fano polytopes $\Gamma(\mathcal{O}(P), -\mathcal{O}(Q))$, $\Gamma(\mathcal{O}(P), -\mathcal{C}(Q))$ and $\Gamma(\mathcal{C}(P), -\mathcal{C}(Q))$, where P and Q are partially ordered sets with $|P| = |Q|$.

5 <u>Kazuho Ozeki</u> (Yamaguchi Univ.)   The structure of the Sally module of integrally closed ideals $\cdots\cdots\cdots$ 15
Maria Evelina Rossi (Genova Univ.)

Summary: The first two Hilbert coefficients of a primary ideal play an important role in commutative algebra and in algebraic geometry. In this paper we give a complete algebraic structure of the Sally module of integrally closed ideals I in a Cohen–Macaulay local ring A satisfying the equality $\mathrm{e}_1(I) = \mathrm{e}_0(I) - \ell_A(A/I) + \ell_A(I^2/QI) + 1$, where Q is a minimal reduction of I, and $\mathrm{e}_0(I)$ and $\mathrm{e}_1(I)$ denote the first two Hilbert coefficients of I.

6 Akihiro Higashitani   Almost Gorenstein standard graded rings and their h-vectors $\cdots\cdots\cdots$ 15
            (Kyoto Sangyo Univ.)

Summary: Recently, for the study of a new class of local or graded rings which are Cohen–Macaulay but not Gorenstein, almost Gorenstein local or graded rings were defined and have been studied. In this paper, for the further study of almost Gorenstein rings, we concentrate on almost Gorenstein standard graded rings and investigate the h-vectors of almost Gorenstein standard graded rings.

7   Satoshi Yamanaka (Okayama Univ.)[♭]   Some remarks on the weakly separability in skew polynomial rings $\cdots$ 10

Summary: The notion of weakly separable extensions was introduced as a generalization of separable extensions. In this talk, we shall study the difference between the separability and the weakly separability in skew polynomial rings of derivation type $B[X; D]$. Moreover, we shall treat weakly separable polynomials in the general case $B[X; \rho, D]$.

8   <u>Naoyuki Matsuoka</u> (Meiji Univ.)   The almost Gorenstein Rees algebras of contracted ideals $\cdots\cdots\cdots\cdots$ 15
    Shiro Goto   (Meiji Univ.)
    Naoki Taniguchi (Meiji Univ.)
    Ken-ichi Yoshida (Nihon Univ.)

Summary: Let $(A, \mathfrak{m})$ be a two-dimensional regular local ring with infinite residue class field $A/\mathfrak{m}$. Goto-Matsuoka–Taniguchi–Yoshida showed that the Rees algebras of integrally closed ideals are almost Gorenstein. Then one can ask how about the case when I is contracted. The purpose of this talk is to give an answer to this question.

9   <u>Kei-ichi Watanabe</u> (Nihon Univ.)[♭]   A characterization of two-dimensional rational singularities via Core of
    Tomohiro Okuma (Yamagata Univ.)   ideals $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Kenichi Yoshida (Nihon Univ.)

Summary: We give a concrete description of the core of p_g-ideals in 2-dimensional normal sngularities and as consequences, we give a characterization of rational singularities and prove the existence of good ideals.

14:15–16:50

10 Shigeru Iitaka (Gakushuin Univ.[⋆])   On ϕ perfect numbers with respect to Euler's function $\cdots\cdots\cdots\cdots$ 10

Summary: Let P be a prime and m a positive integer. If $\phi(P^e) + 1 + m$ is prime then $a = P^e q$ is said to be (ϕ, m) perfect number.

11 <u>Aiichi Yamasaki</u> (Kyoto Univ.)   Degree three unramified cohomology groups $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Akinari Hoshi   (Niigata Univ.)
    Ming-chang Kang (Nat. Taiwan Univ.)

Summary: Let p be an odd prime number. Peyre shows that there is a group G of order p^{12} such that $H^3_{nr}(\mathbb{C}(G), \mathbb{Q}/\mathbb{Z})$ is non-trivial. Using Peyre's method, we are able to prove that the same conclusion is true for some groups of order p^9.

12 <u>Aiichi Yamasaki</u> (Kyoto Univ.)   Bravais group of dimension $n \leq 6$ and corresponding quadratic forms
    Akinari Hoshi   (Niigata Univ.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We confirm that $H^1(G, F) = 0$ for any Bravais group G if dimension $n \leq 6$ where F is the flabby class of the corresponding G-lattice of rank n (Voskresenskii's conjecture). By using the algorithm we developed, one can obtain (positive definite) invariant quadratic forms f under the action of Bravais group $G \leq GL(n, \mathbb{Z})$.

13 Akinari Hoshi   (Niigata Univ.)   On Noether's problem for cyclic groups of prime order $\cdots\cdots\cdots\cdots$ 15

Summary: Let k be a field and G be a finite group acting on the rational function field $k(x_g \,|\, g \in G)$ by k-automorphisms $h(x_g) = x_{hg}$ for any $g, h \in G$. Noether's problem asks whether the invariant field $k(G) = k(x_g \,|\, g \in G)^G$ is rational (i.e. purely transcendental) over k. In 1974, Lenstra gave a necessary and sufficient condition to this problem for abelian groups G. However, even for the cyclic group C_p of prime order p, it is unknown whether there exist infinitely many primes p such that $\mathbb{Q}(C_p)$ is rational over $\mathbb{Q}$. Only known 17 primes p for which $\mathbb{Q}(C_p)$ is rational over $\mathbb{Q}$ are $p \leq 43$ and $p = 61, 67, 71$. We show that for primes $p < 20000$, $\mathbb{Q}(C_p)$ is not (stably) rational over $\mathbb{Q}$ except for affirmative 17 primes and undetermined 46 primes. Under the GRH, the generalized Riemann hypothesis, we also confirm that $\mathbb{Q}(C_p)$ is not (stably) rational over $\mathbb{Q}$ for undetermined 28 primes p out of 46.

Summary: Let G be a finite subgroup of $\mathrm{Aut}_k(K(x_1,\ldots,x_n))$ where K/k is a finite field extension and $K(x_1,\ldots,x_n)$ is the rational function field with n variables over K. The action of G on $K(x_1,\ldots,x_n)$ is called quasi-monomial if it satisfies the following three conditions (i) $\sigma(K) \subset K$ for any $\sigma \in G$; (ii) $K^G = k$ where K^G is the fixed field under the action of G; (iii) for any $\sigma \in G$ and $1 \leq j \leq n$, $\sigma(x_j) = c_j(\sigma) \prod_{i=1}^{n} x_i^{a_{ij}}$ where $c_j(\sigma) \in K^\times$ and $[a_{i,j}]_{1 \leq i,j \leq n} \in GL_n(\mathbb{Z})$. A quasi-monomial action is called purely quasi-monomial if $c_j(\sigma) = 1$ for any $\sigma \in G$, any $1 \leq j \leq n$. When $k = K$, a quasi-monomial action is called monomial. The main problem is that, under what situations, $K(x_1,\ldots,x_n)^G$ is rational over k. We determine the rationality when $n = 3$ and the action is purely quasi-monomial except for few cases. As an application, we will show the rationality of some 5-dimensional purely monomial actions which are decomposable.

Summary: We define a semialgebraic set of a real algebraic variety. This notion is stable under regular maps. We prove that an open set of a real algebraic variety with an algebraic boundary is semialgebraic. For a given linear system H on the real algebraic variety X and a semialgebraic set A of X, the set of all the functions in H which is positive semidefinite on A is called a PDS cone of H on A. This cone is semialgebraic. We study the structure of PSD cones.

Summary: We show that, for any non-Nash analytic function, it is impossible to derive its derivatives algebraically, i.e., by using linearity and Leibniz rule finite times. In fact we prove algebraically the impossibility of algebraic computations, by using Kähler differentials. Then the notion of Leibniz complexity of a Nash function is introduced as the minimal number of usages of Leibniz rules to compute the total differential algebraically. We provide general observations and upper estimates on Leibniz complexity of Nash functions.

Summary: Let L be a special very ample line bundle with degree $\deg(L)$ on a smooth projective curve X of large enough genus g. One says that L is normally generated if X is projectively normal under the associated projective embedding. We show that L is normally generated if $\deg(L) \geq 2g - 2s + 1 - 2(s+1)h^1(L)(s \geq 2)$ and X is not a $m(m \leq s)$-sheeted covering.

Summary: Every genus two fibration on a smooth projective surface whose geometric genus is zero has a not necessarily effective divisor whose intersection number with a general fibre equals one. However there exists a genus two fibration with no section on a rational surface.

March 17th (Thu)   Conference Room I

9:30–12:00

19 Tomohiro Iwami $^{\flat}$ Further refinement of Shokurov's projectivity criterion $\cdots\cdots\cdots\cdots$ 15
       (Kyushu Sangyo Univ.)

Summary: The author gave a certain refinement of Shokurov's projectivity criterion, September 2012, based on several theory of semi-log canonical (slc) pairs mainly developed by J. Kollar. On the other hand, after then,projectivity criterion for moduli spaces are rapidly achieved with special regards to the compactification of moduli of varieties of general type. In this talk,the author will report further refinement of Shokurov's projectivity criterion, as succeeding to the author's previous refinement, based on global extendability property associated to certain strata for slc pairs appearing in O. Fujino's recent work.

20 Yoshiaki Fukuma (Kochi Univ.)   On polarized 4-folds (X, L) with $h^0(K_X + 3L) \leq 1$ $\cdots\cdots\cdots\cdots$ 15

Summary: Let (X, L) be a polarized manifold of dimension n. Then we want to study (X, L) with small $h^0(K_X + (n-1)L)$. This topic relates to a conjecture of Beltrametti and Sommese. It has been already studied for $n \leq 3$. So, in this talk, we will consider the case $n = 4$, and we will give a classification of (X, L) with $h^0(K_X + 3L) \leq 1$.

21 Atsushi Noma (Yokohama Nat. Univ.)   Regularity of projected Roth varieties $\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We work over an algebraically closed field of characteristic zero. The purpose here is to study the Castelnuovo–Mumford regularity of projected Roth varieties, which are divisors of rational scrolls of certain types. These varieties appear, as an exceptional case, in the study of finding whether a projective variety is defined by equations of the expected low degree.

22 <u>Tomoo Matsumura</u>   Segre classes in algebraic cobordism $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
       (Okayama Univ. of Sci.)
    Thomas Hudson   (Postech)

Summary: In this talk, we will explain a new result about the Segre classes of vector bundles in algebraic cobordism introduced by Levine–Morel.

23 Yuki Kato (Ube Nat. Coll. of Tech.)   Loop stacks of the affine motivic stack of K-theory $\cdots\cdots\cdots\cdots$ 15

Summary: We introduce the theory of motivic derived algebraic geometry which is obtained by combining Lurie's derived algebraic geometry and Voevodsky's $\mathbb{A}^1$-homotopy theory. By applying the theory of motivic derived algebraic geometry to algebraic K-theory, we define the pointed $\mathbb{P}^1$-loop stack of the affine motivic stack of the K-theory spectrum. By our main result, we obtain a relation between the pointed $\mathbb{P}^1$-loop stack of the K-theory and the logarithmic differential form Bott element on the K-theory.

24 Yu Yasufuku   (Nihon Univ.)   Vojta's conjecture on surfaces, the *abc* conjecture, and Farey sequences
       $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We prove Vojta's conjecture for certain rational surfaces. Moreover, for certain other rational surfaces, we prove that the Vojta's conjecture implies a special case of the *abc* conjecture, whose proof has been announced by Mochizuki. Conversely, we will also show that the *abc* conjecture implies Vojta's conjecture for these surfaces. For the proofs, we will use some properties of Farey sequences.

25 <u>Hiroshi Tsunogai</u> (Sophia Univ.)   Determination of Galois orbits of genus 1 dessins of degree up to 6
    Michihiko Sawa (Sophia Univ.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We calculated the defining equations of all Belyi pairs of genus 1 of degree up to 6, and determined the Galois orbits in these cases. As a result, we show that these Galois orbits can be separated by known Galois invariants of dessins: valency lists, monodromy groups, Nielsen classes, cartographic groups and automorphism groups.

13   Algebra

26   Sachio Ohkawa (Univ. of Tokyo)   The Riemann–Hilbert correspondence for unit F-crystals $\cdots\cdots\cdots\cdots$ 15

Summary: Let X be an algebraic variety defined over a perfect field k of characteristic $p > 0$ with an embedding $X \hookrightarrow P$ into a proper smooth scheme P over the Witt ring $W_n(k)$. We show that the triangulated category of bounded complexes of $\mathcal{D}_{P/W_n(k)}$-modules with unit Frobenius structures supported on X satisfying certain conditions does not depend on the choice of embeddings and this triangulated category is anti-equivalent to the triangulated category of bounded complexes of étale sheaves of $\mathbb{Z}/p^n\mathbb{Z}$-modules with constructible cohomology sheaves and of finite Tor dimension. Our results can be regarded as a generalization of some part of the Emerton–Kisin theory of the Riemann–Hilbert correspondence for unit F-crystals to the case of embeddable algebraic varieties in characteristic p.

27   Yûsuke Okuyama (Kyoto Inst. Tech.)   A potential theoretic characterization of polynomials among rational functions on the Berkovich projective line $\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Let K be an algebraically closed field that is complete with respect to a non-trivial and possibly non-archimedean absolute value $|\cdot|$. Let $\mathsf{P}^1 = \mathsf{P}^1(K)$ be the Berkovich projective line over K, which is a compactification of $\mathbb{P}^1 = \mathbb{P}^1(K)$. A potential theory on P^1 has been developed by Baker–Rumely, Favre–Rivera-Letelier, and Thuillier.

We say a rational function $f \in K(z)$ of degree > 1, which canonically acts on P^1, has a potentially good reduction if there is a point $\mathcal{S} \in \mathsf{P}^1 \setminus \mathbb{P}^1$ such that $\#\bigcup_{n\in\mathbb{N}} f^{-n}(\mathcal{S}) < \infty$, and otherwise, f has no potentially good reductions. In this talk, we will talk about a characterization of polynomials among rational functions, up to rational functions having potentially good reductions as exceptions, in terms of potential theory and dynamics on P^1.

March 18th (Fri)   Conference Room I

9:00–12:00

28   Yasutoshi Nomura $\flat$ On congruences of Apery-like numbers $\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Let A(n), ..., G(n) denote Apery-like numbers in which A(n) and B(n) were introduced by R. Apery. In this talk we state some conjectures about values mod p, p prime, of numbers: X(p-m) for odd p, 1<m<p, X((pp-1)/8) for odd p, X((ppp-e)/9) for p congruent to e mod 3, e=1 or -1, where X denote one of A, B, ..., G.

29   <u>Taka-aki Tanaka</u> (Keio Univ.)   On the algebraically independent subsets of the 'intersection' of the real
      Miho Nakashima (Keio Univ.)   numbers $\mathbb{R}$ and the finite number of the p-adic fields $\mathbb{Q}_p$ $\cdots\cdots\cdots\cdots$ 10

Summary: The main result of this talk asserts the algebraic independence of the limits of fixed sequences of rational numbers with respect to the ordinary absolute value and to the finite number of the p-adic absolute values. We regard such limits, which are indeed the values at a rational point of Mahler functions over $\mathbb{Q}$, as numbers belonging to the 'intersection' of the rational numbers $\mathbb{R}$ and the finite number of the p-adic fields $\mathbb{Q}_p$.

30   <u>Takahisa Kawada</u>   On the unimodality of the coefficients of Gegenbauer polynomials $\cdots$ 15
          (Nagoya Inst. of Tech.)
      Masakazu Yamagishi
          (Nagoya Inst. of Tech.)

Summary: In this talk, we will focus on the unimodal property of the sequence of the coefficients of Gegenbauer polynomials $C_n^\lambda(x)$. We classify the Gegenbauer polynomials with 2 modes in the case $\lambda \in \mathbb{Z}$. This generalizes a result of Belbachir–Bencherif in which they treated (essentially) the cases $\lambda \to 0$ and $\lambda = 1$, i.e., the Chebyshev polynomials of the first and second kind. We also study asymptotic behavior of the mode of $C_n^\lambda(x)$ as a function of n.

31   Yoshio Tanigawa (Nagoya Univ.)   On a restricted divisor problem $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
     Jun Furuya
     (Hamamatsu Univ. School of Medicine)
     <u>Makoto Minamide</u> (Yamaguchi Univ.)

Summary: We shall consider the function $d_\alpha(n)$ which denotes the number of positive divisors k of a positive integer n satisfying $n^\alpha \le k \le n^{1-\alpha}$ $(0 < \alpha < 1/2)$. We deduce the asymptotic formula for $\sum_{n \le x} d_\alpha(n)$, where $\alpha = 1/N$ (N is a positive integer ≥ 3). Moreover, we study the mean square of the error term of the formula.

32   Debika Banerjee   On the first moment of $\Delta_{(1)}(x)$ $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
          (Harish-Chandra Res. Inst.)
     <u>Makoto Minamide</u> (Yamaguchi Univ.)

Summary: We define an arithmetical function $D_{(1)}(n)$ by the coefficients of the Dirichlet series $(\zeta'(s))^2$ $(\mathrm{Re}\, s > 1)$, where $\zeta'(s)$ is the derivative of the Riemann zeta function. We are studying the error term $\Delta_{(1)}(x)$ in the asymptotic formula for $\sum_{n \le x} D_{(1)}(n)$. In this talk, we show some formulas on the first moment of $\Delta_{(1)}(x)$.

33   Yuta Suzuki   (Nagoya Univ.)   On the sum of a prime and a prime power $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: In this talk, we consider the additive problem of expressing positive integers as a sum of a prime and a prime power. In particular, we study the exceptional set for the asymptotic formula of Hardy–Littlewood type in short intervals. As for the asymptotic formula without any restriction, we succeeded in improving the previous result of C. Bauer (1998).

34   Kaneaki Matsuoka (Nagoya Univ.)[♭]   Mean values of higher derivatives of Hardy's function $\cdots\cdots\cdots\cdots\cdots$ 10

Summary: I will talk about Mean values of higher derivatives of Hardy's function

35   Tomoya Machide   On identities involving cyclic sums of regularized multiple zeta values
     (Nat. Inst. of Information / JST ERATO)   each of depth less than 5 $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: In this talk, we give identities involving cyclic sums of regularized multiple zeta values of depth less than 5. As a corollary, we present an extension of Hoffman's theorem for symmetric sums of multiple zeta values for this case.

36   Tomohiro Ooto (Univ. of Tsukuba)   Properties of Diophantine exponents for formal Laurent series over a
                                  finite field $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we study about Mahler's exponent w_n and Koksma's exponent w_n^* for formal Laurent series over a finite field. We give some results related to the spectrum of the function $w_n - w_n^*$ and that of the function w_n at algebraic points.

37   Fumihiro Sato (Rikkyo Univ.[★])   Real analytic automorphic forms arising from certain prehomogeneous
     <u>Kazunari Sugiyama</u>   zeta functions in two variables $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
          (Chiba Inst. of Tech.)
     Takahiko Ueno
     (St. Marianna Univ. School of Med.)

Summary: In this talk, we explain that the zeta functions in two variables attached to a certain prehomogeneous vector space related to quadratic forms are essentially the Mellin transforms of real analytic automorphic forms.

Summary: We show that the dilatation expectation values in conformal quantum mechanics lead to the asymptotic smoothed counting function of the Riemann zeros. We propose a conceivable implication between fundamental building blocks in math and in physics as a prime number in number theory and a scaling dimension in quantum mechanics.

Summary: Let ζ be a primitive nth root of unity. As is well known, $\mathbb{Z}[\zeta + \zeta^{-1}]$ is the ring of integers of $\mathbb{Q}(\zeta + \zeta^{-1})$. We give an alternative proof of this fact by using the resultants of modified cyclotomic polynomials.

14:15–14:30   Presentation Ceremony for the 2016 MSJ Algebra Prize

14:30–15:30   Award Lecture for the 2016 MSJ Algebra Prize

Kazuhiko Kurano (Meiji Univ.)   Intersection theory over local rings and its application to the theory of
                                  Cohen–Macaulay modules

Summary: P.Roberts applied the singular Riemann–Roch theory to commutative ring theory in the 1980s, and affirmatively solved Serre's vanishing conjecture of intersection multiplicities in 1987. On the other hand, Dutta, Hochster and McLauglhin gave a counterexample to the generalized vanishing conjecture in 1985. After that, by the research of Levine, Roberts, Srinivas, etc, we know that such an example are not abnormal. Therefore we should study why such examples exist. Using functions does not vanish like this, we define the notion of numerical equivalence on the K-group $G_0(A)$ of finitely generated modules over a Noetherian local rings A. We prove that $\overline{G_0(A)}$ (the K-group divided by the numerical equivalence) becomes a lattice. Maximal Cohen–Macaulay (MCM) modules play a role of positive elements in this situation. We consider the cone spanned by MCM's in the lattice tensored with the real number field $\mathbb{R}$. Studying this cone, we prove that, for each positive integer r, there exist only finitely many numerical types of MCM's of rank r. Furthermore, there exist only finitely many MCM's of rank 1 over isolated hypersurface singularities of dimension 3. For such rings, we prove that $\overline{G_0(A)} \simeq \mathbb{Z} \oplus \mathrm{Cl}(A)$, in particular $\mathrm{Cl}(A)$ is torsion free. By this formula, we know that, if such a ring is not UFD, there exists an example like Dutta, Hochster and McLauglhin. (Isolated complete intersection singularities of dimension d are UFD if $d \geq 4$. In the case of $d = 2$, there exist examples that have infinitely many MCM ideals.) A part of these results are joint work with Hailong Dao (University of Kansas).

15:40–16:40   Award Lecture for the 2016 MSJ Algebra Prize

Masa-Hiko Saito（Kobe Univ.)   Moduli spaces of connections and differential equations of Painlevé type

16:50–17:50   Award Lecture for the 2016 MSJ Algebra Prize

Hidenori Katsurada   Periods and congruences of automorphic forms and related topics
        (Muroran Inst. of Tech.)

Summary: For a primitive form f for $SL_2(\mathbb{Z})$, let $\widehat{f}$ be a certain lift of f to the space $S_l(\Gamma)$ of cusp forms for some another modular group Γ, that is, let $\widehat{f}$ be a Hecke cuspidal eigenform whose certain L-function is expressed in terms of certain L-functions of f. Then we ask the following question:

(A). Express the ratio $\dfrac{\langle \widehat{f}, \widehat{f} \rangle}{\langle f, f \rangle^e}$ of periods (Petersson products) in terms of special values of certain L-functions of f.

If the answer to (A) is affirmative, the algebraic parts of such L-values are sometimes related with congruence for $\hat{f}$, and in particular we ask the following question:

(B). Characterize primes giving congruence between $\widehat{f}$ and another Hecke eigenform in $S_l(\Gamma)$ not coming from the lift in terms of the invariants in (A).

In this talk, we give an affirmative answer to (A) in the case where $\hat{f}$ is the Duke–Imamoglu–Ikeda lift or the Hermitian Ikeda lift, and to (B) in the case where $\hat{f}$ is the Duke–Imamoglu–Ikeda lift. We also discuss some other related topics.

March 19th (Sat)   Conference Room I

9:30–12:00

40   Saburou Saitoh   Reality of the division by zero $z/0 = 0$ ·························· 10
     (Gunma Univ.⋆/Inst. of Reproducing Kernels)
     Hiroshi Michiwaki (NejiLaw Inc.)
     Masato Yamada
        (Inst. of Reproducing Kernels)

Summary: We will give some clear evidences of the reality of the division by zero $z/0 = 0$ with a fundamental algebraic theorem, and physical and geometrical examples; that is, A) a field structure containing the division by zero, B) by the gradient of the y axis on the (x, y) plane, C) by the reflection $1/\overline{z}$ of z with respect to the unit circle with center at the origin on the complex z plane, and D) by considering rotation of a right circle cone having some very interesting phenomenon from some practical and physical problem.

41   Saburou Saitoh   The concept of divisions (fractionals) in fields containing the division
     (Gunma Univ.⋆/Inst. of Reproducing Kernels)   by zero ··· 10
     Masato Yamada
        (Inst. of Reproducing Kernels)

Summary: We will introduce the concept of the divisions (fractions) in fields containing the division by zero whoes concept is a natural extension of the division by zero $z/0 = 0$ on the complex field $\mathbf{C}$.

42   Osamu Shimabukuro (Nagasaki Univ.)   Modular adjacency algebras and standard representations of wreath
     Akihide Hanaki (Shinshu Univ.)   products of complete graphs ································ 10

Summary: Let λ be a given non-negative integer sequence $(q_1, q_2, \cdots, q_n)$ $(q_i \geq 2, 1 \leq i \leq n)$. (X^λ, S^λ) be an association scheme $K_{q_1} \wr K_{q_2} \wr \cdots \wr K_{q_n}$ defined by a repeated wreath product of complete graph K_{q_i} with q_i vertices for $1 \leq i \leq n$ and F be a field of characteristic p. We consider the structure of this scheme over F.

43   <u>Katsuhiko Kuribayashi</u> (Shinshu Univ.)   On Mitchell's embedding theorem for a quasi-schemoid $\cdots\cdots\cdots\cdots$ 15
      Yasuhiro Momose (Shinshu Univ.)

Summary: A quasi-schemoid is a small category whose morphisms are colored with appropriate combinatorial data. In this talk, Mitchell's embedding theorem for a tame schemoid is discussed. One of main theorems allows us to give a cofibrantly generated model category structure to the category of chain complexes over a functor category with a schemoid as the domain.

44   <u>Hideo Kamimura</u>   On direct projective H-supplemented modules $\cdots\cdots\cdots\cdots\cdots$ 10
              (Fukuoka Inst. of Tech.)
      Isao Kikumasa (Yamaguchi Univ.)
      Yosuke Kuratomi (Yamaguchi Univ.)

Summary: In this talk, we consider a direct projective H-supplemented module which is a generalization of a discrete module. We show that any direct projective H-supplemented module satisfies the exchange property and also that if M_1 and M_2 are direct projective H-supplemented modules, then $M = M_1 \oplus M_2$ is direct projective H-supplemented if and only if M_i is radical M_j-projective ($i \neq j$).

45   <u>Ryo Tabata</u> (Ariake Nat. Coll. of Tech.)   Congruences on irreducible spin characters of symmetric groups $\cdots\cdots$ 10
      Kazuya Aokage
              (Ariake Nat. Coll. of Tech.)

Summary: There are congruences on the irreducible characters of ordinary representations of finite groups. The similar type of relations for irreducible spin characters has not been found, although the spin analogues of many properties to the ones of ordinary representations are expected to appear.
It is known that the row and column in the spin character table $(\zeta_\rho(\lambda))_{\rho,\lambda}$ of the symmetric group S_n are parametrized by strict partitions ρ and odd partitions λ of n, respectively. In terms of this, we will explain some congruences of the spin characters with respect to S_n; $\zeta_\rho(\lambda) \equiv \pm\zeta_\rho(\mu)$ mod p, where the sign depends on the prime number p and its multiplicity that compose different parts in λ and μ. As the result of this, a conjecture will also be presented.

46   Kenichi Shimizu (Nagoya Univ.)   Remarks on non-semisimple modular tensor categories $\cdots\cdots\cdots\cdots$ 15

Summary: We show that a ribbon finite tensor category is a modular tensor category in the sense of Lyubashenko if and only if it is a factorizable braided tensor category in the sense of Etingof, Nikshych and Ostrik. As a consequence, the monoidal center $\mathcal{Z}(\mathcal{C})$ of a finite tensor category $\mathcal{C}$ is a modular tensor category provided that $\mathcal{Z}(\mathcal{C})$ is a ribbon category. Generalizing a result of Kauffman and Radford, we give a necessary and sufficient condition for $\mathcal{Z}(\mathcal{C})$ to be a ribbon category. As an application, we show that $\mathcal{Z}(\mathcal{C})$ is a modular tensor category if $\mathcal{C}$ is spherical in the sense of Douglas, Schommer–Preis and Snyder.

47   Tsunekazu Nishinaka (Univ. of Hyogo)   Uncountable locally free groups and their group rings $\cdots\cdots\cdots\cdots$ 10

Summary: A group is called locally free if all of its finitely generated subgroups are free. Clearly, a locally free group G whose cardinality is countable has always a countably infinite subgroup which is free. In this talk, we extend this fact to the result for the general cardinality case: If G is a locally free group, then G has a free subgroup whose cardinality is the same as that of G itself.

48   Hiroki Shimakura (Tohoku Univ.)   On orbifold constructions of holomorphic vertex operator algebras of
                                          central charge 24 $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: In this talk, I will explain orbifold constructions of holomorphic vertex operator algebras and recent progress on the classification of holomorphic vertex operator algebras of central charge 24.

49   <u>Yusuke Arike</u> (Univ. of Tsukuba)   Affine vertex operator algebras and modular linear differential equations
Masanobu Kaneko (Kyushu Univ.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Kiyokazu Nagatomo (Osaka Univ.)
Yuichi Sakai

Summary: For a C_2-cofinite and rational vertex operator algebra V, there is a modular linear differential equation whose space of solutions contains the space of characters of simple V-modules. In general, the space of solutions of this modular linear differential equation does not always coincide with the space of characters of simple V-modules. In this talk we focus on affine vertex operator algebras and show that the spaces of characters of simple modules of affine vertex operator algebras coincide with the spaces of solutions of modular linear differential equations if the dimensions of the spaces of characters are at most 5.

50   <u>Yusuke Arike</u> (Univ. of Tsukuba)   Vertex operator algebras, minimal models, and modular linear differen-
Kiyokazu Nagatomo (Osaka Univ.)   tial equations of order 4 $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Yuichi Sakai

Summary: In this talk we classify vertex operator algebras with two conditions which arise from Virasoro minimal models. One is that the space of characters of simple modules is the space of solutions of a modular linear differential equation of order 4. The other restricts dimensions of spaces of lower weights of a vertex operator algebra. It is shown that such vertex operator algebras have central charges $c = -46/3$, $-3/5$, $-114/7$, $4/5$, and are isomorphic to minimal models for $c = -46/3$, $-3/5$ and their extensions for $c = -114/7, 4/5$.

14:15–15:45

51   <u>Hiroshi Yamauchi</u>   On types of Miyamoto involutions $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
(Tokyo Woman's Christian Univ.)
Ching Hung Lam (Academia Sinica)

Summary: We will use VOAs generated by 3-dimensional Griess algebras and determine types of Miyamoto involutions associated to simple Virasoro vectors on the commutant subalgebras. We can apply this result to Conway–Miyamoto correspondeces for Monster, Baby–Monster and Fischer 3-transposition groups.

52   <u>Tomohiro Kamiyoshi</u>   Counting hom-orthogonal partial tilting modules associated with valued
        (Matsue Coll. of Tech.)   Dynkin graphs $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
Yoshiteru Kurosawa
        (Numazu Nat. Coll. of Tech.)
Hiroshi Nagase (Tokyo Gakugei Univ.)
Makoto Nagura
        (Nara Nat. Coll. of Tech.)

Summary: We count the number of isomorphism classes of hom-orthogonal partial tilting modules over tensor algebras of valued graph of Dynkin type; that is, of type B_n, C_n, F_4, and G_2. This number is independent on the choice of an oriented modulation of the graph. In our presentation, we will give an explanation on type B_n as an example, with combinatorial detail.

53   Izuru Mori   (Shizuoka Univ.)   Tilting theory for noncommutative quotient singularities $\cdots\cdots\cdots\cdots$ 15
<u>Kenta Ueyama</u> (Hirosaki Univ.)

Summary: In the study of triangulated categories, tilting objects play a key role. They often enable us to realize abstract triangulated categories as concrete derived categories of modules over algebras. In this talk, we show that the derived category of the noncommutative projective scheme associated to a "noncommutative quotient isolated singularity" has a tilting object. Moreover, we also show that the stable category of graded maximal Cohen–Macaulay modules over a "noncommutative Gorenstein quotient isolated singularity" has a tilting object. As a consequence, these categories are triangle equivalent to the derived categories of finite dimensional algebras.

54   Kengo Miyamoto (Osaka Univ.)   A component of the stable AR quiver that contains Heller lattices: the case of the Kronecker algebra over complete discrete valuation ring

. . . . 15

Summary: Let A be the Kronecker algebra over a complete discrete valuation ring $\mathcal{O}$, and we consider the additive category consisting of A-lattices M with the property that $M \otimes \mathcal{K}$ is projective as an $A \otimes \mathcal{K}$-module, where $\mathcal{K}$ is the fraction field of $\mathcal{O}$. We determine the shape of the component of the stable Auslander–Reiten quiver, say $\mathcal{C}$, that contains Heller lattices of vertical modules and horizontal modules of the Kronecker algebra $\mathcal{O}[X,Y]/(X^2, Y^2)$. Consequently, we have $\mathcal{C} = \mathbb{Z}A_\infty$.

55   Ayako Itaba   (Shizuoka Univ.)   Frobenius Koszul algebras and superpotential · 15
     Gahee Kim   (Shizuoka Univ.)

Summary: Let k be an algebraically closed field of characteristic 0, A a graded k-algebra finitely generated in degree 1 and V a k-vector space. For a Frobenius Koszul algebra A satisfying $(\mathrm{rad}\, A)^4 = 0$, we consider the following two conjectures: (I) for every A, there exist a superpotential $w \in V^{\otimes 3}$ and an automorphism τ of V such that the Koszul dual $A^!$ of A and the derivation-quotient algebra $\mathcal{D}(w^\tau)$ of w^τ are isomorphic as graded algebras; (II) for every A, there exists a symmetric algebra S such that A and S are graded Morita equivalent. In this talk, we give partial results for the above two conjectures.

16:00–17:00   Talk Invited by Algebra Section

Pierre Baumann   Paths, polytopes and loops in representation theory
   (Univ. de Strasbourg, CNRS)

Summary: One word has been on purpose omitted from the title of this talk, and this word is crystal. As is well-known nowadays, Kashiwara's theory of crystals is a device that give combinatorial insight into the representation theory of a semisimple Lie algebra. I will focus on two concrete models that incarnate crystals: Littelmann's path models and Anderson and Kamnizter's MV polytopes. I will also focus on two geometric devices that allow to construct the finite-dimensional representations of a semisimple Lie algebra: the geometric Satake correspondence and Lusztig's nilpotent varieties. MV polytopes naturally emerge in both settings, but in two very different fashions. Moreover, Littelmann's path model is closely related to the geometric Satake correspondence. (This connection somehow boils down to the observation that the geometric Satake correspondence makes use of loop groups, and that loops are closed paths.) Through the geometric Satake correspondence, there is thus an indirect connection between Littelmann's paths and MV polytopes. Unfortunately, one does not know yet how to extend this connection to the case of affine Lie algebras, though Littelmann's paths and MV polytopes both exist in this setting.

Geometry

March 16th (Wed)   Conference Room V

9:30–12:00

1 Sampei Hirose (Shibaura Inst. of Tech.)   Discretization of the vortex filament equation · 15
   Jun-ichi Inoguchi (Univ. of Tsukuba)
   Kenji Kajiwara (Kyushu Univ.)
   Nozomu Matsuura (Fukuoka Univ.)
   Yasuhiro Ohta   (Kobe Univ.)

Summary: The local induction equation, or the binormal flow on space curves is a well-known model of deformation of space curves as it describes the dynamics of vortex filaments, and the complex curvature is governed by the nonlinear Schrödinger equation. In this paper, we present its discrete analogue, namely, a model of deformation of discrete space curves by the discrete nonlinear Schrödinger equation.

2 Jun O'Hara   (Chiba Univ.)   Regularization of Riesz energy of submanifolds · 15
   Gil Solanes
   (Univ. Autònoma de Barcelona)

Summary: We consider the regularization of Riesz energy (which is the integration of the distance between a pair of points to some power on the product space) of knots, closed surfaces, and convex bodies in the Euclidean spaces. We study two types of geometric quantities, Hadamard's finite part of the energy and residues of the energy generalized by analytic continuation.

3 Takanari Saotome   The Olivier Rey's inequality on the Heisenberg group · · · · · · · · · · · · · · · 15
            (Shibaura Inst. of Tech.)

Summary: We will study CR analogue of the Olivier Rey's inequality on the Heisenberg group. In confromal setting this inequality is used to prove the existence of the solution to the linearized Yamabe equation. This inequality shows that the energy functional for perturbed Yamabe equation is bounded below, if the perturbation is small enough.
In this article, we identify the Heisenberg group and the standard sphere via the Cayley transformation, and analyze the eigenvalues of the sub-Laplacian Δ_b on S^{2n+1}.

4 Atsufumi Honda   Isometric immersions with singularities between space forms of the same
   (Miyakonojo Nat. Coll. of Tech.)   positive curvature · 10

Summary: In this talk, we give a definition of coherent tangent bundles of space form type, which is a generalized notion of space forms. Then, we classify their realizations in the sphere as a wave front, which is a generalization of a theorem of O'Neill and Stiel: any isometric immersion of the n-sphere into the $(n+1)$-sphere of the same sectional curvature is totally geodesic.

5 Kotaro Kawai (Univ. of Tokyo)   Stabilities of affine Legendrian submanifolds · 15

Summary: We introduce the notion of affine Legendrian submanifolds in Sasakian manifolds and define a canonical volume called the ϕ-volume as odd dimensional analogues of affine Lagrangian (totally real or purely real) geometry. Then we derive the second variation formula of the ϕ-volume to obtain the stability result in some η-Einstein Sasakian manifolds. It also implies the convexity of the ϕ-volume functional on the space of affine Legendrian submanifolds.

6 Kazuyuki Hasegawa (Kanazawa Univ.)   Twistor lifts and factorization for conformal maps of a surface I · · · · · · 15
   Katsuhiro Moriya (Univ. of Tsukuba)

Summary: We consider conformal maps from Riemann surfaces to the four-dimensional Euclidean space. Such surfaces can be studied by twistor theory and quaternionic holomorphic geometry. The purpose of this talk is to give the relation between these theories explicitly and show a factorization of the differential of a conformal map with respect to the multiplication of quaternions.

7 Katsuhiro Moriya (Univ. of Tsukuba)   Twistor lifts and factorization for conformal maps of a surface II · · · · · 15
   Kazuyuki Hasegawa (Kanazawa Univ.)

Summary: In this talk, we take up two classes of conformal maps and apply the canonical factorization. One is constrained Willmore surfaces and the other is minimal surfaces. A factor of a canonical factorization for a conformal map provides a canonical lift of a conformal map. We characterize constrained Willmore surfaces by canonical lifts. A factor of a canonical factorization for a conformal map provides the area element of a conformal map. We give an upper bound of the area of a minimal surface around a branch point.

8 Katsuhiro Moriya (Univ. of Tsukuba)   The Schwarz–Pick theorem for super-conformal maps · · · · · · · · · · · · · · 15

Summary: We factorize a super-conformal map. This factorization connects a super-conformal map with a holomorphic map. Then we obtain the Schwarz–Pick theorem for super-conformal maps. Then we define a distance on the image of a super-conformal map.

9 Hiroshi Iriyeh   (Ibaraki Univ.) [b]   Hamiltonian non-displaceability of Gauss images of isoparametric hyper-
   Hui Ma   (Tsinghua Univ.)   surfaces · 15
   Reiko Miyaoka (Tohoku Univ.)
   Yoshihiro Ohnita (Osaka City Univ.)

Summary: We study the Hamiltonian non-displaceability of Gauss images of isoparametric hypersurfaces in the spheres as Lagrangian submanifolds embedded in complex hyperquadrics.

14:15–16:30

10 Mitsuhiro Imada   Complex contact metric structures on complex hypersurfaces in hy-
      (Ibaraki Nat. Coll. of Tech.)   perkähler manifolds · 10

Summary: We showed that any complex hypersurface in hyperkähler manifolds admits complex almost contact metric structures. In this talk, we show the condition that complex hypersurfaces in hyperkähler manifolds admit complex contact metric structures.

11 Hiroshi Sawai   Structure theorem for Vaisman completely solvmanifolds · · · · · · · · · · · 15
      (Numazu Nat. Coll. of Tech.)

Summary: Locally conformal Kähler manifold is said to be a Vaisman manifold if the Lee form is parallel with respect to Riemannian metric. In this talk, we have the structure theorem for Vaisman completely solvmanifolds.

12 Changhwa Woo   Ricci semi-symmetric hypersurface in complex two-plane Grassmanni-
      (Kyungpook Nat. Univ.)   ans · 15
   Young Jin Suh (Kyungpook Nat. Univ.)
   Doo Hyun Hwang
      (Kyungpook Nat. Univ.)

Summary: We introduce a new notion of Ricci semi-symmetric hypersurface in complex two-plane Grassmannians. Then we give a non-existence property for Ricci semi-symmetric Hopf hypersurfaces in complex two-plane Grassmannians by using simultaneous diagonalization of commuting symmetric operators.

13   Isami Koga   (Kyushu Univ.)   Rigidity of a certain strongly projectively flat map into the complex
Grassmannian · 15

Summary: In this talk, the author defines a strongly projectively flat map, which is a certain holomorphic
map of compact Kähler manifold into the complex Grassmannian manifold. And then, the author show
that if strongly projectively flat maps of compact simply connected homogeneous Kähler manifolds into the
complex Grassmannian is equivariant with respect to the identity component of isometry groups, then they
are rigid.

14   Toru Kajigaya (Osaka City Univ.)   Homogeneous Lagrangian submanifolds obtained by solvable Lie groups
Takahiro Hashinaga   in complex hyperbolic space · 10
(Kitakyushu Nat. Coll. of Tech.)

Summary: Let $M = \mathbb{C}H^n \simeq G/K = SU(1,n)/S(U(1) \times U(n))$ be the complex hyperbolic space and S the
solvable part of the Iwasawa decomposition of G. We classify homogeneous Lagrangian submanifolds in M
which are obtained by the actions of connected Lie subgroups of S.

15   Kazuhiro Suzuki (Nagoya Inst. of Tech.)   Caluculation methods of polynomial representations of non-flat totally
Misa Ohashi (Nagoya Inst. of Tech.)   geodesic surfaces in symmetric spaces of type AI · · · · · · · · · · · · · · · · · · 15
Hideya Hashimoto (Meijo Univ.)

Summary: The famous Hopf fibration $\pi : S^3 \longrightarrow S^2$ over two dimensional sphere S^2 with S^1 fiber is related
to the primitive map of the Cartan imbedding of type AI. Taking the composition of this imbedding and
non-flat totally geodesic imbedding from S^2 to $SU(n)/SO(n)$ of symmetric space of type AI, we give the
explicit representation of this totally geodesic imbedding from S^2 to $SU(n)$.

16   Shinobu Fujii   Quartic Cartan–Münzner polynomials and Casimir operators · · · · · · · · 10
(Oshima Nat. Coll. of Maritime Tech.)

Summary: We are interested in a relationship between quartic Cartan–Münzner polynomials and Casimir
operators of symplectic representations. In this talk, we consider the Cartan–Münzner polynomials obtained
from the isotropy representations of irreducible Hermitian symmetric spaces of rank two, of compact type
and of classical type.

17   Shinji Ohno (Tokyo Metro. Univ.)   Construction of biharmonic homogeneous submanifolds in compact sym-
Takashi Sakai (Tokyo Metro. Univ.)   metric spaces · 15
Hajime Urakawa (Tohoku Univ.⋆)

Summary: In this talk, we obtain new examples of biharmonic homogeneous submanifolds in compact
symmetric spaces whose codimension is two or greater.

18   Makiko Tanaka (Tokyo Univ. of Sci.)   Maximal antipodal subgroups of compact Lie groups II · · · · · · · · · · · · · 15
Hiroyuki Tasaki (Univ. of Tsukuba)

Summary: In the previous MSJ meeting we gave a talk titled "Maximal antipodal subgroups of compact Lie
groups" in which we gave the classifications of maximal antipodal subgroups of the quotient groups $U(n)/\mathbb{Z}_\mu$
and $SU(n)/\mathbb{Z}_\mu$. This talk is a sequel to that. We classify maximal antipodal subgroups of $O(n)/\{\pm 1_n\}$,
$SO(n)/\{\pm 1_n\}$, $Sp(n)/\{\pm 1_n\}$ and G_2.

16:45–17:45   Talk Invited by Geometry Section

Jost-Hinrich Eschenburg   ♭   Extrinsic symmetric spaces
          (Univ. of Augsburg)

Summary: Compact submanifolds of euclidean space with parallel second fundamental form have many astonishing properties. All their isometries extend to the ambient space. They are "extrinsic symmetric", that is invariant under reflection along all of their normal spaces. Thus they form an interesting subclass of symmetric spaces which are linked to other symmetric spaces in several ways. E.g. they form certain isotropy orbits of symmetric spaces, real forms of hermitian symmetric spaces, and midpoint components between center elements of symmetric spaces. Moreover, they are symmetric R-spaces: the action of the isometry group can be enlarged to a noncompact transformation group, like the conformal group on the sphere. They contain their noncompact dual space as an open subset, and the dual isometry group becomes a subgroup of this noncompact group. We try to link all these properties.

March 17th (Thu)   Conference Room V

9:00–10:45

19   Yuto Yamamoto (Univ. of Tokyo)   Geometric monodromy around the tropical limit · · · · · · · · · · · · · · · · · 15

Summary: The main subjects of study in tropical geometry are tropical varieties which are defined as polyhedral complexes which have certain kinds of affine structures. One can associate a tropical variety T to a one-parameter family of complex varieties $\{X_q\}_q$ by tropicalization. It is known that the tropical variety T encodes the information of the behavior of $\{X_q\}_q$ in the limit $q \to \infty$. In this talk, we give a concrete description of the monodromy transformation of $\{X_q\}_q$ around $q = \infty$ in terms of the tropical variety T.

20   Kazushi Kobayashi (Chiba Univ.)   Structure of the mapping cone of a morphism between holomorphic line
                 bundles on $\mathbb{T}^2$ · 15

Summary: We construct the mapping cone of a morphism between holomorphic line bundles on $\mathbb{T}^2$ and discuss it's structure geometrically via the homological mirror symmetry.

21   Satoshi Sugiyama (Univ. of Tokyo)   On an application of the Fukaya categories to the Koszul duality · · · · · 15

Summary: The Koszul duality is known as a duality between certain finite dimensional algebras, called Koszul algebras, which are isomorphic to quotient algebras of path algebras divided by quadratic ideals. In this talk, we construct the Koszul dual $A^!$ of a Koszul algebra A via Fukaya category of a Riemann surface and prove the bounded derived equivalence of them. Finally, we generalize this construction to higher Koszul algebras and obtain their Koszul duals as A_∞-algebras and prove their bounded derived equivalences.

22   Yosuke Morita (Univ. of Tokyo)   Obstructions to the existence of compact manifolds locally modelled on
                 homogeneous spaces · 15

Summary: Extending the result of Kobayashi–Ono, we give necessary conditions, which are written in terms of relative Lie algebra cohomology, for the existence of a compact manifold locally modelled on a given homogeneous space. Applications include both reductive and nonreductive cases.

23   <u>Kenta Hayano</u> (Hokkaido Univ.)   Topology of holomorphic Lefschetz pencils on abelian surfaces · · · · · · · 15
Noriyuki Hamada (Univ. of Tokyo)

Summary: In this talk, we will discuss smooth isomorphism classes of holomorphic Lefschetz pencils on 2-dimensional complex tori. Our main result states that the isomorphism class of such a pencil is uniquely determined by its genus and the divisibility of the homology class of its regular fiber. We will also show some applications of this result to problems on topology of Lefschetz pencils.

24   Yohsuke Imagi   (Kavli IPMU)[♭]   Construction of compact special Lagrangian T^2-conifolds · · · · · · · · · · · · 15

Summary: Special Lagrangian submanifolds are volume-minimizing submanifolds of Calabi–Yau manifolds. I have been studying singularity of them. Compact special Lagrangian T^2-conifolds are theoretically well-studied but their existence has been unproven so far as I know. I have recently proved it using an idea of Mark Haskins and Dominic Joyce. I explain it in the talk. I start with an explicit algebro-geoemtric data and use a gluing technique in non-linear analysis, which goes back to Taubes' result in Yang–Mills gauge theory.

11:00–12:00   Talk Invited by Geometry Section

Hiraku Nozawa (Ritsumeikan Univ.)   On rigidity and characteristic classes of (G, X)-foliations

Summary: We will discuss some rigidity results on foliations with geometric structures. First we make a brief introduction to characteristic classes of foliations, and review some related rigidity results and open problems. The first results of this talk, obtained in a collaboration with Jesús Antonio Álvarez López, are Bott–Thurston–Heitsch type formulas to compute the Godbillon–Vey classes of certain foliated sphere bundles, and a rigidity result on transversely conformally flat foliations on the unit tangent sphere bundles of hyperbolic manifolds. The second results, obtained in a collaboration with Gaël Meigniez, is that Riemannian foliations whose leaves are isometric to a locally symmetric space is diffeomorphic to some standard foliations on double coset spaces of Lie groups.

March 18th (Fri)   Conference Room V

9:30–11:50

25   Takuya Tsuchiya (Waseda Univ.)   Linear stability of the triangular solution for the three problems in
      Kei Yamada   (Kyoto Univ.)   general relativity · 15
      Hideki Asada   (Hirosaki Univ.)

Summary: In this talk, the three problems in general relativity are considered. The three problems are well known that the general solution does not exists. Whereas the collinear solution and the triangular solution exist. We examine the post-Newtonian effects to the linear stability of the triangular solution in two dimensional space using the Einstein–Infeld–Hoffmann equation which is the motion of equation included the general relativistic effects. Furthermore, we will discuss the stability of the triangular solution in three dimensional space.

26   Stefan Andrew Horocholyn   On the Stokes matrices of the tt^*-Toda equations · · · · · · · · · · · · · · · · · 15
              (Tokyo Metro. Univ.)

Summary: We derive a formula for the signature of the symmetrized Stokes matrix $\mathcal{S} + \mathcal{S}^T$ for the tt^*-Toda equations. As a corollary, we verify a conjecture of Cecotti and Vafa regarding when $\mathcal{S} + \mathcal{S}^T$ is positive definite, reminiscent of a formula of Beukers and Heckmann for the generalized hypergeometric equation. The condition $\mathcal{S} + \mathcal{S}^T > 0$ is prominent in the work of Cecotti and Vafa on the tt^* equation; we show that the Stokes matrices $\mathcal{S}$ satisfying this condition are parameterized by a convex polytope.

27   Yutaro Kabata (Hokkaido Univ.)   Recognition problem of plane-to-plane map-germs and its application
                                        to projective differential geometry · 10

Summary: We show useful criteria to determine the types of given plane-to-plane map-germs, which gives a new insight to the classification result given by J. H. Rieger from the viewpoint of recognition problem. We also show the application of our criteria to generic projective differential geometry.

28   Atsushi Yano (Hokkaido Univ.)   On the characterization of second order partial differential equations of several unknown functions $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Differential systems may be regarded as systems of first order differential equations according to Realization Lemma. We characterize the geometric structure of systems of second order partial differential equations of several unknown functions in terms of differential systems.

29   Goo Ishikawa (Hokkaido Univ.)   Affine connections and singularities of tangent surfaces to space curves
Tatsuya Yamashita (Hokkaido Univ.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We give the complete solution to the local diffeomorphism classification problem of generic singularities which appear in tangent surfaces, in as wider situations as possible. We interpret geodesics as lines whenever a (semi-)Riemannian metric, or, more generally, an affine connection is given in an ambient space of arbitrary dimension. Then, given an immersed curve, or, more generally a directed curve which has well-defined tangent directions along the curve, we define the tangent surface by the ruled surface by tangent geodesics to the curve. We give the generic classification of singularities of tangent surfaces and provide the characterizations of singularities.

30   Kazuyoshi Watanabe (Tohoku Univ.)[b]   Zero-points of closed 1-form on topological spaces $\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: A new Lusternik–Schnirelmann type theory for closed 1-forms on smooth manifolds is introduced by M. Farber. This theory aims at finding relations between topology of the zero set of a closed 1-form and homotopical information, based on the cohomology class of the form. And more, it is related to a dynamics of closed 1-form, a homoclinic cycle. A continuous closed 1-form on topological spaces is defined in this theory. I will talk the definition of zero-point of continuous closed 1-form and show that the Lusternik–Schnirelmann type theory is constructed for CW-complexes used by continuous closed 1-form.

31   Tomoshige Yukita (Waseda Univ.)   On the growth rate of cofinite Coxeter groups in hyperbolic 3-space
$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Certain classes of real algebraic integers show up in the study of the growth rates of hyperbolic Coxeter groups. We study the arithmetic property of growth rates of cofinite Coxeter groups in hyperbolic 3-space and prove that their growth rates are always Perron numbers.

32   Yoshifumi Matsuda   Uniform simplicity of Thompson's group T $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
      (Aoyama Gakuin Univ.)

Summary: We show uniform simplicity of Thompson's group T. As a corollary, it follows that Thompson's group T does not admit any unbounded conjugation-invariant norms and any unbounded real-valued quasimorphisms.

33   Takefumi Kondo (Kagoshima Univ.)   Fixed point property for affine actions on a Hilbert space $\cdots\cdots\cdots\cdots$ 15
Shin Nayatani   (Nagoya Univ.)
Hiroyasu Izeki   (Keio Univ.)

Summary: We report that any affine action of a random group in the Gromov graph model on a Hilbert space, satisfying a certain mild-growth condition, has a fixed point.

14:15–16:00

34   Ryosuke Takahashi (Nagoya Univ.)   Asymptotic stability for Kähler–Ricci solitons $\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Kähler–Ricci solitons arise from the geometric analysis, such as Hamilton's Ricci flow, and have been studied extensively in recent years. It is expected that the existence of canonical metrics is closely related to some GIT stability of manifolds. For instance, Donaldson showed that any cscK polarized manifold with discrete automorphisms admits a sequence of balanced metrics and this sequence converges to the cscK metric. In this talk, we explain that a similar result holds for Kähler–Ricci solitons. This generalizes a previous work of Berman–Witt Nyström, and is an analogous result on asymptotic relative Chow stability for extremal metrics obtained by Mabuchi.

35 <u>Ryosuke Takahashi</u> (Nagoya Univ.)   An obstruction to the existence of anti-canonically balanced metrics on
Shunsuke Saito (Univ. of Tokyo)   Fano manifolds $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Anti-canonically balanced metrics are approximations to Kähler–Einstein metrics obtained by means of holomorphic sections of high powers of the anti-canonical line bundle. In this talk, we use the jumping of complex struxtures to produce a new obstruction to the existence of anti-canonically balanced metrics on Fano manifolds. We also discuss some relation to asymptotic Chow stability.

36 Kenta Tottori (Tohoku Univ.)   Calabi's conjecture of the Kähler–Ricci soliton type $\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we discuss Calabi's equation of the Kähler–Ricci soliton type on a compact Kähler manifold. This equation was introduced by Zhu as a generalization of Calabi's conjecture. We give necessary and sufficient conditions for the unique existence of a solution for this equation on a compact Kähler manifold with a holomorphic vector field which has a zero point. We also consider the case of a nowhere vanishing holomorphic vector field, and give sufficient conditions for the unique existence of a solution for this equation.

37 Masaya Kawamura C^α-convergence of the Chern–Ricci flow on elliptic surfaces $\cdots\cdots\cdots$ 15
(Tokyo Metro. Univ.)

Summary: We will study the Chern–Ricci flow on minimal non-Kähler properly elliptic surfaces. These surfaces are compact complex surfaces whose first Betti number is odd, Kodaira dimension is equal to 1, admitting an elliptic fibration $\pi : M \to S$ to a smooth compact curve S and no (-1)-curve in any fibers of π. We will show that a solution of the Chern–Ricci flow is uniformly bounded in the C^1-topology and converges in the C^α-topology on these elliptic surfaces by choosing a special initial metric.

38 Hikaru Yamamoto (Univ. of Tokyo)   On self-similar solutions in gradient shrinking Ricci solitons $\cdots\cdots\cdots$ 10

Summary: There are many results about self-similar solutions in a Euclidean space. In this talk, I introduce the notion of self-similar solutions in a gradient shrinking Ricci soliton, and I talk about some properties of these, which are some kind of generalizations of results of Futaki-Li-Li and Cao-Li established for self-similar solutions in a Euclidean space.

39 Naoyuki Koike (Tokyo Univ. of Sci.)   On the preservability of the curvature-adaptedness along the mean
curvature flow $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we state some results related to the preservability of the curvature-adaptedness along the mean curvature flow starting from a compact curvature-adapted hypersurface in irreducible locally symmetric spaces, where the curvature-adaptedness means that the shape operator and the normal Jacobi operator of the hypersurface commute.

40 <u>Yoshihiro Tonegawa</u> (Tokyo Tech)   Mean curvature flow of grain boundaries $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
Lami Kim   (Tokyo Tech)

Summary: Suppose that $\Gamma_0 \subset \mathbb{R}^{n+1}$ is a closed countably n-rectifiable set whose complement $\mathbb{R}^{n+1} \setminus \Gamma_0$ consists of more than one connected component. Assume that the n-dimensional Hausdorff measure of Γ_0 is finite or grows at most exponentially near infinity. Under these assumptions, we prove a global-in-time existence of mean curvature flow in the sense of Brakke starting from Γ_0. There exists a finite family of open sets which move continuously with respect to the Lebesgue measure, and whose boundaries coincide with the space-time support of the mean curvature flow.

16:15–17:15   Talk Invited by Geometry Section

Eliot Fried   Variational problems for soap films spanning flexible loops
(Okinawa Inst. of Sci. and Tech. Grad. Univ.)

Summary: We discuss recent results concerning the onset of instability for flat circular solutions to the equilibrium equations for a system in which a soap film spans a flexible loop. Adopting a variational approach, we base our analysis on an energy functional which is the sum of a term proportional to the mapping area of the surface representing the soap film and the shape energy of an elastic rod that models the bounding loop. We also discuss a possible strategy for obtaining nontrivial equilibrium configurations by studying a simple and yet physically motivated model for the dissipative evolution of the system, in which internal friction produces a viscoelastic behavior.

March 19th (Sat)   Conference Room V

9:00–10:45

41   Hirotaka Ebisui (Oval Research Center)   4 points collinear theorem among two given circles (Ellipses) $\cdots\cdots\cdots$ 15

Summary: In mathematics history,a lot of Collinear Theorem have apeared.For Example,Papus Therem ,Pascal Theorem, Desargues Theorem,Simson Theorem apear in big year interval. Some of them are some kind of Projective Geometry Theorem,and,these are Basic on Geometry.This time ,We found another kind of Collinear Theorem.This theorem consist of Two circles(2 Ellipses) and 9 lines,and Among them 4points Collinear line apear. We show this theorem composition by Figure 1,2. This figure is very simple,so,we can see Importancy in geometry on it. Anyway, we report New THeorem,here.

42   Kenzi Satô   (Tamagawa Univ.)   A definition of escribed and inscribed simplices of higher dimensional
                                         Euclidean spaces and an expansion of Bevan point theorem $\cdots\cdots\cdots$ 15

Summary: Escribed and inscribed triangles for a triangle on the plane is generalized to a simplex on the n-dimensional Euclidean space with $n \geqq 3$. As an application, we can get Bevan point theorem for a simplex on the n-dimensional Euclidean space.

43   Mitsuhiro Itoh (Univ. of Tsukuba)   Fisher information metric on the space of probability measures and
     Hiroyasu Satoh (Nippon Inst. of Tech.)   distance function $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Let $\mathcal{P}^+(M)$ be the space of probability measures on a compact, connected smooth manifold M. We report that the distance between two probability measures of $\mathcal{P}^+(M)$ with respect to Fisher metric is exactly the arc-length function of the uniquely defined geodesic segment between them. This result is verified by the aid of three propositions, familiar in a finite dimensional Riemannian geometry; Gauss lemma, Existence theorem of totally normal neighborhood and theorem of characterization of curve minimizing length.

44   Mitsuhiro Itoh (Univ. of Tsukuba)   Generalized mean of probability measures and geodesics for Fisher
     Hiroyasu Satoh (Nippon Inst. of Tech.)   information metric $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: The space of all probability measures having positive density function on a compact connected C^∞-manifold M, denoted by $\mathcal{P}^+(M)$, carries the Fisher information metric G. In this talk we consider generalized means, called the α-power mean, of two probability measures and give characterizations of geodesics for G by the normalized geometric mean (0-power mean). Moreover, we also mention the α-geodesics of dualistic structure $(\nabla^{(\alpha)}, \nabla^{(-\alpha)})$ on $(\mathcal{P}^+(M), G)$.

45   Ryunosuke Ozawa (Kyoto Univ.)   Stability of Talagrand's inequality under the concentration topology
     $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Gromov introduced the observable distance between two metric measure spaces. The topology generated by the observable distance function admits a convergence sequence of Riemannian manifolds of unbounded dimension. We talk about the stability of Talagrand's inequality under the topology generated by the observable distance function.

46   Nobuhiro Innami (Niigata Univ.)   Geodesics in a Finsler surface of revolution $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We show the global behavior of geodesics in a Finsler surface of revolution. In particular, we generalize Clairaut's theorem for geodesics in a Riemannian torus of revolution.

47   Kei Kondo （Yamaguchi Univ.）   Differentiable exotic sphere theorem $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Minoru Tanaka   (Tokai Univ.)

Summary: We prove a differentiable sphere theorem for a pair of topological spheres, even for that of exotic ones. Furthermore, we prove that for each exotic sphere Σ^n of dimension $n > 4$, there exists a bi-Lipschitz homeomorphism between the n-dimensional unit standard sphere and Σ^n which is a diffeomorphism except for a single point.

11:00–12:00   Talk Invited by Geometry Section

Asuka Takatsu (Tokyo Metro. Univ.)[b]   Wasserstein/Information geometry and its applications

Summary: Both Wasserstein geometry and the information geometry are geometry on the space of probability measures. On the one hand the Wasserstein geometry is a metric geometry, where the metric heritages the nature of the underlying space; on the other hand, in the Information geometry, we regard the space of probability measures as a Riemannian manifold, where the Riemannian metric with a pair of connection play central roles. Although these two geometries are completely different from each other, they are related to each other.
By the combined use of two geometry, we develop the theory of Wasserstein geometry, Information geometry. We moreover apply both geometry to the analysis of some evolution equations.

Complex Analysis

March 16th (Wed)   Conference Room VIII

9:45–11:45

1   <u>Rintaro Ohno</u> (Tohoku Univ.)   On a Fekete–Szegö-type problem of concave functions $\cdots\cdots\cdots\cdots\cdots$ 15
Toshiyuki Sugawa (Tohoku Univ.)

Summary: In the present talk we discuss coefficients of bounded holomorphic functions with a fixed point inside the unit disk as well as a maximum value problem for a quadratic polynomial. As an application, we are going to apply the results for the Fekete–Szegö-type problem of concave functions with simple pole at some $p \in (0, 1)$.

2   <u>Rintaro Ohno</u> (Tohoku Univ.)$^\flat$ On the second Hankel determinant of concave functions $\cdots\cdots\cdots\cdots\cdots$ 10
Toshiyuki Sugawa (Tohoku Univ.)

Summary: First, we will characterize the coefficient body of order 2 for the class of analytic functions $\varphi(z)$ on $|z| < 1$ with $|\varphi| < 1$ and $\varphi(p) = p$ where $p \in (0, 1)$. Using the obtained results, we will consider the Hankel determinants $H(f) = a_2 a_4 - a_3^2$ of order 2 for normalized concave functions $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$ with a pole at p.

3   Masanori Amano (Tokyo Tech)   A global coordinate of the Teichmüller space related to asymptotic
Jenkins–Strebel rays $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we give a parametrization of asymptotic Jenkins–Strebel rays. It is a kind of global coordinates of the Teichmüller space. For any admissible curve family of a surface, the subset of the boundary of the Teichmüller space which is constructed by pinching of the given curve family can be determined. There exists a homeomorphism of the product of the boundary space and several parameter spaces onto the Teichmüller space such that each family of asymptotic Jenkins–Strebel rays is represented when varies only the parameters.

4   <u>Masashi Kisaka</u> (Kyoto Univ.)   Julia sets appear quasi-conformally in the Mandelbrot set $\cdots\cdots\cdots\cdots$ 15
Tomoki Kawahira (Tokyo Tech)

Summary: If we zoom in a certain part of the Mandelbrot set, we can see a figure J' which is very similar to a certain Julia set. Furthermore, as we zoom in the middle part of J', we can see a certain nested structure which is similar to the iterated preimages of J' by z^2 and finally a small Mandelbrot set M' appears. We explain how to formulate this phenomena and show that this actually occurs. Also we show that this kind of nested structure exists in J_c for $c \in M'$.

5   Tomoki Kawahira (Tokyo Tech)   From Cantor to Misiurewicz along parameter rays $\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider degeneration process from a Cantor Julia set to a Misiurwicz Julia set in the family of quadratic maps. We give an estimate of the speed of the holomorphic motion when the parameter moves along a pre-periodic parameter ray of the Mandelbrot set. Then we will conclude that such a particular motion dynamically converges. (joint with Yi-Chiuan Chen)

6   Tomoki Kawahira (Tokyo Tech)   The Riemann hypothesis and holomorphic index in complex dynamics
$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We give an interpretation of the Riemann hypothesis in terms of complex and topological dynamics. For example, the Riemann hypothesis is affirmative and all zeros of the Riemann zeta are simple if and only if a certain meromorphic function has no attracting fixed point. To obtain this, we use holomorphic index (residue fixed point index), which characterizes local properties of fixed points in complex dynamics.

7   Hiroki Sumi   (Osaka Univ.)   Hausdorff dimension of the Julia sets of postcritically bounded polyno-
mial semigroups and transversality condition $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider the dynamics of 2-generator hyperbolic polynomial semigroups with bounded planar postcritical set. We show that for the parameter $f = (f_1, f_2)$ in the boundary of connectedness locus, there exists an open neighborhood V of f such that for a.e. $g = (g_1, g_2) \in V$ with respect to the Lebesgue measure on V, the Hausdorff dimension of the Julia set of the semigroup generated $\{g_1, g_2\}$ is equal to the critical exponent of the Poincare series of (g_1, g_2). Note that we do not know whether for such a $g \in V$, the open set condition is satisfied or not.

14:15–15:05

8   <u>Kentarou Itou</u>   (Meijo Univ.)   On weighted polynomial approximation by the de la Vallée Poussin
Ryozi Sakai   (Meijo Univ.)   mean $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Noriaki Suzuki   (Meijo Univ.)

Summary: We study polynomial approximation by the de la Vallée Poussin mean $v_n(f)$ for exponential weight $w(x) = \exp(-Q(x))$ on whole real line. On a proof of this theorem, L^p boundedness of the de la Vallée Poussin mean plays an important role. We also discuss estimates of derivatives of the de la Vallée Poussin mean and approximation for absolutely continuous functions.

9   <u>Yoŝuke Hishikawa</u> (Gifu Univ.) $L^{(\alpha)}$-conjugates on parabolic Bloch spaces $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Masaharu Nishio (Osaka City Univ.)
Yamada Masahiro (Gifu Univ.)

Summary: The parabolic Bloch space is the set of all solutions u of the parabolic operator $L^{(\alpha)}$ with the finite Bloch norm $\|u\|_{\mathcal{B}_\alpha(\sigma)}$. In this talk, we introduce a notion of $L^{(\alpha)}$-conjugates, and investigate several properties of $L^{(\alpha)}$-conjugates on parabolic Bloch spaces.

10   Kiyoki Tanaka (Osaka City Univ.)   Biharmonic Bergman kernel of an external domain $\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider the weighted biharmonic Bergman space on an external domain. The weighted biharmonic Bergman space has the reproducing kernel, which is called the weighted biharmonic Bergman kernel. In this talk, we introduce the form of the weighted biharmonic Bergman kernel of an external domain.

15:25–16:25   Talk Invited by Complex Analysis Section

Johannes Jaerisch (Shimane Univ.)   Hausdorff dimension of the Julia sets of non-hyperbolic polynomial
semigroups and the method of inducing

Summary: There is a rich interplay between the geometric and dynamical properties of Julia sets of semigroups of holomorphic maps on the Riemann sphere $\hat{\mathbb{C}}$. In the 1970s, R. Bowen characterised the Hausdorff dimension of the limit sets of certain Fuchsian groups in terms of the dynamical notion of topological pressure. This formula, which is referred to as Bowen's formula, has been generalized to Julia sets of rational maps on $\hat{\mathbb{C}}$ by D. Sullivan, and it is still an active area of research.
After a brief introduction of the necessary preliminaries on Bowen's formula, we will formulate a new version of Bowen's formula for the Hausdorff dimension of the Julia sets of certain non-hyperbolic postcritically bounded polynomial semigroups satisfying the open set condition. The key to investigate these semigroups is to develop a fractal theory for an associated infinitely generated hyperbolic subsemigroup and to use the method of inducing. By using this method we have a strong tool to analyze the geometric and dynamical properties of various non-hyperbolic semigroups of holomorphic maps on the Riemann sphere. We will discuss the underlying ideas and concepts from ergodic theory and complex analysis. This is a joint work with H. Sumi.

16:45–17:45   Talk Invited by Complex Analysis Section

Yoshihiko Matsumoto (Tokyo Tech)   Deformations of complete Einstein metrics on strictly pseudoconvex domains

Summary: We discuss a certain construction of new complete Einstein metrics on a smoothly bounded strictly pseudoconvex domain Ω of a Stein manifold. S. Y. Cheng and S. T. Yau showed in 1980 that one obtains a complete Kähler–Einstein metric on Ω with negative scalar curvature by solving the complex Monge–Ampère equation. The approach that we take here is to deform this Cheng–Yau metric by an application of the inverse mapping theorem, which generalizes the work of O. Biquard on the deformations of $\mathbb{C}H^n$ (and the corresponding work of R. Graham and J. Lee for the real case). Recasting the problem into the question of vanishing of an L^2-cohomology and taking advantage of the "asymptotic complex hyperbolicity" of the Cheng–Yau metric at the boundary, we establish the possibility of such a deformation when the dimension of Ω is at least 3. I intend to make this talk so organized that it also works as an introduction to geometric analysis on asymptotically complex hyperbolic manifolds.

March 17th (Thu)   Conference Room VIII

9:45–11:50

11   Kouichi Kimura   Homogeneous pseudoconvex Reinhardt domains in $\mathbf{C}^3$ $\cdots\cdots\cdots\cdots$ 15

Summary: A homogeneous Reinhardt domain in $\mathbf{C}^*$ coinsides with $\mathbf{C}^*$. Generalizing this fact, we showed that a homogeneous pseudoconvex Reinhardt domain in $(\mathbf{C}^*)^n$ coinsides with $(\mathbf{C}^*)^n$. Conversely, we investigate pseudoconvex Reinhardt domains containing the origin in $\mathbf{C}^3$ this time, and we decide Liouville foliations which can be defined on them. From this, when the preceeding domains are homogeneous, we classify these domains by means of algebraic equivalence and determine thier canonical forms.

12   Atsushi Yamamori (Nagoya Univ.)   Yet another proof of Poincaré's theorem on the inequivalence of the unit ball and the polydisk $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: This talk gives a concise proof of a classical Poincaré's theorem which asserts that the unit ball $\mathbb{B}^n$ and the polydisk $\mathbb{D}^n$ are not biholomorphic equivalent for any $n > 1$.

13   Tatsuhiro Honda   Radius of univalence and related problems in complex Hilbert spaces
    (Hiroshima Inst. of Tech.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Ian Graham (Univ. of Toronto)
Hidetaka Hamada
    (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.)
Kwang Ho Shon (Pusan Nat. Univ.)

Summary: There are various results related to radius of univalence, parametric representation, starlikeness or convexity for holomorphic mappings on the Euclidean unit ball in $\mathbb{C}^n$. In this talk, we are concerned with certain radius problems for holomorphic mappings on the unit ball in a complex Hilbert space.

14   Filippo Bracci   Variation of Loewner chains, extreme and support points in the class
    (Univ. di Roma"Tor Vergata") S^0 in several complex variables $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Ian Graham (Univ. of Toronto)
Hidetaka Hamada
    (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.)

Summary: In this talk, we introduce a family of normalized Loewner chains in $\mathbb{B}^n$, which we call "geräumig"—spacious—which allow to construct, by means of suitable variations, other normalized Loewner chains which coincide with the given ones from a certain time on. We apply our construction to the study of support points, extreme points in the class S^0 of mappings admitting parametric representation.

15   Yukitaka Abe (Univ. of Toyama)   Cohomology groups of sections of homogeneous line bundles over a toroidal group $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We completely determine cohomology groups of sections of homogeneous line bundles over a toroidal group.

16   Atsushi Atsuji   (Keio Univ.)   Nevanlinna type theorems for meromorphic functions on negatively curved Kähler manifolds $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We give a second main theorem of Nevanlinna theory on complete negatively curved Kähler manifolds. It's remainder term depends only on Ricci curvature of the manifolds.

17   <u>Masanori Adachi</u> (Tokyo Univ. of Sci.)   Curvature restrictions for Levi-flat real hypersrufaces in complex projective planes $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
     Judith Brinkschulte (Univ. Leipzig)

Summary: We study curvature restrictions of Levi-flat real hypersurfaces in complex projective planes, whose existence is in question. We focus on its totally real Ricci curvature, the Ricci curvature of the real hypersurface in the direction of the Reeb vector field, and show that it cannot be greater than -4 along a Levi-flat real hypersurface. We rely on a finiteness theorem for the space of square integrable holomorphic 2-forms on the complement of the Levi-flat real hypersurface, where the curvature plays the role of the size of the infinitesimal holonomy of its Levi foliation.

18   Takeo Ohsawa (Nagoya Univ.) [b]   An optimal L^2 extension theorem on $\mathbb{C}^n$ $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: In view of the proofs of optimal L^2 extension theorems due to Błocki and Guan–Zhou, I could find a straightforward proof of their optimal L^2 extension theorem (to appear in Nagoya Math. J.). Applying this method, an optimal L^2 extension theorem will be shown on $\mathbb{C}^n$.

13:15–14:20

19   <u>Shinichi Tajima</u> (Univ. of Tsukuba) [b]   Limiting tangent spaces and local cohomology $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
     Katsusuke Nabeshima
             (Univ. of Tokushima)

Summary: Limiting tangent spaces associated with hypersurface isolated singularities are considered. A new effective method for computing limiting tangent spaces is described. The key is the use of the concept of parametric local cohomology system.

20   <u>Masataka Tomari</u> (Nihon Univ.) [b]   On maximal ideal cycle of normal two-dimensional graded singularity whose centeral curve is a nonsingular rational curve $\cdots\cdots\cdots\cdots\cdots$ 15
     Tadashi Tomaru (Gunma Univ.)

Summary: We study the maximal ideal cycle and the fundamental cycle for normal two-dimensional singularities with star-shaped resolution where the central curve is a nonsingular rational curve. Our interest is the identification of these, when the cordinated ring of singularity do not have a homogeneous reduced element in the minimal degree.

21   <u>Katsusuke Nabeshima</u>   A computation method of Bruce–Roberts' Milnor numbers with parameters $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
             (Univ. of Tokushima)
     Shinichi Tajima (Univ. of Tsukuba)

Summary: Logarithmic vector field of a hypersurface is an important object with many applications. However, its computation is hard, as a number of open questions and challenges indicate. In this talk, logarithmic vector field associated with hypersurface isolated singularities are considered in the context of symbolic computation. As an application, an algorithm for computing Bruce–Roberts' Milnor numbers with parameters is introduced, too.

22   <u>Katsusuke Nabeshima</u>   Computing holonomic D-modules and b-functions with parameters $\cdots$ 15
                    (Univ. of Tokushima)
Katsuyoshi Ohara (Kanazawa Univ.)
Shinichi Tajima (Univ. of Tsukuba)

Summary: Let f be a polynomial with n variables. In this talk an annihilater ideal $Ann(f^s)$ is considered in $D_X[s]$. A computation method of $Ann(f^s)$ is introduced by using Poincaré–Birkhoff–Witt algebra. As an application, an algorithm for computing b-fucntions with parameters, is given, too.

Functional Equations

March 16th (Wed)　　Conference Room Ⅲ

9:30–12:00

1　Katsumi Matsuda (Tokai Univ.)　On the exact figure eight solution of the eqal-mass planar 3-body problem $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: I describe a new constructon method of planar choreographic three bodies, whose center of mass is the original point and whose angular momentum is constantly zero. Moreover, I explain a trial toward the exact figure eight solution of the equal-mass planar 3-body problem.

2　Takuya Yamashiro (Kumamoto Univ.) ♭　Holonomic system singular along quartic curve with three cusps $\cdots\cdots$ 12
　Yoshishige Haraoka (Kumamoto Univ.)

Summary: We consider the problem to construct the regular holonomic system singular along a prescribed curve. As a curve, we choose a irreducible quartic curve with three cusps. We classified the irreducible representations of the fundamental group of the complement of the curve. The irreducible representations exist only in the case dimension two. Then we construct a corresponding rank two regular holonomic system explicitly. It turns out that we need an appearent singular locus.

3　Masafumi Yoshino (Hiroshima Univ.)　Application of Borel summability to small denominator problem $\cdots\cdots$ 12

Summary: Convergence of formal series solution of some semilinear partial differential equation in the case of small denominators is shown without assuming the Diophantine condition. Instead of the Diophantine condition we make use of Borel summability with respect to a certain parameter introduced in the equation in order to show the convergence.

4　Hikaru Igarashi　(Chuo Univ.)　New Airy-type solutions of the ultradiscrete Painlevé II equation with
　Shin Isojima　　(Hosei Univ.)　parity variables $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
　Kouichi Takemura (Chuo Univ.)

Summary: The q-difference Painlevé II equation admits special solutions written in terms of determinant whose entries are the general solution of the q-Airy equation. An ultradiscrete limit of the special solutions is studied by the procedure of ultradiscretization with parity varialbes. Then we obtain new Airy-type solutions of the ultradiscrete Painlevé II equation with parity variables, and the solutions have richer structure than the known solutions.

5　Mika Tanda　　　The Voros coefficients of the Gauss hypergeometric differential equation
　(Kwansei Gakuin Univ./Kinki Univ.)　with a large parameter $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
　Toshinori Takahashi　(Kinki Univ.)
　Takashi Aoki　　(Kinki Univ.)

Summary: We consider the Gauss hypergeometric differential equation with a large parameter from the viewpoint of the exact WKB analysis. We introduce a large parameter η in the parameters of the hypergeometric equation as general linear forms of η. We define the Voros coefficient of the Gauss hypergeometric differential equation with a large parameter for the origin. Explicit form of the Voros coefficient is given. Moreover, we compute the Borel sums of the Voros coefficient in each Stokes region.

6　Toshinori Takahashi (Kinki Univ.)　The hypergeometric function with a large parameter and WKB solutions
　Mika Tanda　　　$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
　(Kwansei Gakuin Univ./Kinki Univ.)
　Takashi Aoki　　(Kinki Univ.)

Summary: We consider the Gauss hypergeometric differential equation and its WKB solutions. These solutions are Borel summable under suitable conditions. We investigate the relation between the hypergeometric function and the Borel resummed WKB solutions.

7   Patrick van Meurs (Kanazawa Univ.)   Discrete-to-continuum convergence of interacting particle systems $\cdots$ 12

Summary: We study the many-particle limit of an interacting particle system. The velocities of the particles are described by a non-linear function which depends on all particle positions. The resulting system of first-order ODEs has a gradient flow structure with respect to an energy functional E_n, where n is the number of particles. Our first main result states Γ-converge of the energy functionals E_n as $n \to \infty$ to the Γ-limit E. The functional E is defined on the space of measures, equipped with the 2-Wasserstein topology. These measures represent the particle density. Our second result guarantees the convergence of the related gradient flows.

8   Masakazu Onitsuka
        (Okayama Univ. of Sci.)
Satoshi Tanaka (Okayama Univ. of Sci.)   Attractivity, rectifiability and non-rectifiability of solutions for two-dimensional linear differential systems $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider a nonautonomous linear differential system $x' = y$, $y' = -x - h(t)y$, where $h \in C[t_0, \infty)$. The aim of this talk is to establish a necessary and sufficient condition for every nontrivial solution to be rectifiable. Moreover, a necessary and sufficient condition for the zero solution to be attractive is also presented.

9   Masashi Toyoda (Tamagawa Univ.)
Toshiharu Kawasaki (Tamagawa Univ.)   Note on Knežević–Miljanović's theorem in a class of fractional differential equations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: In this talk, we show the existence and uniqueness of solutions of the Cauchy problem in a class of singluar fractional differential equations.

10   Hiroyuki Usami   (Gifu Univ.)[♭]   Asymptotic forms of slowly decaying solutions of a kind of Lanchester-type system $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: It is shown that some class of Lanchester type systems have slowly decaying solutions. In this talk, we give the asymptotic forms of such solutions near the infinity.

14:15–16:15

11   Tomoyuki Tanigawa (Kumamoto Univ.)   Asymptotic behavior of positive solutions of second order half-linear functional differential equations with deviating arguments of mixed type $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: It is well known that there is the qualitative similarity between linear differential equations and half-linear differential equations. Therefore, in our previous paper we proved how useful the regularly varing functions were for the study of nonoscillation and asymptotic analysis of the half-linear functional differential equation with both retarded and advanced arguments. Aim of this talk is to establish a sharp condition of the existence of generalized regularly varying solutions of differential equations with deviating arguments of mixed type.

12   Hideaki Matsunaga (Osaka Pref. Univ.)
Satoru Murakami
Yutaka Nagabuchi
        (Okayama Univ. of Sci.)
Nguyen Van Minh (Univ. of Arkansas)   Center manifold theorem and stability for integral equations with infinite delay $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: For autonomous integral equations with infinite delay, we establish existence, local exponential attractivity and other properties of center manifold by means of the variation-of-constants formula in the phase space. And then we investigate stability properties of the zero solution of certain nonlinear scalar integral equation in the critical case.

13　Tetsutaro Shibata (Hiroshima Univ.)　　Inverse bifurcation problems for the equation of population model ···· 12

Summary: We consider the bifurcation curves for the equation which is related to the population model. Let $\lambda > 0$ be a bifurcation parameter, and $m, k > 0$ be the unknown constants which control the growth of the number of population. We determine the unknown constants m, k from the asymptotic behavior of the bifurcation curves $\lambda(\alpha)$, where $\alpha = \|u_\lambda\|_\infty > 0$.

14　Shingo Takeuchi　　　　　　Multiple-angle formula of generalized trigonometric functions and its
　　　(Shibaura Inst. of Tech.)　　applications to the p-Laplacian ································· 12

Summary: Generalized trigonometric functions with two parameters were introduced by Drábek and Manásevich in 1999 to study an inhomogeneous eigenvalue problem of p-Laplacian. Concerning these functions, no multiple-angle formula has been known except for the classical case and a special case discovered by Edmunds–Gurka–Lang in 2012, not to mention addition theorems. In this talk, we will present a new multiple-angle formula which is established between two kinds of generalized trigonometric functions, and apply the formula to some problems for p-Laplacian.

15　Masato Hashizume (Osaka City Univ.)　　Minimization problem on the Hardy–Sobolev inequality ············ 12

Summary: We consider a minimization problem related to the Hardy–Sobolev inequality on a bounded domain. The attainability of the best constant of the inequality is affected by the position of the singularity. In this talk, we consider the interior singularity case and we prove that the attainability of the best constant changes depending on the scale of the domain.

16　Megumi Sano (Osaka City Univ.)　　Scale invariance structures of the critical and the subcritical Hardy
　　Futoshi Takahashi (Osaka City Univ.)　　inequalities and their improvements ··························· 12

Summary: First we establish an improved subcritical Hardy inequality on the whole space. This also enables us to improve the sharp version of the critical Hardy inequality on a ball. A key ingredient is a new transformation connecting the Hardy inequalities in critical and subcritical cases. By using the transformation, we reveal a relationship between the scale invariance structures of those Hardy inequalities.

17　Megumi Sano (Osaka City Univ.)　　Scaling invariant Hardy type inequalities with non-standard remainder
　　　　　　　　　　　　　　　terms ··· 12

Summary: We consider the Rellich inequality on the whole space and the critical Hardy inequality on a ball. These two Hardy type inequalities can be refined by adding remainder terms. Our remainder terms are expressed by a distance from the families of the "virtual" extremals. A key ingredient is the critical Hardy inequality on the whole space which was proved by Machihara, Ozawa, and Wadade in 2015.

16:30–17:30　　Talk Invited by Functional Equations Section

Mitsuru Shibayama (Kyoto Univ.)　　A variational approach to periodic orbits in the n-body problem

Summary: In recent years variational methods have been successfully applied to the N-body problem to prove the existence of periodic solutions. In this talk we outline ideas and proofs for some recent progresses, and show our results.

March 17th (Thu)　　Conference Room Ⅲ

9:30–12:00

18　Atsushi Kosaka (Osaka City Univ.)　　Singular perturbation of semilinear Neumann problems on non-smooth
　　　　　　　　　　　　　　　domains ·· 12

Summary: In this talk we consider singular perturbation of semilinear Neumann problems, and investigate the asymptotic behavior of least-energy solutions. On domains with smooth boundary, it is known that a least-energy solution concentrates at the point where the mean curvature is attained. We consider similar problems on cone-like domains. Then a least-energy solution concentrates at the vertex which has the least angle.

19 <u>Daisuke Naimen</u> (Tokyo Tech)   Two solutions for the Kirchhoff type elliptic problem with critical
    Masataka Shibata (Tokyo Tech)   nonlinearity in high dimension $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider the Kirchhoff type elliptic problem involving the critical Sobolev exponent in high dimension. We show the existence of two positive solutions of the problem. A typical difficulty occurs because of the lack of the compactness of the associated Sobolev embedding. In addition, the Kirchhoff type nonlocal coefficient induces the multiplicity of solutions of the limiting problem. This causes a serious difficulty in the concentration compactness argument. We overcome this by new techniques utilizing the fibering map method combined with the description of Palais–Smale sequences.

20 <u>Norihisa Ikoma</u> (Kanazawa Univ.)   Existence of positive solutions for nonlinear elliptic equations involving
    Patricio Felmer (Univ. de Chile)   the Pucci operators $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: This talk concerns with the existence of positive solutions for nonlinear elliptic equations involving the Pucci operators and potential functions. Under suitable conditions on the potential functions, we shall give the existence or the nonexistence result of positive solutions which decay at infinity.

21 <u>Kotaro Watanabe</u>   Uniqueness of positive solutions of Brezis–Nirenberg problems on $\mathbb{H}^n$
        (Nat. Defense Acad. of Japan) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
    Naoki Sioji (Yokohama Nat. Univ.)

Summary: We study the uniqueness of positive solutions of $\Delta_{\mathbb{H}^n}\varphi + \lambda\varphi + \varphi^p = 0$ on the n-dimensional hyperbolic space $\mathbb{H}^n$, where $n \in \mathbb{N}$ with $n \geq 2$, $\lambda \leq (n-1)^2/4$, and p is subcritical or critical. In particular, in the case $n = 2$, we improve Mancini and Sandeep's uniqueness result.

22 Ryuji Kajikiya   (Saga Univ.)   Nonradial positive solutions of the p-Laplace Emden–Fowler equation
    $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We study the p-Laplace Emden–Fowler equation with a radial and sign-changing weight in the unit ball under the Dirichlet boundary condition. We show that no least energy solution is radially symmetric. Moreover, we prove in the one dimensional case that a positive solution is unique under a suitable assumption of the weight function.

23 Satoshi Tanaka (Okayama Univ. of Sci.)   Morse index and symmetry-breaking bifurcation for the one-dimensional
    Liouville type equation $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: The one-dimensional Liouville type equation is considered. The Morse indexes of even solutions are studied, and the existence of at least one symmetry-breaking bifurcation is shown.

24 <u>Tomohiko Sato</u> (Nihon Univ.)   Morse indices of the solutions to the Liouville–Gel'fand problem with
    Takashi Suzuki (Osaka Univ.)   variable coefficients $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider a sequence of blow-up solutions to the Liouville–Gel'fand problem with variable coefficients, and their linearized eigenvalue problems. We show the precise coincides of the Morse indices of the solution and the critical point of the Hamiltonian of the singular limit. The results are natural extensions of those for constant coefficients.

25 <u>Masaaki Mizukami</u>   Boundedness in a two-species chemotaxis system with any chemical
        (Tokyo Univ. of Sci.)   diffusion $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
    Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This talk is concerned with boundedness of solutions to a two-species chemotaxis system. Negreanu and Tello studied the system with "non"-diffusive chemoattractant in 2015 and dealt with "slow" chemical diffusion in 2014. The main result asserts existence of bounded global-in-time solutions to the system with "any" chemical diffusion.

26　<u>Tatsuki Mori</u> (Ryukoku Univ.)　All global bifurcation curves for a cell polarization model ·········· 12
Kousuke Kuto
　　　(Univ. of Electro-Comm.)
Tohru Tsujikawa (Univ. of Miyazaki)
Shoji Yotsutani (Ryukoku Univ.)

Summary: We have investigated a stationary limiting problem for a cell polarization model proposed by Y. Mori, A. Jilkine and L. Edelstein-Keshet (SIAM J.Appl Math, 2011). We give answers to the existence, nonexistence, direction, connection of all global bifurcation curves including the unique existence of the secondary bifurcation point. We also clarify all limiting profiles of solutions as a diffusion coefficient tends to 0.

13:30–14:30　Award Lecture for the 2015 MSJ Analysis Prize

Kazunaga Tanaka (Waseda Univ.)　Singular perturbation problems for nonlinear elliptic equations —variational methods for degenerate setting—

Summary: We consider the existence of solutions for nonlinear elliptic problems. Especially we are interested in peaked (or bump) soluitons. In this talk, we introduce a variational approach together with applications. Our approach can be applicable to a wide class of nonlinear elliptic problems.

<div align="center">

March 18th (Fri)　　Conference Room Ⅲ

</div>

9:30–12:00

27　<u>Tsubasa Itoh</u>　(Tokyo Tech)　The growth of the vorticity gradient for the two-dimensional Euler flow
Hideyuki Miura　(Tokyo Tech)　on domains with a corner ··· 10
Tsuyoshi Yoneda (Tokyo Tech)

Summary: In this talk, we consider the two-dimentional Euler equation on domains with a coner. We are concerned with the question how fast the maximum of the gradient of the vorticity can grow as $t \to \infty$. It is shown that the growth of the vorticity gradient is depending on the angle of the sector.

28　Naoki Tsuge　　(Gifu Univ.)　Cauchy problem for the compressible Euler equation with an outer force
　　　　　　　　　　　　　　·· 12

Summary: We study the compressible Euler equation with an outer force. The global existence theorem has been proved in many papers, provided that the outer force is bounded. However, the stability of their solutions has not yet been obtained until now. Our goal in this paper is to prove the existence of a global solution without such an assumption as boundedness. Moreover, we deduce a uniformly bounded estimate with respect to the time. This yields the stability of the solution. When we prove the global existence, the most difficult point is to obtain the bounded estimate for approximate solutions. To overcome this, we employ an invariant region, which depends on both space and time variables. To use the invariant region, we introduce a modified difference scheme. To prove their convergence, we apply the compensated compactness framework.

29　<u>Hirotada Honda</u>　　(NTT)　On maximal attractor and inertial set for Kuramoto–Sakaguchi equation
Atusi Tani　　(Keio Univ.*)　·· 12

Summary: We show the existence of the maximal attractor and inertial set of the Kuramoto– Sakaguchi equation.

30 <u>Masatoshi Okita</u>   Asymptotic profiles for the compressible Navier–Stokes equations in the
      (Kurume Nat. Coll. of Tech.)   whole space $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
    Yoshiyuki Kagei (Kyushu Univ.)

Summary: We will consider the large time behavior of the strong solutions of the compressible Navier–Stokes equation in whole space. We show asymptotic profiles of nonlinear term. Kawashima–Matsumura–Nishida ('79) and Hoff–Zumbrun ('95) proved that the solution is time-asymptotic to the one of the linearized problem. In this talk we will show the second-order asymptotics of strong solution.

31 Kazuyuki Tsuda (Kyushu Univ.)   Time periodic problem for the compressible Navier–Stokes equation on
                                     $\mathbb{R}^2$ with antisymmetry $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider the existence of a time periodic solution to the compressible Navier–Stokes equation on the whole space. We show the existence when the space dimension is equal to 2 for sufficiently small time periodic external force with antisymmetry. The proof is based on the spectral properties of the time-T-map associated with the linearized problem around the motionless state with constant density in some weighted L^∞ and Sobolev spaces. We also obtain the existence of a stationary solution for the stationary problem on $\mathbb{R}^2$ for small external force with the antisymmetry.

32 <u>Yuko Enomoto</u> (Shibaura Inst. of Tech.)[b]   Some global well-posedness results for the compressible barotropic vis-
    Yoshihiro Shibata (Waseda Univ.)   cous fluid flow $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: I would like to talk about some asymptotic behaviors of Matsumura–Nishida solutions in the study of compressible barotropic viscous fluid flow.

33 <u>Yoshiyuki Kagei</u> (Kyushu Univ.)   On Chorin's method for stationary solutions of the Oberbeck–Boussinesq
    Takaaki Nishida (Kyoto Univ.)   equation $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: A. Chorin proposed an artificial compressible system to find stationary solutions of the Oberbeck–Boussinesq equation. The proposed system is obtained by adding the time derivative of the pressure $\epsilon\partial_t p$ to the continuity equation of the Oberbeck–Boussinesq equation, where $\epsilon > 0$ is a small parameter. If the solution of the artificial compressible system converges to a stationary solution, then the stationary solution is also a stationary solution of the Oberbeck–Boussinesq equation. In this talk a mathematical justification of Chorin's method is considered. It will be shown that if a stationary solution of the Oberbeck–Boussinesq equation is asymptotically stable and the velocity field of the stationary solution satisfies some smallness condition, then it is also asymptotically stable as a stationary solution of the artificial compressible system for sufficiently small ϵ.

34 Hajime Koba   (Waseda Univ.)   On compressible fluid flow on an evolving hypersurface $\cdots\cdots\cdots\cdots$ 10

Summary: We consider compressible fluid flow on an evolving hypersurface. We focus on kinetic, dissipation, and thermal energies to derive governing equations for the motion of compressible viscous flow on an evolving hypersurface.

35 Hajime Koba   (Waseda Univ.)   On incompressible fluid flow on an evolving hypersurface $\cdots\cdots\cdots\cdots$ 10

Summary: We consider incompressible fluid flow on an evolving hypersurface. We focus on kinetic, dissipation, and thermal energies to derive governing equations for the motion of incompressible viscous flow on an evolving hypersurface.

36 <u>Erika Ushikoshi</u> (Tamagawa Univ.)   Hadamard variational formula for the eigenvalues of the Stokes equa-
    Shuichi Jimbo (Hokkaido Univ.)   tions and its application $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
    Hideo Kozono (Waseda Univ.)
    Yoshiaki Teramoto (Setsunan Univ.)

Summary: By means of the Hadamard variational formula for the multiple eigenvalues of the Stokes equations, we shall analyze the geometry of the domain.

37　Teppei Kobayasi　(Meiji Univ.)[♭]　A steady flow of an incompressible viscous fluid in a generalized aperture domain for a plane $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: In this talk, we introduce a generalized aperture domain in a plane. Furthermore we consider the steady Navier–Stokes equations approaching Jeffery–Hamel's flow at infinity in a generalized aperture domain in a plane.

14:15–16:15

38　Ana Silvestre (Tech. Univ. of Lisbon)[♭]　A boundary control problem for the steady self-propelled motion of a rigid body in a Navier–Stokes fluid $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
　　Takéo Takahashi (Univ. of Lorraine)
　　Toshiaki Hishida (Nagoya Univ.)

Summary: A boundary control problem for the steady self-propelled motion of a rigid body in a viscous incompressible fluid is studied. We provide a physically relevant control, which vanishes outside a prescribed portion of the boundary but leads to a given rigid motion. It is also shown that the self-propelled condition implies better summability of the fluid flow at infinity.

39　Hideo Kozono　(Waseda Univ.)　A remark on Liouville-type theorems for the stationary Navier–Stokes equations in three space dimensions $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
　　Yutaka Terasawa (Nagoya Univ.)
　　Yuta Wakasugi (Nagoya Univ.)

Summary: Consider the 3D homogeneous stationary Navier–Stokes equations in the whole space $\mathbb{R}^3$. We deal with solutions vanishing at infinity in the class of the finite Dirichlet integral. By means of quantities having the same scaling property as the Dirichlet integral, we establish new a priori estimates. As an application, we prove the Liouville theorem in the marginal case of scaling invariance.

40　Takahiro Okabe (Hirosaki Univ.)　Time periodic strong solution to the Navier–Stokes equations with large data $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider the incompressive Navier–Stokes equation in a three dimensional bounded smooth domain. For any large periodic external force, we construct a periodic strong solution, provided the period is short enough. Moreover, for a long period and a large external force, we construct a unique and stable time periodic strong solution of the Navier–Stokes equations introducing the highly oscillating data in the sense of eigenfunctions of the Stokes operator.

41　Mitsuo Higaki　(Tohoku Univ.)　Navier wall law for nonstationary viscous incompressible flows $\cdots\cdots\cdots$ 12

Summary: The Navier wall law is an effective boundary condition to describe the viscous incompressible flows near the rough boundary, which is formally derived from the boundary layer analysis. In this talk we study the Navier wall law for the two-dimensional initial boundary value problem of the Navier–Stokes system. The Navier wall law is verified for the initial data in C^1 class under the natural compatibility condition. Our proof relies on the boundary layer analysis and the L^∞ theory of the Navier–Stokes equations in the half space.

42　Noboru Chikami (Tohoku Univ.)　Global solution for the Navier–Stokes–Poisson system in two and higher dimensions $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
　　Raphaël Danchin (Univ. Paris-Est)

Summary: We obtain a new a priori estimate for solutions of the Navier–Stokes–Poisson system. As a corollary, we establish the unique global solvability in critical spaces for that system in any dimension $n \geq 2$.

43　Hirokazu Saito (Waseda Univ.)　On the $\mathcal{R}$-boundedness of solution operator families for two-phase Stokes resolvent equations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
　　Sri Maryani　　(Waseda Univ.)

Summary: In this talk, we show the $\mathcal{R}$-boundedness of solution operator families for two-phase Stokes resolvent equations on a general domain. Such a domain covers e.g. $\dot{\mathbf{R}}^N = \mathbf{R}_+^N \cup \mathbf{R}_-^N$ ($N \geq 2$), perturbed $\dot{\mathbf{R}}^N$, layers, perturbed layers, bounded domains, and exterior domains, where $\mathbf{R}_+^N$ and $\mathbf{R}_-^N$ are the open upper and lower half spaces, respectively. The essential assumption is the unique solvability of the weak Dirichlet–Neumann problem, which will be introduced in the talk.

44   Ken Abe   (Kyoto Univ.)   On regularity of axisymmetric Navier–Stokes flows in an exterior domain
. . . . 10

Summary: We consider the initial-boundary value problem of the Navier–Stokes equations for axisymmetric initial data with swirl in the exterior of an infinite cylinder $\Pi_\varepsilon = \{x \in \mathbb{R}^3 | |x_{\text{tan}}| > \varepsilon, x_3 \in \mathbb{R}\}$, subject to the slip boundary condition. We prove global well-posedness of the problem and study spatial profiles of potential singularities as $\varepsilon \to 0$. We establish an upper blow-up estimate in terms of energy for the azimuthal component of vorticity, and prove that a blow-up rate of the energy is at most $O(\varepsilon^{-2})$ as $\varepsilon \to 0$. The proof is based on the Boussinesq system. It is shown that the system is globally well-posed in the exterior domain for axisymmetric initial data without swirl.

45   Takashi Suzuki (Osaka Univ.)   2D Smoluchowski–Poisson equation: criteria on collision of sub-collapses
. . . . 8

Summary: We study the blowup in finite time in the 2D Smoluchowski–Poisson equation. Any blowup point is simple if and only if it has type II blowup rate and the total free energy is bounded.

46   Takayoshi Ogawa (Tohoku Univ.)[♭]   Non-uniform bound and finite time blow up for solutions to a drift-
Hiroshi Wakui (Tohoku Univ.)   diffusion equation in higher dimensions · 12

Summary: We show the non-uniform bound for a solution to the Cauchy problem of a drift-diffusion equation of a parabolic-elliptic type in higher space dimensions. If an initial data satisfies a certain condition involving the entropy functional, then the corresponding solution to the equation does not remains uniformly bounded in a scaling critical space.

16:30–17:30   Talk Invited by Functional Equations Section

Masaki Kurokiba   [♭]   Finite time blow up for a solution to system of the drift-diffusion
        (Muroran Inst. of Tech.)   equations in higher dimensions

Summary: We discuss the existence of the blow-up solution for multi-component parabolic-elliptic drift diffusion model in higher space dimensions. We show that the local existence, uniqueness and well-posedness of a solution in the weighted L2 spaces. Moreover we prove that if the initial data satisfies a certain condition, then the corresponding solution blows up in a finite time. This is a system case for the blow up result of the chemotactic and drift-diffusion equation proved by Nagai (2001) and Nagai–Senba–Suzuki (2000) and gravitational interaction of particles by Biler (1995), Biler–Nadzieja (1994, 1998). We generalize the result in Kurokiba–Ogawa (2003,2015) and Kurokiba (2014) for multi-component problem and give a sufficient condition for the finite time blow up of the solution.

March 19th (Sat)   Conference Room Ⅲ

9:30–12:00

47   Yuki Kimura   (Tohoku Univ.)   Asymptotic profile of a solution to thermoelastic equations · · · · · · · · · · 12

Summary: We consider the asymptotic behavior of a solution to a linear thermoelastic equation in 2-dimension. Decomposing the elastic wave into irrotational and rotational components via the Helmholtz decomposition, we obtain that the solution converges to the solution of heat equations and the diffusive wave by eliminating the certain wave parts.

48   <u>Hiromichi Itou</u> (Tokyo Univ. of Sci.)   On a crack problem for nonlinear elasticity $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12
      Victor A. Kovtunenko (Univ. of Graz)
      Kumbakonam R. Rajagopal
              (Texas A & M Univ.)

Summary: Within the framework of nonlinear elasticity with limiting small strains introduced by Rajagopal, the nonlinear crack problem subject to non-penetration conditions is considered. In this talk, we introduce a solution of generalized variational inequalities, which coincides with the weak solution if the solution possesses extra regularity. The wellposedness is provided by the construction of an approximation problem using elliptic regularization and penalization techniques.

49   Hideo Soga   (Ibaraki Univ.)   Generalization of the Maxwell equation and relation to elastic equations
                                        $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: This talk is on generalization of the Maxwell equation. A real-symmetric system of partial differential equations is proposed as the generalized Maxwell equation. It is explained that this equation can be transformed each other into a generalized elastic equation and that the equation can be decomposed into two parts associated with waves of the transversal type and ones of the longitudinal type. Expression by the potential is also described.

50   <u>Hironari Miyoshi</u> (Waseda Univ.)   Convergence of hydrodynamical limits for generalized Carleman models
      Masayoshi Tsutsumi (Waseda Univ.)   with nonhomogeneous boundary condition $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We consider the initial boundary value problem for a 2-speed system of first order semi-linear hyperbolic equations with inhomogeneous boundary data. We establish the existence of global weak solutions in L^1 by the theory of nonlinear evolution operators in a non reflexive Banach space. Using the monotone method and the div-curl lemma, we investigate the hydrodynamical limits of solutions of the hyperbolic systems and show that the limits verify the doubly nonlinear parabolic equations.

51   Hironobu Sasaki (Chiba Univ.)   Small analytic solutions to the Hartree equation $\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We consider the Cauchy problem for the Hartree equation in space dimension $d \geq 3$. We assume that the interaction potential V belongs to the weak $L^{d/2}$ space. We prove that if the initial data ϕ is sufficiently small in the L^2-sense and the Fourier transform $\mathcal{F}\phi$ satisfies a real-analytic condition, then the solution $u(t)$ is also real-analytic for any $t \neq 0$. We also prove that if ϕ and V satisfy some strong condition, then $u(t)$ can be extended to an entire function on $\mathbb{C}^d$ for any $t \neq 0$. We remark that no L^2 smallness condition is imposed on first and higher order partial derivatives of ϕ and $\mathcal{F}\phi$.

52   <u>Sojiro Murai</u> (Univ. of Electro-Comm.)   Smoothing and scattering for Klein–Gordon equations in exterior do-
      Kiyoshi Mochizuki   main with time dependent perturbations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
      (Tokyo Metro. Univ.*/ Chuo Univ.)

Summary: This paper deals with the existence, smoothing properties and scattering of solutions to magnetic Klein–Gordon equations in exterior domain with time dependent small perturbations. Smoothing properties based on the resolvent estimates will reinforce the abstract scattering theory developed in our previous paper, and our concrete problems are treated in this framework.

53   <u>Mamoru Okamoto</u> (Shinshu Univ.)   Well-posedness and ill-posedness of the Cauchy problem for the one
      Shuji Machihara (Saitama Univ.)   dimensional nonlinear Dirac equations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
      Hyungjin Huh (Chung-Ang Univ.)

Summary: We consider the Cauchy problem for the nonlinear Dirac equations $(\partial_t \pm \partial_x)U_\pm = i|U_\pm|^k|U_\mp|^{m-k}U_\pm$ in one spatial dimension which was introduced by Huh (2013). Several results on well-posedness and ill-posedness have been btained. Since the nonlinearity is not smooth if k or m is odd, an upper bound of s to be well-posed appears. We prove that the upper bound is essential. More precisely, we show ill-posedness in $H^s(\mathbb{R})$ for sufficiently large s.

54   Takiko Sasaki (Univ. of Tokyo)   Blow-up curve for a derivative nonlinear wave equation $\cdots\cdots\cdots\cdots$ 10

Summary: We study one dimensional wave equation $\partial_t^2 u - \partial_x^2 u = (\partial_t u)^p$. The solution of this equation blows up in finite time, under the appropriate initial condition. We are concerned with the shape of the blow-up curve which is defined by $\Gamma = \partial \{(x, t) \in \mathbb{R} \times (0, \infty) \mid |\partial_t u| < +\infty\}$. The purpose of this paper is to show that Γ is a C^1 space-like surface if the initial values are large and smooth enough. Our proof is based on the proof Caffarelli and Friedman (1986).

55   Hiroyuki Takamura   Improved Kato's lemma and a new conjecture on the lifespan of solutions
         (Future Univ.-Hakodate)   of semilinear wave equations in two space dimensions $\cdots\cdots\cdots\cdots$ 12

Summary: We introduce improved Kato's lemma for ordinary differential inequality to have a new conjecture on the lifespan of solutions of semilinear wave equations in two space dimensions. Our result is the upper bound of the lifespan only, but it is shorter than the one from the analogy to higher space dimensions when the integral of the initial speed does not vanish.

56   Masaru Ikehata (Hiroshima Univ.)   On finding an obstacle embedded in the rough background medium via
                                          the enclosure method in the time domain $\cdots\cdots\cdots\cdots$ 12

Summary: A mathematical method for through-wall imaging via wave phenomena in the time domain is introduced. The method makes use of a single reflected wave over a finite time interval and gives us a criterion whether a penetrable obstacle exists or not in a general rough background medium. Moreover, if the obstacle exists, the lower and upper estimates of the distance between the obstacle and the center point of the support of the initial data are given.

57   Yuta Wakasugi (Nagoya Univ.)   Scaling variables and asymptotic profiles of solutions to the semilinear
                                      damped wave equation with variable coefficients $\cdots\cdots\cdots\cdots$ 10

Summary: We study the asymptotic behavior of solutions for the semilinear damped wave equation with variable coefficients. We prove that if the damping is effective, and the nonlinearity can be regarded as perturbations, then the solution is approximated by the scaled Gaussian of the corresponding linear parabolic problem. The proof is based on the scaling variables and energy estimates.

14:15–15:45

58   Sohei Ashida   (Kyoto Univ.)   Propagation estimates for the scattering channels with 2 clusters of
                                          N-body Schrödinger operators $\cdots\cdots\cdots\cdots$ 12

Summary: We consider the propagation estimates for the scattering channels with two clusters. When there are bounded clusters, the clusters are accelerated by the gain of the kinetic energy from the bound state energy. To obtain the minimal velocity estimates positivity of the commutator of the generator of the dilations and the Hamiltonian restricted to small energy interval is used. We use the operator which consists of the generator of the dilations of external coordinates, the projection to the bound state and the cutoff function restricting the channel instead.

59   <u>Masayuki Hayashi</u> (Waseda Univ.)   Global solutions for a generalized nonlinear derivative Schrödinger equa-
      Tohru Ozawa   (Waseda Univ.)   tion $\cdots\cdots\cdots\cdots$ 12

Summary: We consider the Cauchy problem for a generalized nonlinear derivative Schrödinger equation $i\partial_t u + \partial_x^2 u + i|u|^{2\sigma}\partial_x u = 0$, with the Dirichlet boundary condition. We prove small data global in time well-posedness in H_0^1 if $\sigma \geq 1$, and large data global existence of solutions in H_0^1 if $1/2 \leq \sigma < 1$.

60   Ryosuke Hyakuna (Waseda Univ.)   On global solutions to the nonlinear Schrödinger equations with large
                                        L^p-initial data $\cdots\cdots\cdots\cdots$ 10

Summary: We investigate the Cauchy problem for the nonlinear Schrödinger equation with the pure power nonlinearity $|u|^{\alpha-1}u$. It is shown that a local solution of the initial value problem exists in $L_{[-T,T]}^q(L^r)$-space if $p < 2$ and p is close to 2. Moreover, we show that the local solution can be extended globally if p is sufficiently close to 2.

61   Takahisa Inui   (Kyoto Univ.)   Global Dynamics for a nonlinear Schrödinger equation with a repulsive
Masahiro Ikeda   (Kyoto Univ.)   Dirac delta potential $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We consider a focusing L^2-supercritical nonlinear Schrödinger equation with a repulsive Dirac delta potential (δNLS). It is well known that δNLS is locally well-posed in $H^1(\mathbb{R})$ and there exist standing wave solutions $e^{i\omega t}Q_\omega(x)$ when $\omega > \gamma^2/2$ where Q_ω is a unique radial positive solution to $-\frac{1}{2}\partial_x^2 Q + \omega Q - \gamma\delta_0 Q = |Q|^{p-1}Q$. Our aim is to find a necessary and sufficient condition to determine the behavior of solutions below the standing waves.

62   Kota Uriya   (Tohoku Univ.)   Final state problem for systems of cubic nonlinear Schrödinger equations
$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 12

Summary: We are concerned with the asymptotic behavior of the solution to systems of cubic nonlinear Schrödinger equations in one dimension. It is known that mass transition phenomenon occur for a system of quadratic nonlinear Schrödinger equations in two dimensions under the mass resonance condition. We show that mass transition phenomenon also occurs for cubic nonlinearities under the corresponding mass resonance conditions.

63   Yuji Sagawa   (Osaka Univ.)   The lifespan of small solutions to cubic derivative nonlinear Schrödinger
Hideaki Sunagawa (Osaka Univ.)   equations in one space dimension $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Consider the initial value problem for cubic derivative nonlinear Schrödinger equations in one space dimension. We provide a detailed lower bound estimate for the lifespan of the solution, which can be computed explicitly from the initial data and the nonlinear term. This is an extension and a refinement of the previous work (H. Sunagawa; Osaka J. Math. 43 (2006), 771–789) where the gauge-invariant nonlinearity was treated.

16:00–17:00   Award Lecture for the 2015 MSJ Analysis Prize

Mitsuru Sugimoto (Nagoya Univ.)   Smoothing effect of Schrödinger equations in the angular direction

Summary: In 1997, Hoshiro discovered a smoothing effect of Schrödinger equations in the angular direction. We will discuss how this result has been developed in the last two decades.

Real Analysis

March 18th (Fri)   Conference Room IV

9:30–12:00

1   Yoshifumi Ito (Univ. of Tokushima[*])[♭]   New proof of Plancherel's theorem $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this paper, we give the new proof of Plancherel's theorem by using the method of orthogonal measure.

2   Yōhei Yamasaki (Yamato Univ.)   Around a Jordan curve of positive measure in R^3 $\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We construct a Jordan curve of positive measure in the eucledean space of dimension 3 and a measure preserving homeomorphism between the closed simplex and a ball with an additional measure on the center pole.

3   Yōhei Yamasaki (Yamato Univ.)   On the "directed measure" not in the C^1 class $\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: This talk shows that the absolute continuity does not suffice to develope the theory of directed measure not in the C^1 class.

4   Kiyohisa Tokunaga (Yamaguchi Univ.)   The antisymmetric total double integral $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Our new kind of antisymmetric total double integral and the conventional double partial integrals as the iterated anti-derivatives figure out same values for an integrand of various kinds of monomials, and for a domain of a segment and three types of conic section. Moreover, our integral has advantage over the conventional one for approximate values calculated as finite double sums. However, the relationship between the definition of our integral and that of the conventional one is not known. If it is possible to derive one kind of definition from the other between these two kinds of double integrals, it is conjectured that our integral may be reduced to be the conventional one as its special case.

5   Toshiharu Kawasaki (Nihon Univ.)   Some examples between the Lebesgue and Denjoy integrals $\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we give new integrals between the Lebesgue integral and the restricted Denjoy integral. Moreover we give some examples of these integrable functions.

6   Yukino Tomizawa (Chuo Univ.)   Fixed point property with respect to the Bregman distance $\cdots\cdots\cdots\cdots$ 10

Summary: The purpose is to consider the fixed point property of firmly nonexpansive mappings with respect to the Bregman distance.

7   M. Ali Khan (Johns Hopkins Univ.)   Maharam-types and Lyapunov's theorem for vector measures on locally
     <u>Nobusumi Sagara</u> (Hosei Univ.)   convex spaces without control measures $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We formulate the saturation property for vector measures in locally convex Hausdorff spaces as a nonseparability condition on the derived Boolean σ-algebras by drawing on the topological structure of vector measure algebras. We exploit a Pettis-like notion of vector integration in locally convex Hausdorff spaces, the Bourbaki–Kluvánek–Lewis integral, to derive an exact version of the Lyapunov convexity theorem in locally convex Hausdorff spaces without the Bartle–Dunford–Schwartz property. We apply our Lyapunov convexity theorem to the bang-bang principle in Lyapunov control systems in locally convex Hausdorff spaces to provide a further characterization of the saturation property.

8 <u>Ryotaro Tanaka</u> (Niigata Univ.)   On the duality of James constant of rotation invariant norms $\cdots\cdots\cdots$ 15
   Naoto Komuro
           (Hokkaido Univ. of Edu.)
   Kichi-Suke Saito (Niigata Univ.)

Summary: In this talk, we show that the James constant of the space $\mathbb{R}^2$ endowed with a $\pi/2$-rotation invariant norm coincides with that of its dual space. In particular, we have the same statement on the symmetric absolute norms on $\mathbb{R}^2$ as a corollary.

9 Hiroyasu Mizuguchi (Niigata Univ.)   On the duality of a new constant related to Isosceles orthogonality
   $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider Isosceles orthogonality and Birkhoff orthogonality, which are the most used notions of generalized orthogonality. In 2006, Ji and Wu introduced a geometric constant $D(X)$ to measure the difference between these two orthogonality types. From their results, we have that $D(X) = D(X^*)$ holds for any symmetric Minkowski plane. On the other hand, for the James constant $J(X)$, Saito, Sato and Tanaka recently showed that if the norm of a two-dimensional space X is absolute and symmetric then $J(X) = J(X^*)$ holds. We consider a new constant $D(X, \lambda)$ such that $D(X) = \inf_{\lambda \in \mathbb{R}} D(X, \lambda)$ and obtain that in the same situation $D(X, \lambda) = D(X^*, \lambda)$ holds for any $\lambda \in (0, 1)$.

14:15–16:10

10 Hiroko Manaka (Yokohama Nat. Univ.)   Fixed point theorems for an elastic nonlinear mapping in Banach spaces
    $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Let E be a smooth Banach space with a norm $||\cdot||$. Let $V(x, y) = ||x||^2 + ||y||^2 - 2 < x, Jy >$ for any $x, y \in E$, where $< \cdot, \cdot >$ stands for the duality pair and J is the normalized duality mapping. We defined a V-strongly nonexpansive mapping with respect to this bifunction $V(\cdot, \cdot)$. This nonlinear mapping is nonexpansive in a Hilbert space. However, we could show that this mapping is not nonexpansive in some Banach spaces. In this talk, we shall introduce convergence theorems and existence theorems for fixed points of this elastic nonlinear mapping.

11 Fumiaki Kohsaka (Tokai Univ.)   Strong convergence of an implicitly defined iterative sequence for maximal monotone operators in Banach spaces $\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we study the strong convergence of an iterative sequence which is implicitly defined by using the resolvent of maximal monotone operators in Banach spaces.

12 Koji Aoyama   (Chiba Univ.)   Strongly quasi-nonexpansive mappings $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we focus on strongly quasinonexpansive mappings in a metric space or a Banach space. In particular, we present some properties and characterizations of such mappings.

13 Tomonari Suzuki   Topology on ν-generalized metric spaces $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
            (Kyushu Inst. of Tech.)

Summary: We will talk about topology on ν-generalized metric spaces.

14 <u>Aoi Honda</u> (Kyushu Inst. of Tech.)   Fractional Shepp sequence space and fractional difference operators on
    Yoshiaki Okazaki L_p $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
           (Fuzzy Logic Systems Inst.)

Summary: We have introduced the Shepp sequence space which is determined by an L_p function. In this talk, we generalize the Shepp sequence space to the fractional Shepp sequence space and discuss its topological structure and linearity.

15 <u>Yoshiaki Okazaki</u> L_p space for a subadditive monotone measure and its dual $L_p^\dagger$ $\cdots\cdots$ 15
      (Fuzzy Logic Systems Inst.)
Aoi Honda (Kyushu Inst. of Tech.)

Summary: We introduce the L_p-space for a sub-additive monotone measure based on the Choquet integral and its dual space $L_p^\dagger$. The basic properties of L_p and $L_p^\dagger$ are studied. L_p is a quasi-metric space and $L_p^\dagger$ is a complete metric space by the dual metric.

16 <u>Naohito Tomita</u> (Osaka Univ.)   Multilinear Fourier multipliers with minimal Sobolev regularity $\cdots\cdots$ 15
Loukas Grafakos (Univ. of Missouri)
Akihiko Miyachi
(Tokyo Woman's Christian Univ.)
Hanh Van Nguyen (Univ. of Missouri)

Summary: The problem to find the smoothness conditions for multilinear Fourier multipliers that are as small as possible to ensure the boundedness of the corresponding operators from products of Hardy spaces $H^{p_1} \times \cdots \times H^{p_m}$ to L^p, $1/p_1 + \cdots + 1/p_m = 1/p$, is considered.

16:30–17:30   Talk Invited by Real Analysis Section

Enji Sato   (Yamagata Univ.[*])   The operators related to Fourier multipliers on some function spaces

Summary: We talk about the operators related to Fourier multipliers on some function spaces which are L^p spaces, Morrey spaces and etc.

March 19th (Sat)   Conference Room IV

9:30–12:00

17 <u>Yutaka Tsuzuki</u> (Tokyo Univ. of Sci.)   Existence of solutions to Vlasov–Poisson systems in a half-space $\cdots\cdots$ 15
Alexander Leonidovich Skubachevskii
(Peoples' Friendship Univ. of Russia)

Summary: This talk is concerned with solvability of Vlasov–Poisson systems in a half-space. In 2013, an existence result on a time interval $(0, T)$ was obtained by Skubachevskii. However largeness of initial function f_0^β is too strong. The purpose of this talk is to weaken the condition of largeness of f_0^β.

18 Akio Ito   Existence of solutions for brewing model of Japanese Sake with stirring
<u>Yusuke Murase</u> (Meijo Univ.)   effect. $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we discuss the existence of solution for brewing model of Japanese Sake with stirring effect. This model is formulated by using partial differential equations with constraint condition. The constraint set in the model is fixed if temperature is given. In other words, the solution of this model depends upon the solution self. It shows that the model is a problem of quasi-variational inequality type.

19 <u>Dai Noboriguchi</u> (Waseda Univ.)   The existence theorem of solutions for degenerate parabolic equations
Kazuo Kobayasi (Waseda Univ.)   with stochastic forcing $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider the initial value problem for degenerate parabolic partial differential equations with multiplicative noise on a d-dimensional torus $\mathbb{T}^d$:

$$du + \operatorname{div}(B(u))\ dt = \operatorname{div}(A(u)\nabla u)\ dt + \Phi(u)\ dW(t) \qquad\qquad \text{in}\ \ \mathbb{T}^d \times (0, T)$$

We focus on the existence of a solution. Using nondegenerate smooth approximations, Debussche, Hofmanová and Vovelle proved the existence of a kinetic solution. On the other hand, we propose to construct a sequence of approximations by applying a time splitting method. This method will somewhat give us not only a simpler and more clear discussion but an improvement over the existence result.

20   Hiroshi Watanabe (Salesian Polytech.)   Continuous dependence of BV-entropy solutions to strongly degenerate
parabolic equations with variable coefficients $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We consider the initial value problem (CP) for strongly degenerate parabolic equations with variable coefficients. Strongly degenerate parabolic equations are regarded as a linear combination of the time-dependent conservation laws (quasilinear hyperbolic equations) and the porous medium type equations (nonlinear degenerate parabolic equations). Thus, this equation has both properties of hyperbolic equation and those of parabolic equations and describes various nonlinear convective diffusion phenomena such as filtration problems, Stefan problems and so on.
In this talk, we consider BV-entropy solutions to (CP). Our purpose is to prove the continuous dependence of the BV-entropy solutions.

21   Ken Shirakawa   (Chiba Univ.)   Energy-dissipation for phase field model of grain boundary motion with
Hiroshi Watanabe (Salesian Polytech.)   anisotropy $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Salvador Moll (Univ. of Valencia)

Summary: In this talk, a system of parabolic variational inequalities is considered. The system is a modified version of the Kobayashi–Warren–Carter system of grain boundary motion such that the governing free-energy includes some anisotropic effects of grains. Additionally, we note that our mathematical model enables to reproduce the dynamic changes of structural units, caused by the rotations of crystalline orientations. In the last MSJ meeting (in Kyoto Sangyo Univ.), we reported the solvability result for our system. Based on the previous work, we set the subject of this talk to discuss about the continuing topics, that are concerned with energy-dissipation and large-time behavior for our system.

22   Risei Kano   (Kochi Univ.)   The convergence of solutions for the perfect plasticity models $\cdots\cdots\cdots$ 15
Takesi Fukao (Kyoto Univ. of Edu.)

Summary: In this talk, in the variational inequalities related to the perfect plasticity models, we discuss the convergence of the solution at the diffusion parameter to 0.

23   Takeshi Fukao (Kyoto Univ. of Edu.)   Degenerate parabolic equations with dynamic boundary conditions $\cdots$ 15

Summary: In this talk, an asymptotic limit of Cahn–Hilliard systems to a degenerate parabolic equation with dynamic boundary condition is focused. The target diffusion equation is an abstract form of the Stefan problem, porous media equation, Hele-Shaw profile, nonlinear diffusion of singular logarithmic potential, nonlinear diffusion of Penrose–Fife type, fast diffusion equation and so on. By setting the suitable potential of the Cahn–Hilliard systems all of these problems are characterized by the limit of the Cahn–Hilliard systems.

24   Noriaki Yamazaki (Kanagawa Univ.)   Lagrange multiplier and singular limit of double obstacle problems for
Takeshi Fukao (Kyoto Univ. of Edu.)   Allen–Cahn equation with constraint $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Mohammad Hassan Farshbaf-Shaker
(WIAS, Germany)

Summary: In this talk we study the properties of the Lagrange multiplier to an Allen–Cahn equation with double obstacle potential. Here, dynamic boundary condition, including the Laplace–Beltrami operator on the boundary, is investigated. Then, we establish the singular limit of our system and clarify the limit of the solution and the Lagrange multiplier to our problem.

25 Toyohiko Aiki (Japan Women's Univ.)
Sato Naoki
   (Nagaoka Nat. Coll. of Tech.)
Murase Yusuke   (Meijo Univ.)   Hysteresis behavior of a solution to the free boundary problem describing an adsorption phenomena ·································· 15

Summary: In this talk we consider a free boundary problem which is proposed as a mathematical model for adsorption phenomena in a porous media. The existence, uniqueness and large time behavior of solutions were already discussed. Also, we pointed out that the relationship between the humidity and the degree of saturation observed in experiments are represented by our model through some numerical simulations. In this talk we investigate the asymptotic behavior of a free boundary as the density of water in air tends to 0, and hysteresis behavior of a solution to the limit problem.

14:15–15:00

26 Kentarou Fujie (Tokyo Univ. of Sci.)
Sachiko Ishida (Tokyo Univ. of Sci.)
Akio Ito
Tomomi Yokota (Tokyo Univ. of Sci.)   Existence and large time behavior of a global-in-time solution to a chemotaxis tumor invasion model with degenerate diffusion ·········· 15

Summary: In this talk, we consider an initial-boundary problem of a chemotaxis, not haptotaxis, tumor invasion system with a degenerate diffusion. Actually, first of all we can show that our problem has at least one global-in-time solution by considering appropriate approximate systems with non-degenerate diffusions and deriving some uniform estimates, which are independent of approximate parameters and enable us to use the limit procedure. Moreover, we succeed investing a large-time behavior of this global-in-time solution.

27 Noriaki Yoshino (Tokyo Univ. of Sci.)   An operator theoretic approach to parabolic-parabolic chemotaxis systems ··· 15

Summary: In this talk we consider existence of solutions to parabolic-parabolic chemotaxis systems of general form. In the case of parabolic-ellipic chemotaixis systems, existence of local solutions was already shown via nonlinear m-accretive operator theory. However, in the case of parabolic-parabolic chemotaxs systems there is no existence result by this approach. In this talk existence of solutions is obtained by applying nonlinear m-accretive operator theory.

28 Toshitaka Matsumoto (Shizuoka Univ.)
Naoki Tanaka (Shizuoka Univ.)   Quasilinear theoretical approach to size-structured models ·········· 15

Summary: The well-posedness for abstract quasilinear evolution equations in Banach spaces is discussed. We do not assume the denseness of the domain of quasilinear operators. Global well-posedness of C^1-solutions is obtained and the abstract result is applied to size-structured models.

15:15–16:15   Talk Invited by Real Analysis Section

Motohiro Sobajima
(Tokyo Univ. of Sci.)
On an L^p-theory for second-order elliptic operators with unbounded coefficients

Summary: This talk is concerned with an L^p-theory for second-order elliptic operators of the form $Au = -\operatorname{div}(a\nabla u) + F \cdot \nabla u + Vu$ in $\mathbb{R}^N$, where $N \in \mathbb{N}, 1 < p < \infty$ and all coefficients $a = (a_{jk})_{jk}$, $F = (F_j)_j$ and V are allowed to be unbounded at infinity. The essential m-accretivity and m-sectoriality in L^p-spaces have been investigated in recent years. In this talk we deal with the m-accretivity and m-sectoriality in L^p-spaces of minimal realization of A from the view-point of the decomposition formula

$$\int_{\mathbb{R}^N} (Au)\overline{v}\, dx = \int_{\mathbb{R}^N} \left[a\nabla u \cdot \nabla \overline{v} + \left(V - \frac{\operatorname{div} F}{p} \right) u\overline{v} \right] dx + \int_{\mathbb{R}^N} F \cdot \left(\frac{\overline{v}\nabla u}{p} - \frac{u\nabla \overline{v}}{p'} \right) dx$$

which may be regarded as a generalization of the formula decomposing sesqui-linear forms in L^2 into symmetric and skew-symmetric parts. Particularly, the L^2-theory for Schrödinger operators has been widely considered since it plays an important role in the field of quantum mechanics. Despite of this, the problem for selfadointness of operators having rapidly growing diffusion and potential, posed by T. Kato in 1981, has been remained open until 2010. As a byproduct of the L^p-theory in this talk, the answer seems to be very close.

Functional Analysis

March 16th (Wed)   Conference Room IX

10:00–12:00

1   <u>Hisashi Morioka</u>
        (Shibaura Inst. of Tech.)
    Kazunori Ando (Ehime Univ.)
    Hiroshi Isozaki (Univ. of Tsukuba)

Spectral properties of Schrödinger operators on perturbed lattices · · · · 15

Summary: We show the absence of eigenvalues embedded in the continuous spectrum of discrete Schrödinger operators on perturbed lattices, and we construct its scattering theory. Our theory covers the square, triangular, diamond, Kagome lattices, as well as the ladder, the graphite and the subdivision of square lattice.

2   <u>Kazunori Ando</u> (Ehime Univ.)
    Hyeonbae Kang   (Inha Univ.)

Spectral properties of the Neumann–Poincaré operator and anomalous localized resonance · 15

Summary: We study the spectral properties of the Neumann–Poincaré operator on bounded simply connected domains in two and three dimensions with $C^{1,\alpha}$-boundaries. Then, using the quasi-static approximation, we show that anomalous localized resonance (ALR) occurs on ellipses in two dimensions; on the other hand, ALR does not occur on balls in three dimensions.

3   Toshimitsu Takaesu (Gunma Univ.)

Essential spectrum of a fermionic quantum field model and its application · 15

Summary: We consider an interaction system of a fermionic quantum field. The state space is defined by a tensor product of a fermion Fock space and a Hilbert space, and the total Hamiltonian is a self-adjoint operator on the Hilbert space. Then it is proven that a subset of real numbers is the essential spectrum. Its application to the Yukawa model is also considered, and the HVZ theorem is obtained.

4   Atsuhide Ishida (Otemon Gakuin Univ.)

A propagation property for the fractional power of negative Laplacian · 15

Summary: Enss (1983) obtained one of the propagation estimates for the free Schrödinger operator and it turned out that this estimate was very useful for the inverse scattering problem by Enss–Weder (1995). Since then, this method has been called the Enss–Weder method. We study the same type of propagation estimate for the fractional power of negative Laplacian. In the same way of Enss–Weder, we try to apply our estimate to the inverse scattering problem.

5   <u>Michiyuki Watanabe</u> (Niigata Univ.)
    Hiroshi Isozaki (Univ. of Tsukuba)
    Mitsuteru Kadowaki
        (Univ. of Shiga Pref.)

Asymptotic behavior of stationary solutions to elastic wave equations in half-spaces · 15

Summary: We consider the stationary scattering problem for the elastic operator in a perturbed half-space. In this talk, we present
(1) Construction of the generalized Fourier transform.
(2) Characterization of solutions in terms of the generalized Fourier transform.
(3) Asymptotic expansion of solutions and the S-matrix.

6   Hiroyuki Yamagishi   The best constant of discrete Sobolev inequalities on the regular poly-
    (Tokyo Metropolitan Coll. of Indus. Tech.)   hedra including double bond · 15
    Yoshinori Kametaka (Osaka Univ.*)

Summary: We have obtained the best constant of discrete Sobolev inequalities on the regular polyhedra
including double bond. By giving appropriate indices on vertices of polyhedra and by introducing discrete
Laplacians, we have obtained Green matrices and pseudo Green matrices. (Pseudo) Green matrices are
the reproducing kernels by setting appropriate vector spaces and inner products. By applying Schwarz
inequality to the reproducing relations, the discrete Sobolev inequalities are obtained.The maximum of the
diagonal values of pseudo Green matrices is the best constants of inequalities.

7   Toshinao Kagawa (Tokyo City Univ.)   The Hermite expansion of the characteristic functions · · · · · · · · · · · · · · 15
    Kunio Yoshino (Tokyo City Univ.)

Summary: The aim of this talk is to show the examples of the Hermite function expansion. We determine
the coefficients of the Hermite expansion of the characteristic function of $[-a, a]$ and $[0, a]$, explicitly. As
applications, we determine the coefficients of the Hermite expansion of the sinc function, the Heaviside
function

14:15–15:15   Talk Invited by Functional Analysis Section

Hiroaki Niikuni   Band-gap spectral structure of carbon nanotubes
        (Maebashi Inst. of Tech.)

Summary: Carbon has possibilities of forming a lot of types of allotropes: diamonds, fullerenes, graphite and
graphene. Allotropes of carbons located on lattices with cylindrical structures are called carbon nanotubes
and have been playing important roles in the field of mechanical engineering due to their outstanding
properties such as electrical conduction and hardness. In this talk, we study the spectrum of carbon
nanotubes from the point of view of quantum graphs. Namely, we examine the spectral properties of
periodic Schrödinger operators on metric graphs corresponding to carbon nanotubes. Especially, we deal
with one of the simplest models of periodically broken carbon nanotubes and examine its spectral properties.
By utilizing the Floquet–Bloch theory, we show that its spectrum has the band-gap structure. Namely,
we notice that its spectrum consists of the absolutely continuous spectrum and the set of eigenvalues with
infinite multiplicities. Furthermore, we prove that the absolutely continuous spectrum is characterized
by the corresponding discriminants and consists of infinitely many closed intervals. We note that our
spectral discriminants are generally not entire functions but meromorphic functions, whereas the spectral
discriminants for the standard Hill operators are entire.

March 17th (Thu)   Conference Room IX

10:00–12:00

8   Hideyuki Ishi   (Nagoya Univ.)   Harmonic analysis on Bergman–Hartogs domains · · · · · · · · · · · · · · · · · 15

Summary: The Bergman–Hartogs domain is a Hartogs domain defined by a negative power of the Bergman
kernel function over a bounded homogeneous domain. This domain has a relatively large holomorphic
automorphism group, though the domain is not homogeneous in general. We discuss unitary representations
of the group realized on Hilbert spaces of holomorphic functions on the Bergman–Hartogs domain. The
multiplicity free decomposition of the representation is described in terms of harmonic analysis on the
bounded homogeneous domain.

9   Ryosuke Nakahama (Univ. of Tokyo)   Explicit embeddings of holomorphic discrete series representations · · · 15

Summary: In this talk the speaker presents the result on the explicit construction of embedding maps
between two holomorphic discrete series representations. Today we mainly deal with the embedding of the
holomorphic discrete series representation of $Sp(r, \mathbb{R}) \times Sp(r, \mathbb{R})$ into that of $Sp(2r, \mathbb{R})$.

10   Masatoshi Kitagawa (Univ. of Tokyo)   The BGG category $\mathcal{O}$ and the category of generalized Harish-Chandra modules $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Using Zuckerman's derived functor, Enright gave a functor from the BGG category to the category of Harish-Chandra modules of a connected semisimple complex Lie group. He proved that the functor is exact and preserve irreducibility. In this talk, the speaker generalizes the functor defined by Enright to a functor from the BGG category to the category of generalized Harish-Chandra modules. The main purpose of this talk is to introduce that the functor is exact fully faithful, and preserve irreducibility. As an application, we can see that Enright's functor gives an category equivalence.

11   <u>Narufumi Nakagaki</u>   Fusion rule algebras associated with inductions and restrictions of irre-
            (Nara Univ. of Edu.)   ducible representations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Tatsuya Tsurii (Osaka Pref. Univ.)

Summary: For a compact group G, the fusion rule algebra $\mathcal{F}(\hat{G})$ is obtained associated with the dual $\hat{G}$ of G. Let G_0 be a closed subgroup of G such that the index $[G : G_0]$ is finite. Then Frobenius diagram $D(\hat{G} \cup \widehat{G_0})$ is obtained by Frobenius' reciprocity theorem. We discuss the fusion rule algebra $\mathcal{F}(\hat{G} \cup \widehat{G_0})$ related with Frobenius diagram $D(\hat{G} \cup \widehat{G_0})$.

12   <u>Shohei Oyanoki</u> (Nara Univ. of Edu.)   Hypergroup duals and geometric duals $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Tatsuya Tsurii (Osaka Pref. Univ.)

Summary: Associated with many symmetric graphs (diagrams) we obtain finite commutative hypergroups by considering random walks.   Conversely, associated with faithful irreducible $*$-actions of many finite commutative hypergroups we obtain symmetric graphs.   We make clear the correspondence between hypergroups and graphs and discuss their duals.

13   <u>Taiki Okamoto</u> (Nara Univ. of Edu.)   Polynomial representations of hypergroups $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Tatsuya Tsurii (Osaka Pref. Univ.)

Summary: We introduce polynomial representations π (of one-variable and two-variable) of certain finite commutative hypergroups $\mathcal{K}$. Moreover we make clear the relation between hypergroup structure of the dual $\hat{\mathcal{K}}$ of $\mathcal{K}$ and the roots of the determinant equations of $\pi(\mathcal{K})$.

14   <u>Tatsuya Tsurii</u> (Osaka Pref. Univ.)   Non-commutative hypergroup of order five $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Hiromichi Ohno (Shinshu Univ.)
    Akito Suzuki   (Shinshu Univ.)
    Yasumichi Matsuzawa (Shinshu Univ.)
    Satoe Yamanaka (Nara Women's Univ.)

Summary: We discuss a commutativity of finite hypergroups. For a group, the minimum order of non-commutative groups is six. But in the case of a hypergroup there exists a non-commutative hypergroup of order five.

13:15–14:15   Talk Invited by Functional Analysis Section

Atsumu Sasaki   (Tokai Univ.)   Admissible representations, multiplicity-free representations and visible actions on non-tube type Hermitian symmetric spaces

Summary: In this talk, we give a new characterization for a non-compact Hermitian symmetric space to be of tube type (or non-tube type) by multiplicities in some branching laws and visible actions. Further, we provide an example of a kind of the Cartan decomposition for non-symmetric homogeneous spaces.

March 18th (Fri)   Conference Room IX

9:30–12:00

15 Yukiko Iwata (Meteorological Coll.)   Constrictive Markov operators $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Consider a Markov operator $T : L^1(X, \Sigma, \mu) \to L^1(X, \Sigma, \mu)$ defined on a finite measure space (X, Σ, μ). In this talk, we shall give a necessary and sufficient condition for a constrictive Markov operator T which is an integral operator with stochastic kernel satisfying $T\mathbf{1}_X = \mathbf{1}_X$.

16 <u>Kazuya Okamura</u> (Nagoya Univ.)   Measurement theory in local quantum physics $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Masanao Ozawa (Nagoya Univ.)

Summary: In this talk, we aim to establish foundations of measurement theory in local quantum physics. We introduce a condition called the normal extension property (NEP) and establish a one-to-one correspondence between completely positive (CP) instruments with the NEP and statistical equivalence classes of measuring processes. We show that every CP instrument on an atomic von Neumann algebra has the NEP and that every CP instrument on an injective von Neumann algebra is approximated by those with the NEP. Two examples of CP instruments without the NEP are obtained. It is thus concluded that in local quantum physics not every CP instrument represents a measuring process, but in most of physically relevant cases every CP instrument can be realized by a measuring process within arbitrary error limits.

17 Shûichi Ohno (Nippon Inst. of Tech.)[♭]   Weighted composition operators on $H^\infty \cap \mathcal{B}_o$ $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We here characterize the boundedness and compactness of weighted composition operators on $H^\infty \cap \mathcal{B}_o$. Moreover we will consider the domain of weighted composition operators as H^∞ bigger than $H^\infty \cap \mathcal{B}_o$. We present some examples concerning with our results. As a corollary, we have that the boundedness of $C_\varphi : H^\infty \to H^\infty \cap \mathcal{B}_o$ is equivalent to the compactness of $C_\varphi : \mathcal{B}_o \to \mathcal{B}_o$.

18 <u>Sin-Ei Takahasi</u>   A complete classification of continuous fraction-like operations on the
    (Yamagata Univ.[⋆]/Toho Univ.)   complex field $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Yuji Kobayashi   (Toho Univ.)
    Makoto Tsukada (Toho Univ.)

Summary: This is a research report about the classification problem of continuous fraction-like binary operations on the complex field $\mathbb{C}$. We show that non-trivial continuous fraction-like binary operations on $\mathbb{C}$ can be completely classified by the ratio of two complex numbers whose pair determines such an operation. Furthermore, we mention that the set of all the equivalence classes of such operations is equipped with a natural topology and it is homeomorphic to the unit disk $\{z \in \mathbb{C} : |z| \le 1\}$.

19 Toshikazu Abe (Niigata Univ.)   A generalization of normed space based on gyrogroup $\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we consider a generalization of normed space, which addition is not necessarily a commutative group but a gyrocommutative gyrogroup.

20 Benoit Collins   (Kyoto Univ.)   Free probabilistic analysis of random matrices converging to compact
    <u>Takahiro Hasebe</u> (Hokkaido Univ.)   operators $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Noriyoshi Sakuma (Aichi Univ. of Edu.)

Summary: In a recent preprint in 2015, Shlyakhtenko found a free probabilistic method to analyze the eigenvalues of perturbed GUEs (Gaussian Unitary Ensemble). We will strengthen Shlyakhtenko's result and then we analyze polynomials of random matrices whose eigenvalues converge to eigenvalues of a compact operator.

21   <u>Hiroaki Tohyama</u>
         (Maebashi Inst. of Tech.)
     Hiroshi Isa (Maebashi Inst. of Tech.)
     Masatoshi Ito (Maebashi Inst. of Tech.)
     Eizaburo Kamei
     Masayuki Watanabe
         (Maebashi Inst. of Tech.)

Expanded forms of operator valued α-divergence and Petz–Bregman divergence $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Recently, we have defined new operator divergences as the differences of relative operator entropies and have represented them by using Petz–Bregman divergence $D_0(A|B) \equiv B - A - S(A|B)$. In addition, we have discussed Ψ-Bregman divergence for several functions Ψ which relate to divergences defined by the differences of entropies. In this talk, we define expanded Petz–Bregman divergence $D_{0,r}(A|B) \equiv B - A - T_r(A|B)$ and show similar results to our former ones. Moreover, we make a report of results obtained on Ψ-Bregman divergence for several functions Ψ which relate to expanded forms of divergences defined by the differences of entropies.

22   <u>Masaru Nagisa</u>   (Chiba Univ.)
     Albania Nugraha Imam (Chiba Univ.)

Matrix monotone function and Operator monotone function $\cdots\cdots\cdots$ 15

Summary: We consider functions with some special forms as follows: for real numbers a, b, let $h(t) = \frac{b}{a} \frac{t^a - 1}{t^b - 1}$ $t \in (0, \infty)$. We decide values of a, b if and only if $h(t)$ becomes operator monotone on $(0, \infty)$. We also show that $h(t)$ is operator monotone if and only if $h(t)$ is 2-matrix monotone.
We consider the similar result for functions with the form $h(t) = \frac{ab(t-1)^2}{(t^a-1)(t^b-1)}$ $t \in (0, \infty)$. When $b = 1 - a$ and $-1 \le a \le 2$, this function is called Petz–Hasegawa's function and is known the operator monotonicity of this function.

14:15–15:00

23   Yuki Seo (Osaka Kyoiku Univ.)   Matrix inequalities via positive multilinear maps $\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Utilizing the notion of positive multilinear mappings, we present some matrix inequalities. In particular, Choi–Davis–Jensen and Kantorovich type inequalities including positive multilinear mappings are presented.

24   <u>Tsuyoshi Kajiwara</u> (Okayama Univ.)   C*-algebras associated with two dimensional self-similar maps $\cdots\cdots\cdots$ 15
     Yasuo Watatani (Kyushu Univ.)

Summary: In this talk, we present analysis of the C*-algebras associated with two dimensional self-similar maps. We mainly consider the case of the product of the one dimensional tent map. Contrast to the one dimensional cases, there exist chains of branched points. The corresponding Pimsner C*-algebra is simple and purely infinite. By the calculation of K-groups, it coincide with Cuntz algebra $\varnothing_\infty$. We do a complete classification of finite traces on the gauge invariant subalgebra (the core), and present the matrix representation of the finite cores.

25   Hajime Moriya (Shibaura Inst. of Tech.)   Hidden supersymmetries in some fermion lattice models $\cdots\cdots\cdots\cdots$ 15

Summary: We study hidden supersymmetries in fermion lattice models. We consider high degeneracy of SUSY ground states for some concrete SUSY models due to H. Nicolai and by P. Fendley et al. In terms of functional analysis, we formulate these SUSY models as supersymmetric C*-dynamics on the CAR algebra avoiding known obstacles. Some part of this work is collaboration with H. Katsura and Y. Nakayama.

15:15–16:15   Talk Invited by Functional Analysis Section

Hiroshi Ando   (Chiba Univ.)   Ultraproducts of operator algebras

Summary: In this talk I report on some recent works on ultraproducts of von Neumann algebras and its connection to QWEP problem and C*-algebras. The talks are divided in 3 parts.

In part 1, I recall basic notions of the following notiosn: ultralimits, von Neumann algebras and tracial central sequences.

In part 2, I explain various generalizations of tracial ultraproducts and how they are related to each other, and also that how their relationships give structural results on Ocneanu ultraproduct of type III factors.

In part 3, I explain some applications of ultraproducts to (a) Kirchberg's QWEP problem, or equivalently Connes' embedding problem (b) noncommutativity of C*-central sequence algebras for a large class of separable C*-algebras.

The above works are combinations of works with Uffe Haagerup, Carl Winslow and Eberhard Kirchberg.

Statistics and Probability

March 16th (Wed)   Conference Room II

9:30–12:00

1 Isamu Dôku   (Saitama Univ.)   Cox–Perkins type limit theorem for EDMs ⋯⋯⋯⋯⋯⋯⋯⋯ 15

Summary: We consider an environment-dependent model, namely, a kind of stochastic interacting system. Under suitable conditions, if the model is rescaled, then the rescaled process converges to a superprocess, i.e., a Dawson–Watanabe superprocess with spatially dependent branching rate. The result is an extension of the work done by Cox–Perkins (2005).

2 Toshio Nakata (Fukuoka Univ. of Edu.)   Weak laws of large numbers for weighted independent random variables
with infinite mean ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 10

Summary: We study weak laws of large numbers for weighted independent random variables with infinite mean. In particular, this paper explores the case that the decay order of the tail probability is -1. Moreover, we extend a result concerning the Pareto–Zipf distributions given by A. Adler.

3 Koji Tsukuda (Kurume Univ.)   On $L^2(0,1)$ functional central limit theorems for logarithmic assemblies
⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 10

Summary: Functional central limit theorems in $L^2(0,1)$ for logarithmic assemblies are presented. The results in the literature proved the weak convergences of random processes associated with logarithmic assemblies to a standard Borwnian motion $(B(u))_{u\in[0,1]}$ in the Skorokhod space. On the other hand, in this presentation, weak convergences in $L^2(0,1)$ of random processes with the standardization varying with u to $(B(u)/\sqrt{u})_{u\in(0,1)}$ are proved.

4 <u>Yong Moo Chung</u> (Hiroshima Univ.)   On the large deviation principle in one-dimensional dynamics ⋯⋯⋯⋯ 15
   Hiroki Takahasi   (Keio Univ.)
   Juan Rivera-Letelier
            (Univ. of Rochester)

Summary: We study a topologically exact smooth interval map with non-flat critical points. Assuming the map has only hyperbolic repelling periodic points and no critical relation, we establish the large deviation principle for empirical means.

5 Haruyoshi Tanaka   Asymptotic perturbation of graph iterated function systems ⋯⋯⋯⋯ 15
          (Wakayama Med. Univ.)

Summary: In this talk, we study an asymptotic perturbation of the limit set generated from a finitely family of conformal contraction maps endowed with a directed graph. We show that if those maps have asymptotic expansions under certain weak conditions, then the Hausdorff dimension of the limit set behaves asymptotically by the same order. We also prove that the Gibbs measure of a suitable potential and the measure theoretic entropy of this measure have asymptotic expansions under an additional condition. Finally, we demonstrate degeneration of graph iterated function systems.

6 Takahiro Hasebe (Hokkaido Univ.)   On unimodality for free Lévy processes ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 10
   <u>Noriyoshi Sakuma</u> (Aichi Univ. of Edu.)

Summary: We will prove that a symmetric free Lévy process is unimodal if and only if its free Lévy measure is unimodal and that Every free Lévy process with boundedly supported Lévy measure is unimodal in sufficiently large time. For the proof we will (almost) characterize the existence of atoms and the existence of continuous probability densities of marginal distributions of a free Lévy process in terms of Lévy Khintchine representation.

7   Kazuhiro Yoshikawa   Some identities of characters of infinitely divisible multidimensional
        (Ritsumeikan Univ.)   Shintani zeta distributions · 15

Summary: In recent years, Aoyama and Nakamura introduced multidimensional Shintani zeta functions, where a class of multidimensional discrete distributions associated with these zeta functions was definable ([2]). By applying Euler products, they showed that the class contained compound Poisson distributions enough ([1]). In this talk, we consider some conditions for multidimensional Shintani zeta distributions to be infinitely divisible. Some of the conditions have relations to identities of multiple zeta values. Our aim is to calculate probabilities for multidimensional Shintani zeta distributions by making use of their identities.

8   Kiyoiki Hoshino (Osaka Pref. Univ.)   On the integrability of Ogawa integrals of noncausal Wiener functionals
     Tetsuya Kazumi (Osaka Pref. Univ.)   · 10

Summary: In the framework of Wiener chaos, in case a noncausal function is represented by a Skorokhod integral, we are to give a sufficient condition the function is Ogawa-integrable,and to represent the Ogawa integral by Skorokhod integrals under the condition.

9   Takafumi Otsuka (Tokyo Metro. Univ.)   A family of self-avoiding random walks interpolating the loop-erased
     Kumiko Hattori (Tokyo Metro. Univ.)   random walk and a self-avoiding walk on the Sierpinski gasket · · · · · · · 15
     Noriaki Ogo (Tokyo Metro. Univ.)

Summary: We show that the 'erasing-larger-loops-first' (ELLF) method, which was first introduced for erasing loops from the simple random walk on the Sierpinski gasket, does work also for non-Markov random walks, in particular, self-repelling walks to construct a new family of self-avoiding walks on the Sierpinski gasket. The one-parameter family constructed in this method continuously connects the loop-erased random walk and a self-avoiding walk which has the same asymptotic behavior as the 'standard' self-avoiding walk. We prove the existence of the scaling limit and study some path properties: The exponent ν governing the short-time behavior of the scaling limit varies continuously in u. The limit process is almost surely self-avoiding, while it path Hausdorff dimension $1/\nu$, which is strictly greater than 1.

10   Shin Harase (Ritsumeikan Univ.)   A comparison study of Sobol' sequences in option pricing · · · · · · · · · · · 15
     Tomooki Yuasa (Ritsumeikan Univ.)

Summary: We consider multivariate numerical integration in financial engineering by quasi-Monte Carlo methods. Sobol' sequences are typical quasi-Monte Carlo sequences with small discrepancy based on the (t, m, s)-nets. Here, there are several Sobol' sequences with distinct parameter sets. In this talk, we compare Sobol' sequences in terms of examples of option pricing.

14:30–15:30   Talk Invited by Statistics and Probability Section

Kazutoshi Yamazaki (Kansai Univ.)   Refracted-reflected Lévy processes

Summary: We study a combination of the refracted and reflected Lévy processes. Given a spectrally one-sided Lévy process and two boundaries, it is reflected at the lower boundary while, whenever it is above the upper boundary, a linear drift at a constant rate is subtracted from the increments the process. Using the scale functions, we compute the resolvent measure, the Laplace transform of the occupation times as well as other fluctuation identities that will be useful in applied probability including insurance, queues, and inventory management. This talk is based on a joint work with José Luis Pérez (CIMAT).

15:45–16:45   Talk Invited by Statistics and Probability Section

Seiichiro Kusuoka (Okayama Univ.)   An approach to the solutions and the fundamental solutions to non-divergence form parabolic equations by stochastic analysis

Summary: We consider the solutions and the fundamental solutions to time-inhomogeneous non-divergence form parabolic partial differential equations with low-regular coefficients by stochastic analysis. If the coefficients are Hölder continuous, there is a well-known result by the parametrix method. In this talk, we consider the case of less regular coefficients. Precisely speaking, we treat the case that the coefficient of the second-order derivative is continuous in the spacial component uniformly in time and the coefficients of the first-order derivative and of the multiplication are bounded measurable, and obtain the modulus of the continuity of the solutions and the fundamental solutions. We also consider the probabilistic aspect of the perturbation of equations, and obtain the existence and the two-sided bounds of the fundamental solution to the perturbed equations. As an application of the probabilistic representation of the perturbation we concern stochastic differential equations with path-dependent drift terms.

March 17th (Thu)   Conference Room II

9:45–11:30

11   Fumio Nakajima (Iwate Univ.)   Statistical approach to the form of Mt. Fuji through its contour map
. . . . 15

Summary: We shall investigate the form of Mt. Fuji through its contour map from mean value and standard deviation of their data.

12   <u>Yoshihiko Maesono</u> (Kyushu Univ.)   Direct kernel type estimator of a hazard ratio and its asymptotic prop-
Taku Moriyama (Kyushu Univ.)   erties 10

Summary: In this talk, we propose a direct kernel type estimator of a hazard ratio and discuss asymptotic properties of them. We obtain asymptotic mean squared errors and compare them with a natural estimator, which is constituted of two kernel type estimators of density and distribution functions. Mean squared errors of the natural estimator are already obtained. Comparing these mean squared errors, we show that the direct estimator is superior than the in-direct estimator in many cases.

13   Gaku Igarashi (Univ. of Tsukuba)   Boundary-bias-free density estimation using multivariate log-normal
kernel 15

Summary: In the recent fifteen years, in order to avoid the boundary bias problem, several univariate asymmetric kernel (AK) estimators of a density with support $[0, \infty)$ or $[0, 1]$ have been suggested. Also, a few multivariate AK estimators were discussed. The log-normal kernel estimator is one of the univariate AK estimators. In this talk, we report the asymptotic properties of the multivariate AK estimator using multivariate log-normal kernel.

14   <u>Sigeo Aki</u>   (Kansai Univ.)   On monotonicity of expected values of some run-related distributions
Katuomi Hirano   (Josai Univ.)   10

Summary: We show that the expectation of the binomial distribution of order k with success probability p is monotonically increasing with respect to p for all n and k. The result is extended to the problems on exchangeable random sequences and expectations of distributions of mixtures of binomial distributions of order k are studied. If the mixing measure is stochastically increasing with respect to its parameter, the expectation of the mixture of binomial distributions of order k becomes nondecreasing. As examples of mixing measures submodels of beta distributions are examined and the resulting expectation of the mixture distribution is monotonically strictly increasing. Further, we show some properties on the expectation of the ℓ-overlapping 1-runs.

15 <u>Nobuki Takayama</u> (Kobe Univ.)   Numerical evaluation of conditional probability for two way contingency
   Yoshiaki Goto   (Kobe Univ.)   table · 10
   Yoshihito Tachibana (Kobe Univ.)

Summary: We give a complexity analysis of the holonomic gradient method (HGM) to evaluate numerically and exactly the conditional probability of a given two way contingency table. A modular method is applied to evaluate efficiently the probability.

16 Tamio Koyama (Univ. of Tokyo)   Numerical calculation of simplex probability by holonomic gradient
                                     method · 15

Summary: We utilize the holonomic gradient method for the numerical calculation of the probability content of a simplex with a multivariate normal distribution. For this purpose, we calculate the derivatives of the function associated with the probability content of a polyhedron in general position. And we show that these derivatives can be written as integrals on the faces of the polyhedron.

17 <u>Katusi Fukuyama</u> (Kobe Univ.)   Metric discrepancy results for geometric progressions with large ratios
   Mai Yamashita   · 5
   (Osaka Toin Junior and Senior High School)

Summary: For geometric progressions with common ratios greater than 4, the law of the iterated logarithm for discrepancies is proved and the speed of convergence to the uniform distribution is determined for almost all initial values.

18 Yasuki Isozaki (Kyoto Inst. Tech.)   Density of the first hitting time of the integer lattice by symmetric Lévy
                                         processes · 15

Summary: For one-dimensional Brownian motion, the exit time from an interval has finite exponential moments and its probability density is expanded in exponential terms. In this note we establish its counterpart for certain symmetric Lévy processes. We obtain the partial fraction expansion for the Laplace transform of the first hitting time of the integer lattice and by inversion the expansion of the density in exponential terms. Intermediate results such as finite exponential moments are also obtained for a class of nonsymmetric Lévy processes.

11:30–12:00

March 18th (Fri)   Conference Room II

9:45–12:00

19 Seiichi Iwamoto (Kyushu Univ.[*])   Dual least squares method —some variants— · 15

Summary: This talk presents some variants of dual least squares method. Four models – (1) linear perturbation, (2) quadratic-convexity, (3) x-quadratic y-linearity, and (4) y-quadratic x-linearity – are introduced with its closed form of primal and dual optimal solutions. The linear perturbation model is completely solved. The others also have the same structure in optimal solution. The dual (maximization) problem is derived from the primal (minimization) problem through three – (a) dynamic, (b) plus-minus, (c) inequality – approaches.

20 <u>Yutaka Kimura</u> (Akita Pref. Univ.)   Is Golden path optimal? · 15
   Seiichi Iwamoto (Kyushu Univ.[*])

Summary: It is shown that Golden path is optimal for two quadratic programming problems (maximization and minimization) under semi-Fibonacci constraints. Some relations to reversed problem and dual problem are discussed. It turns out that both the problems are dual to each other and have an identical optimal solution (point and value). The optimal solution is characterized by the Golden number.

21　Akio Tanikawa (Osaka Inst. of Tech.)　　A generalized class of pseudomeasurements for identifying unknown parameters of linear stochastic systems ··························· 10

Summary: A new class of pseudomeasurements for discrete-time stochastic systems are derived from continuous-time linear stochastic systems with unknown parameters by applying time-discretization and Taylor expansion. Utilizing these pseudomeasurements, we propose new iterative methods which estimate the states of the discrete-time stochastic systems and identify the unknown parameters simultaneously.

22　Masayuki Horiguchi (Kanagawa Univ.)　　Optimal stopping problem in uncertain Markov decision processes ···· 15
　　A. B. Piunovskiy (Univ. of Liverpool)

Summary: This note is concerned with the optimal stopping problem under Markov decision processes with the total expected cost criterion. The state of the system is observable, but the transition matrices are unknown. Under the general formulation, the problem is solved by combining dynamic programming and Bayesian approach and the optimal stopping rule of a threshold type is derived.

23　Masahiko Sakaguchi (Kochi Univ.)　　A minimal imbedding for maximization the S. W. Golomb exponential function ·· 10

Summary: We maximize the the exponential function by S. W. Golomb (Amer. Math. Monthly 75, 1968). The original problems are equivalent to the maximizing problem with a multiplicative reward function with real numbers. Therefore we give a minimal imbedding for the maximizing multiplicative reward problem and the optimal recursive equation.

24　Kazuki Matsubara (ChuoGakuin Univ.)　　Some existence of cyclic splitting BIB designs ····················· 15
　　Sanpei Kageyama (Tokyo Univ. of Sci.)

Summary: The concept of splitting balanced incomplete block (BIB) designs $B(v, u \times k, \lambda)$ has been defined with some applications for authentication codes in Ogata et al. (2004). In this talk, some fundamental combinatorial properties of splitting BIB designs with cyclic automorphism are given and some direct methods of constructing such designs are provided. Finally, the complete existence of a cyclic splitting $B(v, 2 \times 2, \lambda)$ for any v and λ, and non-existence of a cyclic splitting $B(k^2t + 1, 2 \times k, 1)$ for any odd integers $k \geq 3$ and $t \geq 1$ are shown.

25　Xiao-Nan Lu　　(Nagoya Univ.)　　A construction of cyclic 3×3 grid-block designs and its application
　　Masakazu Jimbo (Chubu Univ.)　　 ··· 15

Summary: The notion of grid-block designs originated from the experimental designs for DNA library screening as follows: For a v-set V, let $\mathcal{B}$ be a collection of $r \times k$ arrays with rk different entries in V. A pair $(V, \mathcal{B})$ is called an $r \times k$ grid-block design if every pair of distinct points in V occurs exactly once in the same row or in the same column of a grid-block of $\mathcal{B}$. Moreover, $(V, \mathcal{B})$ is cyclic, if $\mathcal{B}$ admits a cyclic group of order v as its automorphism. In this talk, by utilizing cyclotomic methods, we investigate a construction of cyclic 3×3 grid-block designs and apply the resultant designs to construct resolvable 3×3 grid-block designs.

26 <u>Hiromu Yumiba</u> (Int. Inst. for Nat. Sci.)   Characteristics of balanced fractional 3^m factorial designs of resolution
    Yoshifumi Hyodo $R^*(\{10, 01\}|\{00, 10, 01, 20, 11\})$ with $N < \nu(m)$ $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    (Okayama Univ. of Sci./Int. Inst. for Nat. Sci.)
    Masahide Kuwada
            (Int. Inst. for Nat. Sci.)

Summary: Consider a fractional 3^m factorial design with m factors each at three levels, which is derived from a simple array (SA) of three symbols, where $m \geq 4$, and the non-negligible factorial effects are the general mean, the linear components and the quadratic ones of the main effect, and the linear by linear ones and the linear by quadratic ones of the two-factor interaction. Under these situations, if all the main effects are estimable, and the remaining non-negligible factorial effects may or may not be estimable, then a design is said to be of resolution $R^*(\{10, 01\}|\Omega)$, where $\Omega = \{00, 10, 01, 20, 11\}$. Then by using the properties of some algebra, we give the existence conditions of a 3^m-BFF design of resolution $R^*(\{10, 01\}|\Omega)$ derived from an SA, where the number of assemblies is less than the number of non-negligible factorial effects.

27 <u>Masanori Sawa</u>   (Kobe Univ.)   A generalization of the corner-vector method for constructing D-optimal
    Masatake Hirao (Aichi Pref. Univ.)   designs on the hyperballs $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Hirotaka Yamamoto (Kobe Univ.)

Summary: Many publications have been devoted to the constructions of D-optimal designs on the hyperballs, most of which are however for regression models for polynomials of degree at most 3. In this talk we propose a geometric construction of D-optimal designs and thereby find such designs of degree at least 4. The proposed method is not only of statistical interest but also a natural generalization of a classical construction of Euclidean designs using the corner vectors for the hyperoctahedoral group in algebraic combinatorics.

14:15–15:15   Talk Invited by Statistics and Probability Section

Nobuhiro Taneichi (Kagoshima Univ.)   An approximation for the distribution of the multinomial goodness-of-fit
                                          statistic and its application to discrete statistical model

Summary: On the goodness-of-fit test for the multinomial distribution, an approximation based on an asymptotic expansion for the distribution of a test statistic under simple null hypothesis has been developed (Ranga Rao (1961), Yarnold (1972), Siotani & Fujikoshi (1984), Read (1984)). First, we summarize the theory of the approximation and show a difficulty to extend the theory. Second, we consider the approximation for the distribution of a test statistic under alternative hypotheses. Third, we apply the approximation to some discrete statistical models (e.g., contingency table, generalized linear model with binary response).

15:30–16:30   Award Lecture for the 2015 MSJ Analysis Prize

Akimichi Takemura (Univ. of Tokyo)   Studies on holonomic gradient method

Summary: We give a review talk on holonomic gradient method, from its origin to recent developments. The holonomic gradient method combines algebraic algorithms for the module of differential operators and numerical solvers for ordinary differential equations. The method is found to be very useful for evaluation of the normalizing constants of many probability distributions in statistics and the computation of the maximum likelihood estimators.

March 19th (Sat)   Conference Room II

9:50–12:00

28   <u>Fumiya Akashi</u> (Waseda Univ.)   LAD-based empirical likelihood method for linear hypothesis and its
     Xiaofeng Shao   local asymptotic power $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
     (Univ. of Illinois at Urbana-Champaign)

Summary: In this talk, we construct the least absolute deviation (LAD)-based empirical likelihood (EL) test
statistic for a linear hypothesis on unknown parameters of linear regression models. As a noteworthy result,
LAD-based EL test statistic is shown to converge to the standard chi-square distribution. Since the limit
distribution is pivotal, we can construct a testing procedure without estimating any unknown quantities
of the model. In addition, the limit distribution of LAD-based EL test statistic under local contiguous
alternatives is elucidated, and the asymptotic local power of the proposed test is derived. Finally, we
investigate finite sample performance of the proposed test by simulation experiments, and it is shown that
our approach has advantages in many senses compared with classical one.

29   Fumiya Akashi (Waseda Univ.)   Self-weighted empirical likelihood method for hypothesis testing of sta-
                                     ble ARMA models $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: This talk applies the empirical likelihood method to the testing problem for a linear hypothesis of
stable ARMA models, which is one of infinite variance processes. In particular, by using the method called
self-weighting, we construct self-weighted least absolute deviation-based empirical likelihood (SWLAD-EL)
test statistic. Remarkably, it is shown that the limit distribution of the proposed test statistic becomes
a standard chi-square distribution, and hence we can carry out hypothesis testing without estimating any
unknown quantities of the underlying model. We also compare the finite sample performance of the proposed
test with that of classical LAD-based test by simulation experiments. It is also reported that the proposed
test is applicable to the real data analysis such as variable selection or testing serial correlations.

30   Yan Liu   (Waseda Univ.)   Box–Cox transformation for variance stabilization of dependent obser-
                                      vations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Box–Cox transformation is one of the most famous transformations to stabilize the variance
of estimators. In this talk, we focus on the dependent random variables with the multivariate Tweedie
distributions to derive the optimal power coefficient in Box–Cox transformation for stabilizing variance of
dependent random variables. Under a new condition between dispersion parameters, we show the formula
for power parameter in the Box–Cox transformation for variance stabilization of dependent observations.
The result shows that even in the dependent case, the same formula as that in the case of identically and
independent distributed random variables holds. The proof and numerical simulation will also be given.

31   <u>Yujie Xue</u>   (Waseda Univ.)   Minimax extrapolation error of predictors $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
     Yan Liu   (Waseda Univ.)
     Masanobu Taniguchi (Waseda Univ.)

Summary: In characterizing time series, an important representation is of frequency domain because of the
periodic nature of the trigonometric functions. As we know, for a weakly stationary process $\{X_t : t \in Z\}$
with mean 0 and spectral distribution function $F(\lambda)$, the linear prediction problem can be transferred into a
minimization problem of the distance from 1 to a subspace of $L^2(dF)$. In this paper, we give the structure
of optimal predictor of l-step prediction problem when $L^2(\cdot)$ is extended to the cases of $p > 1$ i.e., $L^p(\cdot)$,
and the minimax extrapolation error of predictors is discussed.

32 <u>Hideaki Nagahata</u> (Waseda Univ.)   Analysis of variance for multivariate time series · · · · · · · · · · · · · · · · · · · 10
    Masanobu Taniguchi (Waseda Univ.)

Summary: An asymptotic distribution about three test statistics (likelihood ratio, Lawely–Hotelling, Bartlett–Nanda–Pillai) under MANOVA model with an independently and identically distributed innovation term is well-known. In practice, we often need to analyze multivariate time series data (for example real financial data). For this, under MANOVA model with dependent error processes we drive the asymptotic distribution about the three test statistics. We give a sufficient condition for the tests to have the χ^2-asymptotic distribution. It is shown that the CHARN models satisfy this condition, which leads to a lot of applications in financial analysis. Also some interesting numerical studies will be given.

33 Yoshihiro Suto (Waseda Univ.)   Shrinkage estimation for the misspecified pseudo interpotator of a stationary process · 10

Summary: We consider a misspecified interpolation problem, and propose a shrinkage estimator of the usual pseudo interpolator. We evaluate the mean squared interpolation error (MSIE) of the pseudo shrinkage interpolator. Then we provide a condition when the pseudo shrinkage interpolator improves the usual pseudo interpolator. Next we propose the practical shrinkage interpolator, and evaluate MSIE. Under the appropriate conditions, we see that the practical shrinkage estimator improves the usual pseudo interpolator asymptotically. We also give some numerical examples which show an interesting feature of the pseudo shrinkage interpolator.

34 Yoshihide Kakizawa (Hokkaido Univ.)   Generalized Birnbaum–Saunders kernel density estimator · · · · · · · · · · · 15

Summary: We consider estimation of the probability density for nonnegative data. In that case, the standard kernel density estimator is, in general, inconsistent near the boundary, due to the so-called boundary bias. Many authors have suggested some remedies, on the basis of renormalization, reflection, and generalized jackknifing (see Jones (1993)). On the other hand, over the last decade, there has been growing interest in the use of asymmetric kernel (AK), whose support matches the support of the density to be estimated. We propose AK density estimator using a generalized BS kernel.

35 Yoshihide Kakizawa (Hokkaido Univ.)   Some integrals involving multivariate Hermite polynomials · · · · · · · · · · 10

Summary: We present the formula for a certain integral with respect to multivariate Hermite polynomials. Such integrals are used for deriving higher-order local power functions of asymptotically chi-squared tests. Our argument for the proof of main theorem is very simple, except for the use of an unfamiliar derivative of composite function $f(g(t))$, where f is a scalar-valued function of a real variable and g is a scalar-valued function of a vector variable $t = (t_1, \ldots, t_p)'$.

36 <u>Kazuyoshi Yata</u> (Univ. of Tsukuba)   Estimation of a signal matrix for high-dimensional data · · · · · · · · · · · · · 15
    Makoto Aoshima (Univ. of Tsukuba)

Summary: In this talk, we consider the problem of recovering a signal (low-rank) matrix in high-dimension, low-sample-size (HDLSS) situations. We first consider the conventional PCA to recover the signal matrix and show that the estimation of the signal matrix holds consistency properties under severe conditions. The conventional PCA is heavily subjected to a noise. In order to reduce the noise, we apply the noise-reduction (NR) methodology and propose a new estimation of the signal matrix. We show that the proposed estimation by the NR method holds the consistency properties under mild conditions and improves the error rate of the conventional PCA effectively.

14:15–16:10

37   Aki Ishii   (Univ. of Tsukuba)   Note on two-sample tests for high-dimension, low-sample-size data ⋯ 15

Summary: A common feature of high-dimensional data is the data dimension is high, however, the sample size is relatively low. We call such data HDLSS data. Ishii et al. (2015) gave asymptotic properties of the first principal component by using the noise-reduction (NR) methodology that was created by Yata and Aoshima (2012). In this talk, we consider two-sample tests for high-dimensional data when the data dimension goes to infinity while the sample-size is fixed. We propose a new test statistic by applying the NR estimator of the largest eigenvalue.

38   Ayaka Yagi (Tokyo Univ. of Sci.)   On likelihood ratio test statistic for test of mean vector with monotone
     Takashi Seo (Tokyo Univ. of Sci.)   missing data ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 15
     Muni Srivastava (Univ. of Toronto)

Summary: We consider the likelihood ratio test (LRT) for testing of mean vector when the data have a monotone pattern of missing observations. In order to obtain the modified LRT statistic, we express the LRT statistic as the combining independent LRT statistics, and we derive an asymptotic expansion for the distribution of each independent LRT statistic. As a result, we propose a new modified LRT statistic using the correction factors of the LRT statistics. Finally, we investigate the asymptotic behavior of these LRT statistics for chi-squared distribution and the numerical powers using Monte Carlo simulation.

39   Mana Aizawa (Tokyo Univ. of Sci.)   Measure of departure from sum-symmetry model for square contingency
     Kouji Yamamoto (Osaka Univ.)   tables having ordered categories ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 10
     Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For the analysis of square contingency tables, Yamamoto et al. (2013, 2015) considered the sum-symmetry (SS) model. We propose a measure to represent the degree of departure from the SS model, which is expressed by using Cressie and Read's (1984) power-divergence.

40   Yusuke Saigusa (Tokyo Univ. of Sci.)   A measure of departure from second-order marginal symmetry for multi-
     Kouji Tahata (Tokyo Univ. of Sci.)   way contingency tables ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 15
     Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For multi-way contingency tables, Bhapkar and Darroch (1990) considered the second-order marginal homogeneity model. We shall propose the measure to represent degree of departure from second-order marginal homogeneity. Also we shall give the approximate confidence interval of the proposed measure.

41   Akira Shibuya (Tokyo Univ. of Sci.)   Diagonal exponent conditional symmetry model for square contingency
     Kiyotaka Iki (Tokyo Univ. of Sci.)   tables with ordered categories ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 10
     Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For square contingency tables with ordered categories, Tomizawa (1992) proposed the diagonal exponent symmetry (DES) model which indicates that in addition to the structure of symmetry of the probabilities with respect to the main diagonal of the table, the expected frequency has an exponential form along every subdiagonal of the table. In this paper, we propose new model which indicate that in addition to the structure of asymmetry of the probabilities with respect to the main diagonal of the table, the expected frequency has an exponential form along every subdiagonal of the table. Also this paper gives the three kinds of decompositions of the DES model.

42   Ryotaro Maeda (Tokyo Univ. of Sci.)   Extended double linear diagonals-parameter symmetry model and de-
     Kouji Tahata (Tokyo Univ. of Sci.)   composition of double symmetry for square tables with ordered cate-
     Sadao Tomizawa (Tokyo Univ. of Sci.)   gories ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯ 15

Summary: For square contingency tables with ordered categories, we consider the extended double linear diagonals-parameter symmetry model, and show that the double symmetry model is separated into the proposed model and the moment equality model. Also, the relationship between test statistics is given.

Summary: We consider the problem of finding the parent set of variables on which a variable depends using the MDL principle. It is known that the parent set can be efficiently found using branch and bound (Suzuki 1996). In this paper, we show that the optimal parent set has at most $L = O(\log n)$ variables and the total computation is at most $O(p^L)$ for the method.

Summary: We consider a prediction problem regarding the location and scale families with restricted parameters. It is shown that the best equivariant predictors, which are constructed under unrestricted parameters, are minimax, but are improved. Unlike the location and scale families, it seems difficult to generally show that there exists a predictor which dominates the best equivariant predictor in the location-scale family. Instead, we shall give an example in which the best equivariant predictor is improved.

Applied Mathematics

March 16th (Wed)   Conference Room VII

10:30–12:00

1 Kazuhiko Ushio   Balanced C_9-foil designs and related designs $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In graph theory, the decomposition problem of graphs is a very important topic. Various type of decomposition of many graphs can be seen in the literature of graph theory. This paper gives balanced C_9-foil designs and related designs.

2 <u>Shoichi Tsuchiya</u> (Senshu Univ.)   On maximum HIT in P_6-free graph $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
Michitaka Furuya (Tokyo Univ. of Sci.)

Summary: It is known that every 3-connected P_5-free graph of order at least 8 has a HIST. On the other hand, we found an infinite family of k-connected P_6-free graphs without HISTs. In this talk, we introduce a result on maximum HIT in a P_6-free graph.

3 Kenta Noguchi (Tokyo Denki Univ.)   Colorings of a medial graph of plane quadrangulations $\cdots\cdots\cdots\cdots$ 15

Summary: In this talk, we discuss colorings of a medial graph of plane quadrangulaions. The main theorem is the following: every medial graph of a plane quadrangulation G has a proper vertex-3-coloring if the dual of G is C-simple.

4 Naoki Matsumoto (Seikei Univ.)   Graph-grabbing game on bipartite graphs $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: A *graph-grabbing game* is a two-players game on weighted connected graphs. In the game, they alternately remove a non-cut vertex from the graph and get the weight assigned to the vertex. Both players' aim is to maximize their outcomes, when all vertices have been taken. Seacrest and seacrest proved that Alice can obtain at least half of the total weight of every weighted tree with even order, and conjectured that the same statement holds for connected bipartite graphs with even order. In this talk, we prove that Alice can obtain at least $\frac{1}{4}$ of the total weight of every weighted connected bipartite graph with even order.

5 <u>Shohei Satake</u> (Nagoya Univ.)   Asymmetry of oriented graphs and some related results $\cdots\cdots\cdots\cdots$ 15
Masanori Sawa   (Kobe Univ.)
Masakazu Jimbo (Chubu Univ.)

Summary: In this talk, we deal with oriented graphs and hereafter, "graph" means oriented graph. First, we define the asymmetry number of graphs with n vertices and show an upper bound. And we also introduce the result which shows this bound is asymptotically best possible by using probabilistic methods. Moreover we show some results about the symmetry of the random oriented graph RO. Next, we consider finite graphs with n vertices and N edges and show an upper bound of the asymmetry number for such graphs and we will also discuss the asymptotically best possibility.

14:30–16:00

6 Tadashi Takahashi (Konan Univ.)   The Inference Process using Automated Theorem Prover $\cdots\cdots\cdots\cdots$ 10

Summary: Theorema system allows you to organize mathematical knowledge as hierarchies of interdependent theories. We present a case study using the theorema system to explore for inference process.

7   <u>Masataka Kaneko</u> (Toho Univ.)   Effective linkage between TeX drawing and handling of graphical data
     Toshio Oshima   (Josai Univ.)   · 15
     Setsuo Takato   (Toho Univ.)

Summary: In this presentation, we introduce the KETCindy system which is a plug-in of dynamic geometry software to convert its graphical data into TeX graphics code. Throgh the example of drawing Bezier curves and its application to the calculation of the areas surrounded by those curves, it will be demonstrated that the effective linkage between TeX drawing and the handling of its graphical data can be realized by KETCindy system. It is expected that these features of KETCindy system might serve a powerful tool in wide range of mathematical science.

8   <u>Ryohei Miyadera</u>   A Variant of Nim —A necessary and sufficient condition for the Grundy
     (Kwansei Gakuin High School)   number of this game to be the Nim-sum— · 15
     Yushi Nakaya
     (Kwansei Gakuin High School)

Summary: Chocolate bar games are variants of Nim (or CHOMP) in which the goal is to leave your opponent with the single bitter part of the chocolate. Here, we investigate step chocolate bars whose widths are determined by a fixed function of the horizontal distance from the bitter square. We present a necessary and sufficient condition for a chocolate bar to have Grundy number $G(\{y, z\}) = y \oplus z$. We also present a necessary and sufficient condition for a chocolate bar to have Grundy number $G(\{y, z\}) = (y \oplus (z + s)) - s$.

9   Akihiro Higashitani   Classification of lattice simplices and binary simplex codes · · · · · · · · · · 15
          (Kyoto Sangyo Univ.)

Summary: It was proven that for a lattice simplex of dimension d with degree k which is not a lattice pyramid over a lower-dimensional simplex, the inequality $d \leq 4k - 2$ holds. In this talk, we classify all the lattice simplices of dimension $4k - 2$ with degree k which are not lattice pyramids up to unimodular equivalence. Actually, such a lattice simplex is uniquely determined by its degree and arises from a binary simplex code.

10   Masahiro Hachimori   Partitionability of simplicial complexes, h-triangles and hereditary prop-
          (Univ. of Tsukuba)   erties · 15

Summary: Shellability of simplicial complexes implies sequential Cohen–Macaulayness and partitionability. While sequentail Cohen–Macaulayness implies the nonnegativity of h-triangles, h-triangles of partitionable simplicial complexes can have negative entries. We, however, observe that partitionability implies somewhat weaker nonnegativity property of h-triangles (i.e., property SNNDH). We then proced to show that hereditary-shellability, hereditary-sequential Cohen–Macaulayness, hereditary-partitionability and hereditary-SNNDH are all equivalent for dimensions upto 2.

16:10–17:10   Talk Invited by Applied Mathematics Section

Tadashi Sakuma (Yamagata Univ.)   Similarities and dissimilarities between the blocking and anti-blocking
                                    polyhedra

Summary: The study of similarities and dissimilarities between the blocking and anti-blocking polyhedra began with a series of celebrated papers by Fulkerson (1970, 1971, 1972), and it has grown up a mature theory by significant contributions of Lehman, Lovász, Padberg, and others in 1970s and 1980s. Even today, this theory still shows a big progression such as the perfect graph theorem of Seymour et al. (2006). In this paper, we survey the current status of this research field with a focus on the conjecture of Conforti & Cornuéjols and the conjecuture of Grinstead.

March 17th (Thu)   Conference Room VII

10:00–11:30

11   <u>Iwao Sato</u> (Oyama Nat. Coll. of Tech.)   Zeta function of a simplicial complex · 15
     Etsuo Segawa   (Tohoku Univ.)
     Kaname Matsue (Inst. of Stat. Math.)

Summary: We define a zeta function for a 2-dimensional simplicial complex of a maximal planar graph, and present its determinant expression. Furthermore, we generalize it to a 2-dimensional cell complex of a planar graph. Next, we define a zeta function for a skeleton of the clique complex of a graph, and give its determinant expression. Finally, we give a determinant expression for the zeta function of the 2-dimensional skeleton of the clique complex of a complete graph.

12   <u>Hideo Mitsuhashi</u> (Utsunomiya Univ.)   Quaternionic weighted zeta functions of finite graphs · · · · · · · · · · · · · · 15
     Norio Konno (Yokohama Nat. Univ.)
     Iwao Sato (Oyama Nat. Coll. of Tech.)

Summary: We establish the quaternionic weighted zeta function of a graph and its study determinant expressions. For a graph with quaternionic weights on arcs, we define a zeta function by using an infinite product which is regarded as the Euler product. This is a quaternionic extension of the square of the Ihara zeta function. We show that the new zeta function can be expressed as the exponential of a generating function and that it has two study determinant expressions, which are important for the theory of zeta functions of graphs.

13   Akito Suzuki   (Shinshu Univ.)   Asymptotic behavior of a quantum walker and the weak limit theorem
                                         · 15

Summary: We consider the discrete time quantum walk on the line with a position dependent coin. We construct the asymptotic velocity operator of the quantum walk. As a consequence, we obtain the weak limit theorem.

14   <u>Takuya Tsuchiya</u> (Waseda Univ.)   Numerical simulations of Maxwell's equations by discrete variational
     Gen Yoneda   (Waseda Univ.)   derivative method · 15

Summary: In this talk, the discretized Maxwell's equations using the discrete variational derivative method (DVDM) are considered. It is well known the discretized equations are not unique and that the results of simulations depend on the discretized equations used. However, this is difficult because the discretization scheme depends on the continuous equations. Using the DVDM, the discretized equations are derived appropriately. We derive the discretized evolution equation of the constraint equation using the DVDM and the iterated Crank–Nicolson scheme (ICNS), show the equation by the DVDM is superior to that by the ICNS in analytical. Then we perform some simulations using the discretized equations using the DVDM and the ICNS, confirm that the numerical results are consistent with analytical ones.

15   Fumihiko Nakamura (Hokkaido Univ.)   Asymptotic periodicity of non-expanding piecewise linear maps with
                                            random small noises · 10

Summary: The non-expanding piecewise linear map $S_{\alpha,\beta}(x) = \alpha x + \beta \pmod 1$ for $(\alpha, \beta) \in (0,1)^2$ is known as the Nagumo–Sato model which describes simplified dynamics of a single neuron. We first consider parameter regions of (α, β) in which $S_{\alpha,\beta}$ has a periodic point with period n for an arbitrary integer n. We then describe these regions explicitly and show these complicated structure associated with the Farey series. Next we consider the random dynamical system of NS model with random small noises. We discuss that the Markov operator of this system is either asymptotically periodic or asymptotically stable depending on a noise level.

13:10–14:00

16   Shinya Fujita (Yokohama City Univ.)   Some results on properly colored cycles in edge-colored graphs · · · · · · · 10

Summary: Some recent results on properly colored cycles in edge-colored graphs will be reviewed. We present a new result on this topic.

17   <u>Akira Saito</u>   (Nihon Univ.)   The Chvátal–Erdős condition and a 2-factor with two components in a
    kiyoshi Yoshimoto (Nihon Univ.)   graph · 15

Summary: A graph G is said to satisfy the Chvátal–Erdős condition if $\alpha(G) \leq \kappa(G)$ holds, where $\alpha(G)$ and $\kappa(G)$ are the independence number and the connectivity of G, respectively. Chen et al. (2007) have proved that a graph G of order at least 128 satisfying the Chvátal–Erdős condition contains a 2-factor with two components. Their proof uses the Ramsey theorem. By a different approach which does not use the Ramsey theorem, we have proved that a graph of order at least 31 satisfying the Chvátal–Erdős condition contains a 2-factor with two components.

18   Kiyoshi Ando   A condition on $G[V_5(G)]$ for a 5-connected graph G to have a con-
    (Nat. Inst. of Information / JST ERATO)   tractible edge · 15

Summary: An edge of a 5-connected graph is said to be contractible if the contraction of it results in a 5-connected graph. Let K_4^- stand for the graph obtained from K_4 by deleting one edge. Let G be a 5-connected graph. Let $V_5(G)$ denote the set of degree 5 vertices of G. We show that if $G[V_5(G)]$ has a component H such that $|H| \leq 4$ and $H \ncong K_4^-$, then G has a contractible edge.

14:00–14:15   **Presentation Ceremony for the 2015 MSJ Prize for Excellent Young Applied Mathematicians**

<div align="center">

March 18th (Fri)   Conference Room VII

</div>

9:15–11:55   **Special Session "Topological data analysis and persistent homology"**

Yasuaki Hiraoka (Tohoku Univ.)   Topological data analysis and persistent homology · · · · · · · · · · · · · · · · 35

Summary: In this talk, I survey recent progresses on topological data analysis, especially persistent homology, and applications to materials science. On mathematical side, after a brief introduction, several connections to quiver representations are explained in detail. I show that Gabriel's theorem, the Auslander–Reiten theory, and matrix problems studied in quiver representations are useful for generalizing persistent homology. Then, these generalizations are applied to geometric analysis on soft-matters such as amorphous structures and polymers. I show that persistent homology is a powerful language for describing order in disorder.

Ippei Obayashi (Tohoku Univ.)   Inverse problem from persistence diagrams to point clouds · · · · · · · · · · 35

Summary: Persistent homology is the main tool of Topological data analysis (TDA), a mathematical framework to analyze data from the viewpoint of topology. In this talk, our data is a point cloud, a finite set of point in euclidean space. A persistence diagram is a visualization tool for persistence homology and it encodes the ℓ-dimensional topological features of given data.

We already know the efficient way to compute a persistence diagram from a point cloud and there are many applications of persistence diagrams. In this talk, we consider the inverse problem from a persistence diagram to a point cloud. In other words, we study how to find the point cloud whose persistence diagram is a given target diagram. Since the solution of this problem is not unique, we need an additional constraints. In our method, for a given point cloud (called an initial point cloud), we try to find the point cloud closest to the initial point cloud and whose persistence diagram is the given target diagram. The Newton–Raphson method with pseudo inverse matrices is used to compute the solution. The key is the differentiability of the persistence map, the map from the space of point clouds to the space of persistence diagrams.

In this talk, I will show the mathematical framework of the method and some numerical examples.

This study is a joint work with Marcio Gameiro (Universidade de São Paulo) and Yasuaki Hiraoka (Tohoku University).

Tomoyuki Shirai (Kyushu Univ.)   Random complex and persistent homology ······················ 35

Summary: In the beginning of this century persistent homology theory appears as a tool of topological data analysis for point cloud data, protein data, image data, material sciences, and so on. It describes birth and death of homology classes as persistence diagram by providing an increasing sequence of simplicial complexes. We are interested in the topological feasture of random object, in particular, random persistence diagram obtained from random input. The Erdős–Renyi graph process is such a typical example of increasing stochastic process and we can see its random persistence diagram as an output. In this talk, we focus on simplicial complex versions of the Erdős–Renyi graph process and discuss the mean lifetime of its homology classes by emphasizing the relationship between mean lifetime of persistent homology and minimum spanning acycle.

Genki Kusano (Tohoku Univ.)   Kernel methods for persistent homology and topological data analysis
·· 35

Summary: In this talk, we will establish a kernel based framework of statistics for "shapes of data". In topological data analysis, shapes of data are algebraically encoded and expressed as a persistence diagram (PD). It gives us novel applications in a wide variety of fields, such as biology, information technology, material science, and image analysis, and these scientific rapid developments create new industrial movements in data analysis. The statistical discussions for PDs, however, have not been developed until recently, and are strongly desired by many researchers. Our results answer to this demand. The main theoretical contribution is to ensure that perturbation of data does not drastically affect the results of kernel methods. Moreover, the numerical experiments show the effectiveness of our presented method in physics and material science.

14:30–16:00

19   Masaji Watanabe (Okayama Univ.)   Study on inverse problems from modeling of exogenous type microbial
      Fusako Kawai (Kyoto Inst. Tech.)   depolymerization processes ···································· 15

Summary: A mathematical model for exogenous type depolymerization processes is described. Inverse problems are formulated for a time factor and a molecular factor of degradation rate. Techniques for inverse problems are illustrated.

20   Fumio Nakajima (Iwate Univ.)   A mathematical approach to the economy of atomic power generation
·· 15

Summary: We shall construct a mathematical model for the economy of the atomic power generation, and show its ultimate state, which means the abolition of this generation.

21   Kaname Matsue (Inst. of Stat. Math.)   Covering-exchange for fast-slow systems with multi-dimensional slow
      variables ··· 15

Summary: We provide a methodology of validating rigorous trajectories of the fast-slow system with multi-dimensional slow variables

$$x' = f(x, y, \epsilon), \quad y' = \epsilon g(x, y, \epsilon),$$

which are near slow manifolds for the time interval $O(1/\epsilon)$ within an explicit scale parameter range $(0, \epsilon_0]$, which will be applicable to rigorous numerics. Main tools of our procedure are a topological tool called covering relation and the rigorous estimate of normal hyperbolicity for invariant manifolds via cone estimates. The local product structure of covering relation and normal hyperbolicity of invariant manifolds enable us to construct trajectories which shadow slow manifolds even for systems with multi-dimensional slow variables.

22   <u>Koichi Anada</u>   Blow-up sets and rates for Type II blow-up solutions to a quasi-linear
      (Waseda Univ. Senior High School)   parabolic partial differential equation · 15
      Tetsuya Ishiwata
            (Shibaura Inst. of Tech.)

Summary: In this talk, we consider a quasi-linear parabolic partial differential equations that solutions blow up regionally and has blow-up rates of Type II. Our purpose is to specify their blow-up sets and blow-up rates.

23   Toshikazu Kuniya (Kobe Univ.)   Global dynamics of a mathematical model for the spread of information
                                         · 15

Summary: In this study, a mathematical model for the spread of information is formulated as a system of partial differential equations. The basic reproduction number Ro is obtained in the sense of reproduction of new information spreaders by an information spreader invading into the information-free population. It is proven that the information-free equilibrium is globally asymptotically stable if Ro is less than or equal to 1, and the information-endemic equilibrium is so if Ro is greater than 1. In the numerical simulation, the occurrence of traveling waves is observed.

16:15–17:15   Talk Invited by Applied Mathematics Section

Miyuki Koiso   (Kyushu Univ.)   Geometry of anisotropic surface energy

Summary: An anisotropic surface energy is one that depends on the direction of a surface at each point. It was introduced by Josiah Willard Gibbs (1839–1903) to model the equilibrium shape of a crystal. Whereas the surface energy of a liquid drop is isotropic, the ordered arrangement of molecules in a crystal means that its interfacial energy depends on the surface direction. This causes that, while the closed surface with the minimum area (isotropic surface energy) among closed surfaces enclosing a given volume is a sphere, the closed surface with the minimum anisotropic surface energy is in general non-spherical. In this talk, we discuss existence, stability, and uniqueness of equilibrium surfaces for anisotropic surface energy and their geometric properties.

March 19th (Sat)   Conference Room VII

10:00–12:00

24   Shunzi Horiguchi   Experiments to compare the convergences of third extended Halley
            (Niigata Sangyo Univ.)   method with Halley method · 15

Summary: We can not obtain the degree of convergence of third extended Halley method. So, we do the experiments to compare the convergences of third extended Halley method with Halley method.

25   <u>Hidenori Ogata</u>   Numerical integration method based on the hyperfunction theory · · · · 15
            (Univ. of Electro-Comm.)
      Hiroshi Hirayama
            (Kanagawa Inst. of Tech.)

Summary: In this speech, we propose a numerical integration method based on Sato's hyperfunction theory. In our method, we transform a desired integral into a complex loop integral and approximate it by the trapezoidal rule. A theoretical error estimate shows exponential convergence of this method if the integrand is a real analytic function, and numerical examples show that this method works very well especially for integrals with strong endpoint singularities. We also remark that this method is closely related to the hyperfunction theory in the sense that, in this method, we approximate the complex integral which defines the desired integral as a hyperfunction integral.

26   Takaharu Yaguchi (Kobe Univ.)   Application to a learning algorithm for multilayer perceptrons of dissi-
      Ai Ishikawa   (Kobe Univ.)   pative structure-preserving numerical methods ···················· 15

Summary: This talk is about application to a learning algorithm for multilayer perceptrons of structure-preserving numerical methods for the differential equations that stem from the Caldirolla–Kanai variational principle. This principle is a variation of Hamilton's principle of least action. Whereas Hamilton's principle considers an extremum of the integral of a given Lagrangian in the Caldirolla–Kanai variational principle that of the weighted integral is considered. The differential equations that are derived from this principle always have the energy-dissipation property. In this talk, some numerical schemes that preserve the property of the differential equation are derived and then applied to a learning algorithm for multilayer perceptrons.

27   Naoharu Ito (Nara Univ. of Edu.)   A study on self-inversive operator polynomials with spectrum on the
                                          unit circle ··· 15

Summary: Self-inversive operator polynomials with spectrum on the unit circle are studied. If the inner numerical radius of an associated polynomial is not less than one, the spectrum lies on the unit circle and consists of normal approximate characteristic values.

28   Patrick van Meurs (Kanazawa Univ.)   Discrete-to-continuum limits of interacting dislocations ············· 15

Summary: Plasticity of metals is facilitated by the collective behaviour of many dislocations, which are represented by point particles if we consider a two dimensional scenario. Currently, there exist *several different* models in the engineering literature for the dislocation density by means of a PDE. We aim ultimately to quantify the accuracy of these models by establishing a precise connection between the 'continuum' description (i.e. a continuity equation for the density) and the 'discrete' description (i.e. the movement of the particles described by a non-linearly coupled system of ODEs). To connect these two descriptions, we establish the many-particle limit by relying on variational techniques such as Γ-convergence.

29   Fuminori Sakaguchi (Univ. of Fukui)   Implementation of an integer-type algorithm for linear partial differen-
                                            tial equations using quasi-orthogonalization ···················· 15

Summary: In this study, a practical method is proposed for implementing an integer-type algorithm for solving linear higher-order partial differential equations which utilizes quasi-orthogonalization of integer vectors. This algorithm is a direct extension of an integer-type algorithm for linear ordinary differential equations proposed by the author and M. Hayashi several years ago. However, this extension requires some complicated techniques based on discrete mathematics. In this presentation, the details of these techniques are explained.

14:15–15:45

30   Hirofumi Notsu (Waseda Univ.)   Error estimates of a stabilized Lagrange–Galerkin scheme for an Oseen-
      Masahisa Tabata (Waseda Univ.)   type diffusive Peterlin model ································· 15
      Mária Lukáčová-Medvid'ová
              (Univ. of Mainz)
      Hana Mizerová (Univ. of Mainz)

Summary: A stabilized Lagrange–Galerkin scheme for an Oseen-type diffusive Peterlin model is presented. It employs a semi-implicit approximation for the time integration, which yields a nonlinear scheme. Existence, uniqueness, (essentially) unconditional stability and error estimates are proved for the scheme. Numerical results are shown in order to see the theoretical convergence order.

31   Nobuyuki Higashimori (Kyoto Univ.)   Convergence of an abstract finite difference scheme for the Cauchy
     Hiroshi Fujiwara (Kyoto Univ.)   problem on a Banach scale ·· 15
     Yuusuke Iso   (Kyoto Univ.)

Summary: We show a sufficient condition for convergence of an abstract finite difference scheme to solve the Cauchy problem on a Banach scale. As an application we obtain a result of convergence of a finite difference scheme to solve the Cauchy problem for a partial difference equation of normal form whose coefficients are assumed to be real analytic in space variables but not so in the time variable. Moreover we do not require that the equation is hyperbolic or that the Courant–Friedrichs–Lewy condition (CFL condition) is satisfied for the case of hyperbolic equation.

32   Yoshitaka Watanabe (Kyushu Univ.)   Computer-assisted instability proof with high accuracy for plane Poiseuille
     Takehiko Kinoshita (Kyoto Univ.)   flow ··· 15
     Mitsuhiro T. Nakao
          (Sasebo Nat. Coll. of Tech.)

Summary: This talk shows a numerical verification method for computing eigenpair enclosures of the Orr–Sommerfeld equation describing hydrodynamic stability of Poiseuille flow. By using spectral Galerkin approximate solutions bounding its small defect and the Banach fixed-point theorem, an eigenpair is enclosed with guaranteed accurate error and locally unique bounds in computer. Some verification results confirm the effectiveness of the method, and, to the best of the authors' knowledge, they give the best upper bound of the critical Reynolds number.

33   Akitoshi Takayasu (Waseda Univ.)   Verified computations for solutions to nonlinear heat equations based
     Makoto Mizuguchi (Waseda Univ.)   on fractional powers of a positive operator and the evolution operator
     Kubo Takayuki (Univ. of Tsukuba)   ··· 15
     Shin'ichi Oishi (Waseda Univ.)

Summary: In this talk we consider a numerical method for verifying existence and local uniqueness of a solution for an initial-boundary value problem of nonlinear heat equations. This method is based on a fixed-point formulation using the evolution operator introduced by Tanabe–Sobolevskii. Using fractional powers of a positive operator, we derive a sufficient condition for enclosing the solution in a neighborhood of an approximate solution.

34   Makoto Mizuguchi (Waseda Univ.)   On a computable Sobolev embedding constant for fractional powers of
     Akitoshi Takayasu (Waseda Univ.)   a weighted Laplace operator ···································· 15
     Takayuki Kubo (Univ. of Tsukuba)
     Shin'ichi Oishi (Waseda Univ.)

Summary: This talk is concerned with a computable Sobolev embedding constant for fractional powers of a weighted Laplace operator on a domain $\Omega \subseteq \mathbb{R}^N$. The constant is explicitly described using the analytic semigroup over $L^2(\Omega)$ and the infimum value of spectrum of the weighted Laplace operator. Each value of the constants for some domains will be presented.

16:00–17:00   Talk Invited by Applied Mathematics Section

Kota Ikeda   (Meiji Univ.)   Congestion flow of pulses in an excitable reaction-diffusion system

Summary: Self-driven motion is observed in several fields, e.g., biology, chemistry, and nonlinear physics. Organisms move spontaneously to aggregate and form self-organized structures. As a spatiotemporal collective motion, congestion flow is observed in a system with animal and in animal organisms. For example, camphor boats constitute a system for changing the number of particles and with simple interaction and generate congestion flow as reported by Suematsu et al in 2010. The mechanism of the congestion dynamics of camphor boats has been investigated theoretically. As stated in our previous works, a traveling wave solution in a model with an inhomogeneity plays an important role. Recently it was reported that traveling wave solutions with a pulse shape, simply called traveling pulses, could generate congestion flow in a reaction-diffusion system with excitability. It is well-known that a traveling pulse is formed spontaneously in an excitable system like the FitzHugh–Nagumo model. This fact seems to imply that the same mechanism as in a system with camphor boats works in the congestion flow of an excitable system. However, it is not true because the reaction-diffusion system has no inhomogeneity. In this talk, we focus on studying the traveling pulse and consider what is different between the congestion flow in the model of camphor boats and the excitable system.

Topology

March 16th (Wed)   Conference Room VI

10:00–11:55

1 Yusuke Takimura   Thirty-two equivalence relations on knot projections · · · · · · · · · · · · · · · 10
(Gakushuin Boys' Junior High School)
<u>Noboru Ito</u>   (Waseda Univ.)

Summary: For the set of the knot projections, we define 32 homotopy equivalence relations, each of which is generated by some of the five types of Reidemeister moves. We show that 32 cases correspond to 8 trivial cases and 20 non-trivial cases reduced from 24 cases. The 20 non-trivial cases are mutually different. To show the statement, we introduce new invariants of knot projections.

2 <u>Noboru Ito</u>   (Waseda Univ.)   Triply-graded knot projections under (1, 3) homotopy · · · · · · · · · · · · · · 15
Yusuke Takimura
(Gakushuin Boys' Junior High School)

Summary: In 2001, Oestlund conjectured that Reidemeister moves RI and RIII are sufficient to describe a homotopy from any generic immersion of a circle into the plane to the simple closed curve. In 2014, Hagge and Yazinski obtained a counterexample (having at least 16 double points) of this conjecture. In this study, we obtain a counterexample of Oestlund conjecture where the minimum number of double points is 15. We show that for any integer k more than 14, there exists a knot projection where the minimum number of double points is k. We also discuss the minimum number of Type RII Reidemeister moves required to obtain the simple closed curve under the equivalence relation generated by Reidemeister moves RI and RIII.

3 <u>Shosaku Matsuzaki</u> (Waseda Univ.)   Minors of multibranched surfaces · 10
Makoto Ozawa (Komazawa Univ.)

Summary: We say that a 2-dimensional CW complex is a *multibranched surface* if we remove all points whose open neighborhoods are homeomorphic to $\mathbb{R}^2$, then we obtain a 1-dimensional complex which is homeomorphic to a disjoint union of some S^1's. A multibranched surface is a generalization of graphs. So we can define "minors" of multibranchd surfaces analogously. We study various properties of the minors of multibranched surfaces.

4 <u>Makoto Ozawa</u> (Komazawa Univ.)   Genera of multibranched surfaces · 10
Shosaku Matsuzaki (Waseda Univ.)

Summary: We say that a 2-dimensional CW complex is a *multibranched surface* if we remove all points whose open neighborhoods are homeomorphic to $\mathbb{R}^2$, then we obtain a 1-dimensional complex which is homeomorphic to a disjoint union of some S^1's. We define the (minimal) genus of a multibranched surface X as the minimal number of genera of 3-manifold into which X can be embedded. In this talk, we state some inequalities which give an upper bound for the genus of a multibranched surface.

5 Shinya Okazaki (Osaka City Univ.)   An invariant comes from the Alexander polynomial of a handlebody-
knot · 10

Summary: A handlebody-knot is a handlebody embedded in the 3-sphere. In this talk, we introduce an invariant of a handlebody-knot which is represented by a vertex-weighted graph. This invariant comes from the Alexander polynomial of a handlebody-knot.

6 <u>Atsuhiko Mizusawa</u> (Waseda Univ.)   On invariants of HBL-homotopy classes of 3-component handlebody-
   Yuka Kotorii   (Univ. of Tokyo)   links with vanishing linking numbers $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: A handlebody-link is an embedding of handlebodys into the 3-sphere. A handlebody-link is represented by its spine (a spatial graph). Two spatial graphs which represent the same handlebody-link are transformed to each other by a sequence of contraction moves. Two handlebody-links are HBL-homotopic if their representing spatial graphs are transformed to each other by a sequence of contraction moves and self-crossing changes. In this talk, we give a bijection between HBL-homotopy classes of 3-component handlebody-links with vanishing linking numbers and 3-dimensional hyper matrices up to elementary transformations. Through this map, we give some invariants of the HBL-homotopy classes.

7 <u>Kodai Wada</u>   (Waseda Univ.)   Milnor invariants of clover links $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10
   Akira Yasuhara (Tokyo Gakugei Univ.)

Summary: J. P. Levine introduced a clover link to investigate the indeterminacy of Milnor invariants of a link. It is shown that for a clover link, Milnor numbers of length at most $2k + 1$ are well-defined if those of length at most k vanish, and that Milnor numbers of length at least $2k + 2$ are not well-defined if those of length $k + 1$ survive. For a clover link c with Milnor numbers of length at most k vanishing, we show that the Milnor number $\mu_c(I)$ for a sequence I is well-defined up to the greatest common divisor of $\mu_c(J)'s$, where J is a subsequence of I obtained by removing at least $k + 1$ indices. Moreover, if I is a non-repeated sequence with length $2k + 2$, the possible range of $\mu_c(I)$ is given explicitly. As an application, we give an edge-homotopy classification of 4-clover links.

8 <u>Kazuhiro Ichihara</u> (Nihon Univ.)   On cosmetic surgery conjecture on knots $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
   Toshio Saito (Joetsu Univ. of Edu.)
   In Dae Jong   (Kinki Univ.)

Summary: The cosmetic surgery conjecture saids that no pair of Dehn surgeries along inequivalent slopes yield orientation preservingly homeomorphic 3-manifolds. First I will tlak about a recent result on this conjecture for certain two-bridge knots. Next I will present a new example of a hyperbolic knot admitting a pair of of Dehn surgeries along inequivalent slopes yield orientation reversingly homeomorphic hyperbolic 3-manifolds.

9 <u>Kazuhiro Ichihara</u> (Nihon Univ.)   Hyperbolicity and the number of components for random link $\cdots\cdots\cdots$ 15
   Jiming Ma   (Fudan Univ.)
   Ken-ichi Yoshida (Nihon Univ.)

Summary: From a probabilistic point of view, Jiming Ma introduced and studied two models of random links. One model is given as the closure of a braid obtained from a random walk on the braid group. For such a random link, the expected value for the number of components was calculated by Jiming Ma. We first report on the most expected number of components for a random link, and further, the most expected partition of the number of strings for a random braid. Another model is given by considering random bridge decomposition for links. We next show that a random link via random bridge position is hyperbolic with asymptotic probability 1.

14:15–15:15   Talk Invited by Topology Section

Yukio Matsumoto   On the compactification of moduli spaces and crystallographic groups
(Gakushuin Univ./Chuo Univ./Univ. of Tokyo*)

Summary: The purpose of this talk is to give a natural orbifold-chart system on the Deligne–Mumford compactification of moduli space of Riemann surfaces of genus $g \geqq 3$. The charts are indexed by simplices of the curve complex associated with the underlying topological surface. We will point out that certain crystallographic group on $\mathbb{E}^{3g-3}$ arises from the orbifold-chart around each maximally degenerated ideal point.

15:30–17:10

10 Masakazu Teragaito (Hiroshima Univ.)   Generalized torsion elements in the knot groups of twist knots $\cdots\cdots$ 10

Summary: It is well known that any knot group is torsion-free, but it may admit a generalized torsion element. We show that the knot group of any negative twist knot admits a generalized torsion element. This is a generalization of the same claim for the knot 5_2, which is the (-2)-twist knot, by Naylor and Rolfsen.

11 Yuta Nozaki   (Univ. of Tokyo)   The preimage of a knot under the covering map from S^3 to $\mathbb{R}P^3$ $\cdots\cdots$ 15

Summary: When a knot K in S^3 is the preimage of a knot K' in $\mathbb{R}P^3$, we describe the fundamental group $\pi_1(S^3 \setminus K)$ in terms of $\pi_1(\mathbb{R}P^3 \setminus K')$. Using this description, we give a necessary condition for K being the preimage of a knot K' in $\mathbb{R}P^3$.

12 Akiko Shima   (Tokai Univ.)   Properties of CS-minimal charts $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
   Teruo Nagase   (Tokai Univ.*)

Summary: Two charts are said to be CS-equivalent if one deforms to the other by a finite sequence of C-moves, conjugations, stabilizations and destabilizations. Let Γ be an n-chart, $w(\Gamma)$ the number of white vertices in Γ, and $f(\Gamma)$ the number of free edges in Γ. The pair $(w(\Gamma), n - f(\Gamma))$ is called the CS-complexity of Γ. A chart Γ is CS-minimal if its CS-complexity is minimal among the set of charts CS-equivalent to Γ with respect to the lexicographical order of the pair of integers. In this talk, we prove that if Γ is a CS-minimal chart with $w(\Gamma) = 6$, then Γ is CS-equivalent to the product of a ribbon chart and a 'chart' representing a 2-twist spun trefoil.

13 Noriyuki Hamada (Univ. of Tokyo)   Finite covers of Lefschetz fibrations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
   Kenta Hayano (Hokkaido Univ.)

Summary: We will talk about the simple fact that taking an unbranched finite cover of a Lefschetz fibration or pencil gives a new Lefschetz fibration/pencil. We will give a general recipe to imply the monodromy factorization of such a fibration and then show several examples with (very) neat monodromies. Other associated new fibrations will also be presented.

14 Erika Kuno   (Tokyo Tech)   Disk graphs and right-angled Artin subgroups in handlebody groups
$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: Koberda proved that if a graph Γ is a full subgraph of a curve graph $\mathcal{C}(S)$ of an orientable surface S, then the right-angled Artin group $A(\Gamma)$ on Γ is a subgroup of the mapping class group $\mathrm{Mod}(S)$ of S. On the other hand, for a sufficiently complicated surface S, Kim–Koberda gave a graph Γ which is not contained in $\mathcal{C}(S)$, but $A(\Gamma)$ is a subgroup of $\mathrm{Mod}(S)$. In this talk, we prove that if Γ is a full subgraph of a disk graph $\mathcal{D}(H)$ of a handlebody H, then $A(\Gamma)$ is a subgroup of the handlebody group $\mathrm{Mod}(H)$ of H. Further, we show that there is a graph Γ which is not contained in some disk graphs, but $A(\Gamma)$ is a subgroup of the corresponding handlebody groups.

15 Genki Omori   (Tokyo Tech)   A simple infinite presentation for the mapping class group of a non-
orientable surface $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We obtain a simple infinite presentation for the mapping class group of a non-orientable surface. The generating set consists of Dehn twists and crosscap pushing maps. We use the Stukow's finite presentation for the mapping class group of a non-orientable surface and apply the Gervais's discuccion in the orientable case to obtain the presentation.

16 Genki Omori   (Tokyo Tech)   Simple closed curves on a non-orientable surface and the twist subgroup
of the mapping class group $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: The twist subgroup $\mathcal{T}(N)$ of the mapping class group $\mathcal{M}(N)$ of a non-orientable surface N is the subgroup of $\mathcal{M}(N)$ generated by all Dehn twists. $\mathcal{M}(N)$ is not generated by Dehn twists and when N is compact, $\mathcal{T}(N)$ is an index 2 subgroup of $\mathcal{M}(N)$. We consider the following problem: for simple closed curves c_1, c_2 on N whose complements are diffeomorphic, what is a condition to satisfy that there exists an element f of $\mathcal{T}(N)$ such that $f(c_1) = c_2$. We answer the problem partially.

March 17th (Thu)   Conference Room VI

10:00–11:40

17 Chieko Komoda   Open mapping theorems with finite fibers for C-spaces and finite C-
    (Kurume Nat. Coll. of Tech.)   spaces $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: This is a joint work with Takashi Kimura. We assume that all spaces are normal and all mappings are continuous.

In this talk we study open mapping theorems with finite fibers for C-spaces and finite C-spaces.

18 Katsuhisa Koshino (Kanagawa Univ.)   Topological types of hyperspaces of finite sets in metrizable spaces $\cdots$ 10

Summary: Let $\mathrm{Fin}(X)$ be the hyperspace consisting of non-empty finite subsets of a space X with the Vietoris topology. In this talk, we characterize a metrizable space X whose hyperspace $\mathrm{Fin}(X)$ is homeomorphic to a pre-Hilbert space spanned by the canonical orthonormal basis of a non-separable Hilbert space.

19 Tomohiko Ishida (Kyoto Univ.)   Quasi-isometry type of the metric space derived from the kernel of the
    Calabi homomorphism $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We prove that the set of symmetrized conjugacy classes of the kernel of the Calabi homomorphism on the group of area-preserving diffeomorphisms of the 2-disk is not quasi-isometric to the half line.

20 <u>Huhe Han</u> (Yokohama Nat. Univ.)   Strictly convex Wulff shapes and C^1 convex integrands $\cdots\cdots\cdots\cdots$ 15
    Takashi Nishimura
        (Yokohama Nat. Univ.)

Summary: In this talk, it is shown that a Wulff shape is strictly convex if and only if its convex integrand is of class C^1. Moreover, applications of this result are given.

21 Takahiro Yamamoto   Elimination of B_2-singularities $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
        (Kyushu Sangyo Univ.)

Summary: For a stable map $f\colon N \to P$ of a 3-manifold with one boundary component into a surface without boundary, we show that f is homotopic to a stable map which have no B_2 points.

22 <u>Kenichirou Shinkai</u> (Shinshu Univ.)   On the matrix Toda brackets and 3-rd cohomology groups of small
    Yasuhiro Momose (Shinshu Univ.)   categories $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Hardie–Kamps–Marcum have given a categorical treatment of matrix Toda brackets introduced Barratt in the category of topological spaces. Baues–Dreckmann shawed that there exists a class in Baues–Wirsching cohomology of a small category which represents all classical Toda brackets. Our aim is to generalize such a relationship to that between the cohomology of a 2-category and matrix Toda brackets.

23 Miho Hatanaka (Osaka City Univ.)   Cohomology representations of toric manifolds associated to some sim-
    ple graphs $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We can construct toric manifolds from simple graphs. The automorphism group of a simple graph induces a representation on the cohomology ring of the toric manifold associated to the simple graph. The automorphism group of a complete graph is a symmetric group. Procesi described the cohomology representation when the simple graph is a complete graph. In this talk we take a graph obtained by removing an edge from a complete graph and describe the associated cohomology representation.

13:30–14:30   Talk Invited by Topology Section

Kei Irie   (Kyoto Univ.)   A C^∞ closing lemma for three-dimensional Reeb flows via embedded contact homology

Summary: We prove a C^∞ closing lemma for three-dimensional Reeb flows, and deduce that for any closed contact three-manifold with a C^∞ generic contact form the union of all periodic Reeb orbits is dense. The proof uses recent developments in quantitative aspects of embedded contact homology, which is an invariant of contact three-manifolds defined by holomorphic curve techniques in symplectic geometry. Applications to closed geodesics and area-preserving diffeomorphisms on surfaces will be also presented.

March 18th (Fri)   Conference Room VI

10:00–11:45

24   Hokuto Konno (Univ. of Tokyo)   Bounds on genus and configurations of embedded surfaces in 4-manifolds
· 15

Summary: For finitely many surfaces with zero self-intersection number embedded in a 4-manifold with $b_1 = 0$, we show a lower bound on genus for at least one of the surfaces under some conditions on the surfaces. As an application we derive a constraint for a pair of genera of two embedded surfaces and we also give an alternative proof of the adjunction-type inequality by Strle for configurations of surfaces with positive self-intersection numbers.

25   Antonio J. Di Scala   Non-Kähler complex structures on $\mathbb{R}^4$ II · 15
        (Politecnico di Torino)
Naohiko Kasuya
        (Aoyama Gakuin Univ.)
Daniele Zuddas   (KIAS)

Summary: We already constructed uncountably many non-Kähler complex manifolds diffeomorphic to $\mathbb{R}^4$, and I talked about the construction at the last meeting of MSJ. This time, I will talk about various properties of our complex manifolds. For example, they have nontrivial Picard groups and cannot be holomorphically embedded in any compact complex surface. This is a joint work with Antonio J. Di Scala and Daniele Zuddas.

26   Yoshihiko Mitsumatsu (Chuo Univ.)   Turbulization of 2-dimensional foliations on 4-manifolds · · · · · · · · · · · · 15
Elmar Vogt (Freie Univ. Berlin)

Summary: The notion of turbulization is formulated for higher codimensional foliations. It has been well-known for foliations of codimension one since long ago but in higher codimension case, it is not only not-trivial to formulate but also complicated to a certain degree to realize it geometrically. In the case of 2-dimensional foliations on 4-manifolds it is done, where 3-dimensional geodesic Ansov foliations play an important role.
Under this dimension setting, some other modifications which are similar to turbulization are also introduced. The motivation from and the relation with the h-principle due to Thurston are also explained.

27   Yoshihiko Mitsumatsu (Chuo Univ.)   Convexity of symplectic ends, leafwise symplectic foliations on 5-sphere, and strange symplectic 4-manifolds · 15

Summary: The construction of leafwise symplectic foliations of codimension one on the 5-sphere from the simple elliptic singularities and cusp singuralities of complex three variables is reviewed, with an emphasis on the topological flexibility of convexity of the end of open symplectic manifolds.
The method enables us to construct some b-symplectic structures on closed 4-manifolds and some strange closed symplectic 4-manifolds as well.

28   <u>Takahiro Oba</u>   (Tokyo Tech)   Open book decompositions of unit cotangent bundles of orientable
     Burak Ozbagci   (Koç Univ.)   closed surfaces $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Thanks to a result of Giroux, we can make use of open book decompositions to study contact structures. The unit cotangent bundle $ST^*\Sigma_g$ of an orientable closed surface Σ_g admits the canonical contact structure ξ_{can}. For $g = 0, 1$, an explicit description of a supporting open book decomposition of ξ_{can} is known. For $g \geq 2$, J. Johns gave an abstract description of a Lefschetz fibration on the unit disk bundle $DT^*\Sigma_g$. It follows one of a supporting open book decomposition of ξ_{can}. In this talk, we will present an explicit description of a supporting open book decomposition of ξ_{can} for any g. As a corollary of this result, we will also give one of a Lefschetz fibration on $DT^*\Sigma_g$.

29   Kouichi Yasui (Hiroshima Univ.)   Nonexistence of Stein structures on 4-manifolds and maximal Thurston–
                                       Bennequin numbers $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: For a 4-manifold represented by a framed knot in S^3, it has been well known that the 4-manifold admits a Stein structure if the framing is less than the maximal Thurston–Bennequin number of the knot. In this paper, we prove either the converse of this fact is false or there exists a compact contractible oriented smooth 4-manifold (with Stein fillable boundary) admitting no Stein structure. Note that an exotic smooth structure on S^4 exists if and only if there exists a compact contractible oriented smooth 4-manifold with S^3 boundary admitting no Stein structure.

30   Kouichi Yasui (Hiroshima Univ.)   Maximal Thurston–Bennequin number and reducible Legendrian surgery
                                       $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 10

Summary: We give a method for constructing a Legendrian representative of a knot in S^3 which realizes its maximal Thurston–Bennequin number under a certain condition. The method utilizes Stein handle decompositions of D^4, and the resulting Legendrian representative is often very complicated. As an application, we construct infinitely many knots in S^3 each of which yields a reducible 3-manifold by a Legendrian surgery in the standard tight contact structure. This disproves a conjecture of Lidman and Sivek.

14:15–15:30

31   Motoo Tange (Univ. of Tsukuba)   On finite order corks $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We construct examples of finite order cork. The point is to prove that the contractible 4-manifold admits Stein structure. We realize it by describing some Legendrian link on $\#^n S^2 \times S^1$.

32   Motoo Tange (Univ. of Tsukuba)   Branched double covers and rational homology 4-balls $\cdots\cdots\cdots\cdots$ 15

Summary: We give examples of non-slice knot whose branched cover bounds rational homology 4-ball. The knots are Whitehead double of a torus knot. To find the examples, Heegaard Floer d-invariant is useful. Further, we consider a way to compute $CFK^\infty(\#^2 T_{p,q})$.

33   Kouki Sato   (Tokyo Tech)   1-connected rational filling of rational homology 3-spheres $\cdots\cdots\cdots$ 15

Summary: For a rational homology 3-sphere Y, a 1-connected rational filling W for Y is a rational homology 4-ball with boundary Y such that the induced map from the inclusion $i_* : \pi_1(Y) \to \pi_1(W)$ is surjective.
In this talk, we consider which rational homology 3-spheres have 1-connected rational filings. In particular, we give characterizations of such rational homology 3-spheres from different two view points; cyclic branched covers of S^3 branched over knots, and Dehn surgeries on links in S^3.

34   <u>Tetsuya Abe</u>   (OCAMI)   Ribbon disks via handle decompositions of B^4 $\cdots\cdots\cdots\cdots\cdots\cdots$ 15
     Motoo Tange (Univ. of Tsukuba)

Summary: We recall Hudson–Sumners' construction of ribbon disks. Using this construction, we give ribbon disks with the same exterior.

35   Tatsuro Shimizu (Kyoto Univ.)   Chern–Simons perturbation theory around a non-tirvial flat connection and Morse homotopy ··· 10

Summary: We give a Morse homotopy theoretic description of the degree 1 part of the Chern–Simons perturbation theory around a non-trivial flat connection.

15:45–16:45   Talk Invited by Topology Section

   Dai Tamaki   (Shinshu Univ.)   Configuration spaces and homotopy theory

Infinite Analysis

March 18th (Fri)   Conference Room VIII

10:00–12:00

1   <u>Masahiko Ito</u> (Tokyo Denki Univ.)   The Jackson integral of A type and a generalization of Ramanujan's
    Masatoshi Noumi (Kobe Univ.) $_1\psi_1$ summation and Slater's $_r\psi_r$ transformation $\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We will talk about a connection formula for the Jackson integrals of A type. The connection formula gives a generalization of Slater's transformation formula for a basic hypergeometric series $_r\psi_r$. As an application of the connection formula, we obtain a determinant formula as the Wronskian of the q-difference system for the Jackson integrals of A type. The determinant formula includes Ramanujan's summation formula for a basic hypergeometric series $_1\psi_1$.

2   <u>Masahiko Ito</u> (Tokyo Denki Univ.)   A construction of the elliptic Lagrange interpolation functions of type A
    Masatoshi Noumi (Kobe Univ.) $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In the connection formula for the Jackson integral of A type, the elliptic Lagrange interpolation functions appear naturally as the connection coefficients. We will explain a construction of the elliptic Lagrange interpolation functions of type A. As a consequence, we will show the explicit expression of the elliptic Lagrange interpolation functions.

3   Shuhei Kamioka (Kyoto Univ.)   A generalization of the q-Chu–Vandermonde sum for basic hypergeo-
    metric series $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: A generalization of a q-Chu–Vandermonde sum for basic hypergeometric series, which involves multiple parameters substituting for the base q, is exhibited. Generalizations of the little q-Laguerre (Wall) polynomials, that are classical orthogonal polynomials in the Askey scheme, are also shown. The orthogonality of the generalized little q-Laguerre polynomials is proven by means of the generalized q-Chu–Vandermonde sum.

4   Genki Shibukawa (Osaka Univ.)   Pseudo Wilson polynomials $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: By considering the image of the Jacobi transformation of a finite type orthogonal system constructed by the Jacobi polynomials, we obtain new finite type orthogonal polynomials, which we call "pseudo Wilson polynomials", and their properties.

5   <u>Hidehito Nagao</u> (Akashi Coll. of Tech.)   Padé method and the q-Garnier system $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15
    Yasuhiko Yamada (Kobe Univ.)

Summary: We study some Padé problem of the differential grid, related to the q-Garnier system. Solving the problem, we derive the evolution equation, the scalar Lax pair and the determinant formulae of special solutions for the corresponding q-Garnier system.

6   Takao Suzuki   (Kinki Univ.)   Fourth order q-Painlevé system containing q-hypergeometric function
    $_3\phi_2$ $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We proposed the hyper order q-Painlevé system containing q-hypergeometric function $_n\phi_{n-1}$ in March 2012. In this talk, we give a new expression of that q-difference system.

14:15–15:15

7   Shotaro Konnai   (Kobe Univ.)   Analysis of the Katz operations stabilizing the class of Okubo systems
    $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: In this talk we investigate certain Katz operations (additions and middle convolutions) which stabilize the class of Okubo systems of ordinary differential equations. We also dicuss some applications to the connection problem for the fundamental solution matrices of Okubo systems.

8   Kazuki Hiroe   (Josai Univ.)   Stokes structure and links ································· 15

Summary: Some similarities between ramified irregular singularities of linear ordinary differential equations and singularities of plane curve germs are found, for instance in transformations: local Fourier transform and blowing up, in invariants: Komatsu–Malgrange irregularity and Milnor number, and so on. In this talk we shall define links from linear ODEs with ramified irregular singularities as an analogy of links of singular plane curve germs. Some relations between link invariants and invariants of ODEs shall be explained. Furthermore, it shall be discussed that isomonodromic deformation of ODEs induces link isotopy of the corresponding links as an analogy of the fact that equisingularity of plane curve singularities induces link isotopy.

9   Kimio Ueno   (Waseda Univ.)   Monodromy preserving deformation associated to KZ equation ······· 15

Summary: We consder the monodromy preserving deformation associated to the KZ equation of three variables and holomorphic solutions to the deformation equations.

10   Yoshishige Haraoka (Kumamoto Univ.)[b]   On representations of braid groups associated with complex reflection
groups ··· 15

Summary: We classify three dimensional irreducible representations of braid groups associated with primitive finite irreducible complex reflection groups in $GL(3, \mathbb{C})$. Spectral types of the local monodromies play a substantial role. The representations give monodromy representations for some uniformization equations.

15:30–16:30   Talk Invited by Infinite Analysis Special Session

Daisuke Yamakawa (Tokyo Tech)   Twisted wild character varieties

Summary: This is joint work with Philip Boalch. The wild character varieties are Poisson algebraic varieties related to the moduli spaces of unramified meromorphic connections on compact Riemann surfaces with fixed irregular type at each singularity under the Riemann–Hilbert–Birkhoff correspondence. We will extend the construction of the wild character varieties to the case of ramified connections. In the unramified case, the formal monodromy of meromorphic connections can be interpreted as a group-valued moment map in the sense of Alekseev–Malkin–Meinrenken. In order to extend that interpretation to the ramified case, we introduce the moment maps taking values in "twisted groups".

March 19th (Sat)   Conference Room VIII

9:30–12:00

11   Yoshihiro Takeyama   Algebraic construction of multi-species q-Boson system ············· 15
(Univ. of Tsukuba)

Summary: We construct a stochastic particle system which is a multi-species version of the q-Boson system due to Sasamoto and Wadati. Its transition rate matrix is obtained from a representation of a deformation of the affine Hecke algebra of type GL.

12   Masato Okado (Osaka City Univ.)   Multispecies TAZRP ·· 15
Atsuo Kuniba (Univ. of Tokyo)
Shouya Maruyama (Univ. of Tokyo)

Summary: We introduce an n-species asymmetric zero range process (n-TAZRP) on the periodic chain of L sites. It is a continuous time Markov process, and obtained as the image of a projection from another stochastic system called n-line process. By using a combinatorial R of the quantum affine algebra $U_q(\widehat{sl}_L)$, we establish a matrix product formula of the steady state probability of the n-TAZRP in terms of corner transfer matrices of a $q = 0$-oscillator valued vertex model. It is also derived from the commutativity of a layer-to-layer transfer matrix of a 3D lattice model constructed from a distinguished solution to the tetrahedron equation.

13   <u>Saburo Kakei</u>   (Rikkyo Univ.)   Linearization of the box-ball system: an elementary approach · · · · · · · · 15
     Jonathan J. C. Nimmo
                (Univ. of Glasgow)
     Satoshi Tsujimoto (Kyoto Univ.)
     Ralph Willox (Univ. of Tokyo)

Summary: Kuniba, Okado, Takagi, and Yamada found that the time-evolution of the Takahashi–Satsuma box-ball system (BBS) can be linearized by considering rigged configurations associated with states of the BBS. We introduce a simple way to understand the rigged configuration of $A_1^{(1)}$-type, and give an elementary proof of the linearization property.

14   <u>Yasuhiro Ohta</u>   (Kobe Univ.)   Determinant and Pfaffian solutions for motion of discrete space curve
     Sampei Hirose (Shibaura Inst. of Tech.)   · 15
     Jun-ichi Inoguchi (Univ. of Tsukuba)
     Kenji Kajiwara (Kyushu Univ.)
     Nozomu Matsuura (Fukuoka Univ.)

Summary: Determinant and Pfaffian solutions for motion of discrete space curve are given.

15   Yoko Shigyo   (Tsuda Coll.)   Expansion coefficients of a solution of the BKP hierarchy · · · · · · · · · · · 15

Summary: In this talk we study the degenerate Giambelli type formulae in the BKP hierarchy. It is known that a formal power series $\tau(x)$ expanded as Schur's Q-function is a solution of the BKP hierarchy if and only if the coefficients of this expansion satisfy Giambelli type formulae. We proved this statement with a condition $\tau(0) \neq 0$. Here we prove this result with a condition $\tau(0) = 0$.

16   Takanori Ayano (Osaka City Univ.)   A generalization of Jacobi inversion formulae to telescopic curves on all
     the strata · 15

Summary: For a hyperelliptic curve, it is well-known that an element of the k-th symmetric product is expressed in terms of its Abel–Jacobi image by the hyperelliptic sigma functions on all the strata (Jacobi inversion formulae). Matsutani and Previato extended the Jacobi inversion formulae to the more general plane algebraic curves defined by $y^r = f(x)$, which are special cases of the (n, s) curves, and derived a property of the vanishing of the sigma functions as a corollary. In this talk, we extend the formulae to telescopic curves proposed by Miura, which contain the (n, s) curves as special cases, and remark that the vanishing property of the sigma functions is also satisfied for the telescopic curves.

17   Yosuke Saito (Osaka City Univ.)   Eigenfunctions of Ruijsenaars operator arising from the functional equa-
     tion of the dual Cauchy type kernel function · 15

Summary: We show that eigenfunctions of Ruijsenaars operator are obtained from the functional equation of the dual Cauchy type kernel function in a special case.

18   Diogo Kendy Matsumoto   Yang–Baxter maps on the Generalized pre-semiring · · · · · · · · · · · · · · · 15
                (Waseda Univ.)

Summary: In this talk, we introduce a generalized pre-semiring as a generalization of ring, and consider Yang–Baxter maps on the generalized pre-semiring. These Yang–Baxter maps including many well-known examples of the Yang–Baxter maps.

14:15–15:15

19   Takeshi Ikeda (Okayama Univ. of Sci.)   Littlewood-Richardson rule for factorial P-functions · · · · · · · · · · · · · · · 15

Summary: We give a combinatorial description for the multiplicative structure constants of the factorial P-functions.

20   <u>Yuki Kanakubo</u> (Sophia Univ.)   Cluster variables on double Bruhat cell of classical group and cystal
Toshiki Nakashima (Sophia Univ.)   base $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: Coordinate rings of certain subgroups or cells of algebraic group G have the structures of cluster algebra, and generalized minors are their cluster variables. In the case $G = SL_{r+1}(\mathbb{C})$, generalized minors are coincide with ordinary minors. Last year, we had shown a relation between minors on double Bruhat cell of $SL_{r+1}(\mathbb{C})$ and crystal bases. Using coordinate transformation, the minors become polynomials whose terms are equal to the monomial realization of some crystal bases. In this talk, we will extend these results to other classical groups.

21   Yoshiyuki Kimura (Kobe Univ.)   Remarks on quantum unipotent subgroup and dual canonical basis $\cdots$ 15

Summary: In this talk, we show the tensor product decomposition of the half of quantized universal enveloping algebra associated with a Weyl group element that was conjectured by Berenstein and Greenstein using the theory of the dual canonical basis.

22   <u>Shunsuke Tsuchioka</u> (Univ. of Tokyo)   Pattern avoidance seen in multiplicities of maximal weights of affine Lie
Masaki Watanabe (Univ. of Tokyo)   algebra representations $\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$ 15

Summary: We prove that the multiplicities of certain maximal weights of $\mathfrak{g}(A_n^{(1)})$-modules are counted by pattern avoidance on words. This proves and generalizes a conjecture of Misra–Rebecca. We also prove similar phenomena in types $A_{2n}^{(2)}$ and $D_{n+1}^{(2)}$. Both proofs are applications of Kashiwara's crystal theory.

15:30–16:30   Talk Invited by Infinite Analysis Special Session

Hiroyuki Yamane (Univ. of Toyama)   Weyl groupoids and representation theory of generalized quantum
groups

Summary: In this talk, I introduce Weyl groupoids, and Matsumoto–Tits type theorem of them, and explain how they can be used to study representation theory of generalized quantum groups U. We have got a Shapovalov determinant formula for U and classification of finite dimensional simple U-modules.