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Mathematical Society of Japan

2014 AUTUMN MEETING

Titles and Short Summaries of the Talks

September, 2014

at Hiroshima University

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2014 Mathematical Society of Japan

AUTUMN MEETING

Dates: September 25th (Thu)–28th (Sun), 2014

Venue: Hiroshima University, Higashi-Hiroshima Campus
1–7–1, Kagamiyama, Higashi-Hiroshima City,
Hiroshima 739-8521

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	I Fac. Int. Arts Sci. K110	II Fac. Int. Arts Sci. K108	III Fac. Int. Arts Sci. K107	IV Fac. Int. Arts Sci. L101	V Fac. Int. Arts Sci. L102	VI Fac. Int. Arts Sci. K211	VII Fac. Int. Arts Sci. K210	VIII Fac. Int. Arts Sci. K201	IX Fac. Int. Arts Sci. K314
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	MSJ Prizes Presentation (Satake Memorial Hall) ····· (14:50–15:20) Plenary Talks (Satake Memorial Hall) MSJ Autumn Prize Winner ····· (15:30–16:30) Ken'ichi Ohshika (Osaka Univ.) ····· (16:45–17:45) Official Party (Saijo HAKUWA Hotel) ····· (18:15–20:15)								
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Plenary Talks

September 26th (Fri) Satake Memorial Hall

MSJ Autumn Prize Winner ..... (15:30–16:30)

Ken'ichi Ohshika (Osaka Univ.) Geometry of Kleinian groups and its applications ..... (16:45–17:45)

Summary: The study of Klenian groups using geometric method began with Thurston's paradigm-making work in 1980's. During a few decades after then, many specialists in this field worked to solve problems raised by Thurston. Now all of these problems are solved, and it is time to look further.
In this talk, I shall first explain what are Thurston's problems and what are their significances, and summarise how they have been solved. After that, I shall present how techniques developed in the process of solving these problems are useful in the study of three-manifolds and discrete groups, taking results I have recently obtained as examples.

Featured Invited Talks

September 25th (Thu)

Conference Room II

Ming-Lun Hsieh (Nat. Taiwan Univ.)$^{\flat}$ Modular forms and Iwasawa theory ..... (13:00–14:00)

Summary: One of the most intriguing formulas in algebraic number theory is Dirichlet class number formula, which relates the analytic objects: special L-values and algebraic objects: class numbers and Selmer groups. Many outstanding conjectures such as Bloch–Kato conjecture, Birch and Swinnerton-Dyer conjecture and Iwasawa main conjectures all share the same flavour. Number theorists have been using modular forms to study analytic or algebraic properties of special L-values by various period integral formulas and to study associated Galois representations and Selmer groups via the development of Langlands correspondence. One effective way to make a connection between special L-values and Selmer groups is via the method of congruence among modular forms. In this talk, we would like to talk about successful examples of this method as well as the recent progress on Iwasawa main conjectures and the application to Birch and Swinnerton-Dyer conjecture.

Conference Room V

Seiro Omata (Kanazawa Univ.) Mathematical and numerical analysis of a droplet and bubble motion ..... (13:00–14:00)

Summary: In this talk we discuss the motion of droplets or bubbles on a flat surface. This surface is represented by a plane, which serves as an obstacle. The motion is controlled mainly by the surface tension and the contact angle between the plane and the surface of the droplet. We introduce the governing equations for the evolution of the droplet surface. The equations are of wave type (hyperbolic type) with an obstacle and a free boundary. Since the droplet should keep its volume throughout the evolution, we need to impose a volume-preserving constraint. To establish an existence theorem, we approximate the governing equations by a discrete Morse flow.

Furthermore, we present an algorithm describing a motion of multiple bubbles, based on the so-called BMO algorithm. We modify the BMO algorithm in order to handle multiphase mean curvature or mean curvature acceleration problems under a volume constraint.

September 27th (Sat)

Conference Room II

Masaki Kashiwara (Kyoto Univ.) Riemann Hilbert correspondence for irregular holonomic D-modules ..... (13:00–14:00)

Summary: The original Riemann-Hilbert problem is to construct a liner ordinary differential equation with regular singularities whose solutions have a given monodromy. Nowadays, it is formulated as a categorical equivalence between the category of regular holonomic D-modules and the category of perverse sheaves. However it is a long standing problem to describe holonomic D-modules with irregular singularities in a geometric or topological language.

Recently, I, with Andrea D'Agnolo, proved a Riemann-Hilbert correspondence for holonomic D-modules which are not necessarily regular (arXiv:1311.2374). In this correspondence, we have to replace the derived category of constructible sheaves with the enhanced sheaves category. This category is a quotient of the derived category of ind-sheaves (or subanalytic sheaves) on the product of the base space and the real projective line. Then we construct a fully faithful functor from the derived category of holonomic D-modules to the enhanced sheaves category.

Conference Room III

Toshitake Kohno (Univ. of Tokyo) Iterated integrals and de Rham homotopy theory ····· (13:00–14:00)

Summary: The notation of iterated integrals of differential forms was initiated by K.-T. Chen in 1970's. The theory of iterated integrals provides a method to describe the de Rham cohomology of the loop spaces of simply connected manifolds. It also enables us to extract information about the nilpotent completion of the fundamental groups. The theory of iterated integrals is closely related to the rational homotopy theory due to D. Quillen and the de Rham homotopy theory due to D. Sullivan.

After reviewing these historical aspects, I will focus on more recent developments concerning the theory of iterated integrals. First, I describe the Kontsevich integral which gives a universal expression for finite type invariants of knots in terms of iterated integrals of logarithmic forms. The Kontsevich integral is relevent to the Drinfel'd associator and multiple zeta values as well.

There is also a new aspect for the algebraic structure of the homology of free loop spaces in the framework of string topology. Such structures are related to iterated integrals by means of Hochschild homology. I describe how loop products and the Batalin- Vilkovisky structure for the homology of free loop spaces are expressed in terms of iterated integrals. Finally, I will mention a description of volumes of spherical and hyperbolic simplices by iterated integrals based on the Schläfli formula.

Conference Room V

Yasuo Komori-Furuya (Tokai Univ.) Cauchy integral operator and related topics ····· (13:00–14:00)

Summary: This talk is a survey for Cauchy integral operator and related topics. We recall the results by Calderón and Coifman, McIntosh and Meyer: L^p boundedness of Cauchy integral operator. We consider close relations between this problem and some problems in PDE: the Laplace equation on Lipschitz domains and Kato's square root problem.

September 28th (Sun)

Conference Room II

Ichiro Shimada (Hiroshima Univ.) K3 surfaces and lattice theory ····· (13:00–14:00)

Summary: Thanks to the Torelli-type theorems for the period mapping, many geometric problems on K3 surfaces are reduced to computational problems in lattice theory, and the latter can often be solved by means of computer. In this talk, we explain how to use the lattice theory and computer in the study of K3 surfaces.

Conference Room III

Mitsuo Morimoto
(Yokkaichi Univ./Sophia Univ.*)

The 350th anniversary of Takebe Katahiro ····· (13:00–14:00)

Summary: Takebe Katahiro (1664-1739) is a Japanese mathematician in the Edo era, a student and a coworker of Seki Takakazu (ca 1642-1708). Takebe's mathematical works include the *Kenki Sanpō* (1683), the *Endan Genkai* (1685) to the *Hatsubi Sanpō* (Seki Takakazu, 1674), the *Genkai Taisei* (1690) to the Chinese mathematics book *Suanxue Qimeng* (Zhu Shijie, 1299) and the *Tetsujutsu Sankei* (1722). He, together with his master and his elder brother Kata'akira, conceives the *Taisei Sankei*, an encyclopedic monograph of all mathematics known to them. The project starts in 1683 and ends in 1711 after 28 years of compilation.

To celebrate his 350th anniversary, an international conference on the "Traditional Mathematics of East Asia and Related Topics," the Takebe Conference 2014, is organized on August 25-30 at Ochanomizu University. The Takebe Conference 2014 is one of the satellite conferences of SEOUL ICM 2014 and supported by the Mathematical Society of Japan.

In this talk, we survey the mathematics of Takebe Katahiro and the events of his 350th anniversary.

Foundation of Mathematics and History of Mathematics

September 27th (Sat) Conference Room IX

9:30–11:40

Summary: 1. Constructible world. All sets are constructible::Then::Conntinuum problem::General contunuum Problem is true::We stand on Kantian philosophy: $V == L : -problem :$

2. Theory of H-theorems. H-function in mathematics:Entropy concept in math... Then:: $dH/dt =< 0 ==========> 0 :$

3. Representation theory. Representations of Diff(M):::Aut(R):Poincaré conjectures hold:Real orthogonal representations:

4. Fluctuation. Fluctuation and prigogine theory:H-theorems:δ-H theorems:Gibbs free energy::::Helmholtz free energy:: $H = SdAU(\mu) : H = SdA\Sigma UilogUi : \delta - H = SdAdUlogdU : \delta - H = SdA\Sigma dUilogdUi$

5. Riemann surface. Taniyama–Simura conjecture:Auto-morphic functions:Modular functions:Modular curves: $X ==========> E : V$:::::Morphism:

6. Maximal ideal space. $R =====> SPEC(R) :: R =====> M(R) : M(R) = \{$Maximal ideals in $R\}$ Topology:::Topological space:Introduce topology in $M(R)$:This makes $M(R)$::::A manifold::

Summary: In this paper we give the new definition of the concept of ordinal numbers and prove its existence theorem on the basis of the ZFC set theory. This is the generalization of Peano's system of axioms of finite ordinal numbers.

Summary: The first incompleteness theorem consists of two statements. One is that the Gödel sentence of a theory of arithmetic is unprovable if the theory is consistent, and the other is that the negation of the Gödel sentence is unprovable if the theory satisfies a certain soundness condition. We discuss the difference of the constructive nature of these two statements by interpreting their proofs in terms of the constructions of primitive primitive recursive functions.

Summary: The set of theorems of arithmetic in a nonstandard model of arithmetic is equal to or is bigger than the standard set of theorems of arithmetic. We firstly show that if the set of theorems in such a model is bigger than the standard one, the set must contain true and untrue sentences. Then, we show the existence of nonstandard models which satisfy the condition that set of theorems on their consistent initial segments are always standard, and are always nonstandard. At last, we prove that there is a Rosser-type provability predicate and a nonstandard model such that the theory defined by the provability predicate in the model is true arithmetic.

Summary: RM (reverse mathematics) and CMI (concrete mathematical independence) are two related areas of foundational interest which have emerged in mathematical logic. Recently, Andreas Weiermann innovated a new dichotomy principle called 'phase transitions' to illustrate an incompleteness phenomenon of CMI. In this talk, we are going to present some finer versions of the phase transition principle via abounding results of RM. Thus we can cross-link RM and CMI for a better understading of foudational phenomena.

Summary: We study a probability distribution d on the truth assignments to a uniform binary AND-OR tree. Liu and Tanaka [2007, Inform. Process. Lett.] showed the following: If d achieves the equilibrium among independent distributions (ID) then d is an independent identical distribution (IID). We show a stronger form of the above result. Given a real number r such that $0 < r < 1$, we consider a constraint that the probability of the root node having the value 0 is r. Our main result is the following: When we restrict ourselves to IDs satisfying this constraint, the above result of Liu and Tanaka still holds.

Summary: The notion of probability plays a crucial role in quantum mechanics. It appears through the so-called Born rule. In modern mathematics which describes quantum mechanics, however, probability theory means nothing other than measure theory, and therefore any operational characterization of the notion of probability is still missing in quantum mechanics. In this sense, the current form of quantum mechanics is considered to be imperfect as a physical theory which must stand on operational means. In this talk, we present an alternative rule to the Born rule based on algorithmic randomness without reference to the notion of probability. We use the notion of Martin–Löf randomness with respect to Bernoulli measure for specifying the property of the results of quantum measurements in an operational way. We consider the validity of the new rule, in particular, based on the many-worlds interpretation of quantum mechanics.

Summary: Type-two Theory of Effectivity (TTE) provides a general framework for computable analysis. To refine it to polynomial-time computability while keeping as much generality as possible, Kawamura and Cook recently proposed a modification to TTE using machines that have random access to an oracle and run in time depending on the "size" of the oracle. They defined type-two analogues of P, NP, PSPACE and applied them to real functions and operators. We further refine their model and study computation below P: type-two analogues of the classes L, NC, and P-completeness under log-space reductions. As prototypical applications, we recast several facts (some in a stronger form than was known) about the complexity of numerical problems into our framework.

14:15–15:40

Summary: The concept of a point degree spectrum links the study of degree structures in computability theory to the study of dimension in descriptive set theory and topology. We answer an open question whether there are more than two equivalence classes of perfect Polish spaces w.r.t. countable continuous isomorphisms in the positive.

Summary: Frankiewics and Kunen (1987) proved that the assertion "for any Baire space X and any topological space Y with σ-disjoint open base, if f is a Baire function from X to Y then f is continuous on a co-meager subset of X" is independent over ZFC and the negation of the assertion is equi-consistent with a measurable cardinal. We shall discuss some results related to this theorem.

Summary: We will talk about the dominating number of F_σ ideals on Katětov–Blass order is equal to the dominating number $\mathfrak{d}$ which is the least size of cofinal subsets of the family of functions from the natural numbers to the natural numbers ordered by the relation "alomost dominating".

Summary: On κ, selectivle ideals are rigid, and normal ideals selective. While on $\mathcal{P}_\kappa\lambda$, all normal ideals are not selective. We proved last year a weakly normal ideal is selective if the sup-function is one-to-one on a measure one set. We show the same assumption gives the regidity to a weakly normal ideal.

Summary: Set-theorecit geology is a study of the structure of all ground models of the universe. We prove that under $V = HOD$ or a bit weaker assumption, the structure of all ground models behaves well as under $V = L[A]$.

16:00–17:00 Talk Invited by Section on Foundation and History of Mathematics

Daisuke Ikegami (Kobe Univ.) Gödel's program, large cardinals, and forcing axioms

Summary: After proving that one cannot refute the Continuum Hypothesis (CH) in Zermelo–Fraenkel set theory with the Axiom of Choice (ZFC), Gödel suspected that one cannot decide the truth-value of CH in ZFC, i.e., CH is *independent* from ZFC. To discuss the truth-values of CH and other mathematical statements, Gödel initiated the following program nowadays called **Gödel's Program**: Decide the truth-values of mathematically interesting statements independent from ZFC in "well-justified" extensions of ZFC.

What Gödel had in mind at that time was the notion of *large cardinals*. He expected to decide the truth-value of CH by assuming the existence of a certain large cardinal in ZFC.

After Cohen introduced *forcing* which is now a basic tool to argue the unprovability of statements in set theory, it was shown by Lévy and Solovay that the existence of *any* large cardinal in ZFC cannot decide the truth-value of CH. However, using large cardinals in ZFC, one can decide the truth-values of many mathematical statements which are independent from ZFC alone, and furthermore one can obtain a clear understanding of the theory of the second-order structure $\big(\mathbb{N}, \mathcal{P}(\mathbb{N}), \in\big)$.

In this talk, we try to extend this understanding to the theory of the structure $\big(\omega_1, \mathcal{P}(\omega_1), \in\big)$ where ω_1 is the least uncountable cardinal, by using large cardinals, forcing axioms, and some hypothesis from inner model theory in ZFC. This is joint work with Matteo Viale.

September 28th (Sun) Conference Room IX

9:30–11:30

Summary: Evans and Wang proved that if an omega-categorical generic structure is not simple then it has SOP_3. We consider a generalization of their result.

Summary: We discuss the model completeness of countably categorical structures constructed by Hrushovski's amalgamation method. We obtained some positive results in the ab initio case with coefficient 1 for the predimension function and with a ternary relation. We will discuss the cases with coefficient other than 1.

Summary: In this talk, we see a new proof to Chernikov–Kaplan's theorem which insists the equivalence of dividing and forking over extension bases. We use indiscernible structures to prove the theorem, which are more elementary notions than the ones used in Chernikov and Kaplan's proof. The new proof was obtained by improving Tsuboi's idea.

Summary: We introduce a both-way translation between the category of concrete domains and a certain category of sheaves, based on which we furthermore study the equivalence of these two categories.

18 Katsuhiko Sano (JAIST) Cut-elimination theorem for Belnap–Dunn's four-valued logic ····· 15

Summary: This talk concerns a proof theory for Belnap–Dunn's four-valued logic. First, we overview how we can extract Dunn's relational semantics for a given logical connective from a four-valued truth table for the connective. Second, we provide inference rules for the connective in a sequent calculus of Belnap–Dunn logic and establish an admissibility of the rule of cut in the expanded calculus with these rules.

19 Nobu-Yuki Suzuki (Shizuoka Univ.) The independence of existence and disjunction properties in intermediate predicate logics ····· 15

Summary: An intermediate predicate logic $\mathbf{L}$ is said to have the *existence property* (EP), if for every $\exists x A(x)$, $\mathbf{L} \vdash \exists x A(x)$ implies that there exists an individual variable v such that $\mathbf{L} \vdash A(v)$. A logic $\mathbf{L}$ is said to have the *disjunction property* (DP), if for every A and every B, $\mathbf{L} \vdash A \vee B$ implies either $\mathbf{L} \vdash A$ or $\mathbf{L} \vdash B$. Since $\exists$ is regarded as the generalized $\vee$, a natural question arises: *Does EP imply DP?* This is known as Ono's problem **P52**. We provide a negative solution to this problem. We also present an affirmative partial result under a natural condition for reasonable logics.

20 Ryo Kashima (Tokyo Tech) On semilattice relevant logics ····· 15

Summary: Urquhart's semilattice relevant logic is defined to be the set of valid formulas in semilattice models. We call it R_0, which is slightly different from the orthodox relevant logic R. In this talk, semilattice models are extended and a new logic, called R_1, is defined. R_1 is a proper subset of R_0. The following formulas are elements of $R_0 - R_1$: $((p \to r) \wedge (q \to r)) \to ((p \vee q) \to r)$, $((r \to (p \vee q)) \wedge (p \to q)) \to (r \to q)$; the former is an axiom of R, and the latter is not provable in R. We study certain properties of R_1; e.g., finding a sound and complete proof system.

11:30–12:00 Research Section Assembly

14:15–14:45 Mathematics History Team Meeting Part 1

"On the map of Japan drawn under the direction of TAKEBE Katahiro with orders of Yoshimune, the eighth Tokugawa shogun, during the Kyoho period"
Lecture by Minoru Kuge (Hiroshima Prefectural Museum of History) and discussion

15:00–16:10

21 Shunzi Horiguchi (Niigata Sangyo Univ.)
Tetsuaki Shimotomai
A discovery of the Shimizu style surveying secret book —Considerations from the connections of the surveyors and religions— ····· 15

Summary: The Shimizu style surveying secret book of early stages in the Edo period (1603–1868) was found in 2007 in Sapporo. We consider the surveying from the connections of the surveyors and religions.

22 Shotaro Tanaka ♭ Methods for power series expansions of rational functions. Strictness and handiness of their methods ····· 15

Summary: Example: rational function: $f(z) = (4z^2-7z+11)/(2+5z)(2z-3)^2 = 1/(2+5z)+1/(2z-3)^2$. By Wada's theorem, power series: $\sum_1 : k = 1 \to \infty$, $d_p(k) \equiv (k+p-1)!/p!(k-1)!$. $\sum_1\{d_0(k)(-1)^{k-1}(5^{k-1}/2^k)+ d_1(k)(2^{k-1}/3^{1+k})\}z^{k-1}$ $(|z| < 2/5)$, $\sum_1\{d_1(k)(2^{k-1}/3^{1+k})\}z^{k-1} + \sum_1 d_0(k)(-1)^{k-1}(2^{k-1}/5^k)(1/z^k)$ $(2/5 < |z| < 3/2)$, $\sum_1\{d_0(k)(-1)^{k-1}(2^{k-1}/5^k) + d_1(k)(3^{k-1}/2^{1+k})(1/z)\}(1/z^k)$ $(3/2 < |z|)$. By Cauchy's integral formula, $\sum a_n(z-c)^n : n = (-\infty) \to \infty, a_n = (1/2\pi i)\oint\{f(\zeta)/(\zeta-c)^{n+1}\}d\zeta = (1/n!)f^{(n)}(c)$. If $c = 0$, then $a_n = (1/2\pi i)\oint\{f(\zeta)/\zeta^{n+1}\}d\zeta = (1/n!)f^{(n)}(0)$ is equal to the result from Wada's. It is not easy to find the general term from the recurring series.

23 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) La valeur particurière and the eigenvalue ····· 15

Summary: We discuss the eigenvalue problem, especially, the coincidence between *la valeur particulière* and the eigenvalue. The eigenvalue problem is the model of the Schrödinger equations or the quantum equations, namely, the Sturm–Liouville type boundary value problem of heat diffusion is the model of the Schrödinger equations. Sturm and Liouville discuss *la valeur particulière*, without its corresponding eigenspace, and the definition of eigenvalue and eigenspace/eigenfunction are introduced by Hilbert. This handling of the value is traditionally relates to the sudies of linear differential equations, such as by Laplace, Fourier, Poisson, Cauchy, et al. Especially, Poisson's preceding studies contribute to the study of this type differential equations by Sturm and Liouville and convergence of series in his heat theory.

24 Shigeru Masuda (Res. Workshop of Classical Fluid Dynamics) Prévost's study preceding Fourier of heat communication in the history of physico-mathematics ····· 15

Summary: We discuss Prévost's work on heat communication, which precedes Fourier. These situations owe to the arrival of continuum, on which we summarize the topics as the background from the viewpoint of mathematical history in 18–19th centuries as follows: 1) On the attraction and replusion of molecule, Navier depends on Fourier's principle of heat molecule. The then hysico-mathematicians had little evaluated Navier until the top of 20th century. 2) Poisson points strongly out Fourier's invalidity on the handling of De Gua's theory into the transcendental equations. 3) For formulation of heat motion in the fluid, Fourier had submitted this paper, however, until his death, he has not published it, in which he seems to aim the unity of hydro- and thermodynamics. 4) The hydrodynamicists, like Poisson and Cauchy propose the equations in unity of elasticity and fluid. Finally, we evaluate Prévost's work on these background.

16:10–16:40 Mathematics History Team Meeting Part 2

Other topics

Algebra

September 25th (Thu) Conference Room II

9:30–12:00

1 Hiroko Yanaba (Hiroo Gakuen) On some results of the function associated with the Euler function $\varphi(a)$
Takahiro Shishikura (Hiroo Gakuen) 10

Summary: Given a positive integer a, we have the Euler function $\varphi(a)$. By s we denote the associated function of $\varphi(a)$, which is indicated by $\widetilde{\varphi}(a)$.
Given x, we consider the equation $a - 2^{e+1}\widetilde{\varphi}(a) = x$, e being a positive integer.
The main result is as follows.
If $x = 0$, then $e = 1$ and $a = 2^{\varepsilon}$ for some $\varepsilon > 0$. If $x = 1$ and $e \leq 4$, then the equation has no solution.

2 Shigeru Iitaka (Gakushuin Univ.*) On a function associated with $\sigma(a)$ 10

Summary: Associated with Euler tossile function, we introduced a new function $\widetilde{\varphi}(a)$, which is defined to be $\frac{\varphi(a)}{2^s}$, s being the number of distinct prime factors of a.
Here, associated with divisor (sum) function $\sigma(a)$, we introduce a yet another new function $\widetilde{\sigma}(a)$, which is defined to be $\frac{\sigma(a)}{2^s}$.
If $2\widetilde{\sigma}(a) - a = -1$ then $a = 2^e p$, where $p = 2^{e+1} + 1$ is a prime.
Here $e + 1$ turns out to be 2^m.

3 Yasutoshi Nomura * Primality and divisibility of Stirling numbers of the 2nd kind 10

Summary: We discuss in this talk when Stirling numbers S(n,k) are prime and when they are divisible by prime powers.

4 Isao Kiuchi (Yamaguchi Univ.) * On a sum involving the Möbius function 10
Makoto Minamide (Yamaguchi Univ.)
Yoshio Tanigawa (Nagoya Univ.)

Summary: Let $c_q(n)$ be the Ramanujan sum, i.e., $c_q(n) = \sum_{d|(q,n)} d\mu(q/d)$, where μ is the Möbius function. Chan and Kumchev gave formulas for $\sum_{n\leq y}\left(\sum_{q\leq x} c_q(n)\right)^k$ $(k = 1, 2)$. In this our talk, we shall consider formulas for $\sum_{n\leq y}\left(\sum_{n\leq x} \widehat{c}_q(n)\right)^k$ $(k = 1, 2)$.

5 Eiji Miyanohara (Waseda Univ.) Transcendence of digital expansions generated by a cyclic permutation and k-adic expansion 10

Summary: We prove the transcendence of certain real numbers defined by using a cyclic permutation and k-adic expansion of natural numbers.

Summary: Let $q \geq 2$ be an integer. We separate a given power series into q subseries, called q-components, according to the residue classes mod q of their powers. We study algebraic independence for values at an algebraic point of q-components for a certain trigonometric functions.

Summary: Let q ($|q| \geq 2$) and $\ell \geq 2$ be rational integers. Then the ℓ numbers $1, \sum_{n=1}^{\infty} d_k(n)q^{-n}$ $(k = 2, 3, ..., \ell)$ are linearly independent over $\mathbb{Q}$, where $d_k(n)$ are the generalized divisor functions. This generalizes a result of Erdos who treated the case $\ell = 2$.

Summary: We give a numerical sufficient condition for the existence of rational points on diagonal cubic surfaces over the rationals under the assumption that the Tate–Shafarevich group of any elliptic curve over the rationals is finite.

Summary: Let m_1 and m_2 be distinct square-free integers with $12 \nmid m_1 m_2$ and let S_+, S_-, S_0 be mutually disjoint finite sets of prime numbers not containing 2, 3, and the prime factors of $m_1 m_2$. We show that there exist infinitely many square-free integers d with $\gcd(m_1 m_2, d) = 1$ such that the class numbers of quadratic fields $\mathbb{Q}(\sqrt{m_1 d})$ and $\mathbb{Q}(\sqrt{m_2 d})$ are both divisible by 3, every prime number $p \in S_+$ splits in $\mathbb{Q}(\sqrt{d})$, every prime number $p \in S_-$ is inert in $\mathbb{Q}(\sqrt{d})$, and every prime number $p \in S_0$ is ramified in $\mathbb{Q}(\sqrt{d})$.

Summary: We study mean values of the Euler–Zagier multiple zeta-functions.

Summary: First, as a generalization of the classical notion of Dirichlet series, we define multiple Dirichlet series and we give zero-free regions of multiple Dirichlet series. Next, we give zero-free regions of multiple zeta star functions.

12 Yumiko Hironaka (Waseda Univ.)* Zeta functions of finite groups by counting numbers of subgroups ···· 15

Summary: For a finite group G, we consider the zeta function $\zeta_G(s) = \sum_H |H|^{-s}$, where H runs over the sugroups of G.
We give examples of certain abelian p-group G and non-abelian p-group G' of order p^m, $m \geq 3$ for odd p (resp. 2^m, $m \geq 4$) for which $\zeta_G(s) = \zeta_{G'}(s)$. Hence we see there are many non-abelian groups whose zeta functions have symmetry and Euler product like the case of abelian groups.
On the other hand, we show that $\zeta_G(s)$ determines G within abelian groups.
We will explain some relation to the theory of Eisenstein series of of GL_n and local densities of square matrices.

14:15–16:15

13 Hiroto Inoue (Kyushu Univ.) Expansion of the completed Riemann zeta function in Meixner–Pollaczek polynomials and its zeros ····· 10

Summary: We will introduce the expansion of the completed Riemann zeta function in the Meixner–Pollaczek polynomials, which satisfy the functional equation. It is showed that the expansion converses uniformly in every compact set in the critical strip. Then we are interested in investigating the zeros of the partial sums because these zeros approximate the nontrivial zeros of the Riemann zeta function. Furthermore, we will have an observation that almost all the approximating zeros seem to lie on the real axis in a numerical calculation. For the last, we will mention the representation theoretical back ground of the Meixner–Pollaczek polynomials and the future works.

14 Yoshikatsu Yashiro (Nagoya Univ.)* Distribution of zeros and zero-density estimate for the derivatives of L-function attached to cusp form ····· 10

Summary: Let $L_f^{(m)}(s)$ the m-th derivative of L-function attached to cusp form. In this talk we shall give the approximate formula of the number of zeros of $L_f^{(m)}(s)$ and estimate the density of zeros of $L_f^{(m)}(s)$ in the right hand side of critical line.

15 Takahiro Wakasa (Nagoya Univ.)* An explicit upper bound of the argument of Dirichlet L-functions on the generalized Riemann hypothesis ····· 10

Summary: We prove an explicit upper bound of the function $S(t, \chi)$, defined by the argument of Dirichlet L-functions. An explicit upper bound of the function $S_1(t)$, defined by the integral of the argument of the Riemann zeta-function, have already been obtained by A. Fujii. Our result is obtained by applying an idea of Fujii's result on $S_1(t)$. The constant part of the explicit upper bound of $S(t, \chi)$ in this paper does not depend on a primitive Dirichlet character $\chi \pmod{q > 1}$.

16 Kohta Gejima (Osaka Univ.) Shintani functions on $\mathrm{SL}(2, \mathbf{C})$ and Heun's differential equations ····· 15

Summary: Shintani functions for the semisimple symmetric pair $(\mathrm{SL}(2, \mathbf{C}), \mathrm{GL}(1, \mathbf{C}))$ are defined for a pair (π, η) of representations. Here π is a non-unitary principal series representaition of $\mathrm{SL}(2, \mathbf{C})$ induced from its parabolic subgroup, and η a character of $\mathrm{GL}(1, \mathbf{C})$. In this talk, we give explicit formulas of Shintani functions of type (π, η), where π has a non-trivial minimal $\mathrm{SU}(2)$-type $\mathrm{Sym}^n(\mathbf{C}^2)$ $(n = 1, 2)$.

Summary: We give a derivative version of the relative trace formula on PGL(2) studied in our previous work, and obtain a formula of an average of central values (derivatives) of automorphic L-functions for Hilbert cusp forms. As an application, we prove existence of Hilbert cusp forms with non-vanishing central values (derivatives) such that the absolute degrees of their Hecke fields are sufficiently large.

Summary: This talk is related to lifts to Siegel modular forms of half-integral weight. The Maass relation is a certain relation among Fourier coefficients of a certain kind of Siegel modular forms of degree two. This relation characterizes the image of the Saito–Kurokawa lift. In particular, Siegel–Eisenstein series of degree two satisfy the Maass relation. In the end of 80's T. Yamazaki obtained generalizations of the Maass relation for Siegel–Eisenstein series of integral weight of arbitrary degrees. In the present talk I would like to explain some refinements of Yamazaki's results and give also a generalization of the Maass relation for Siegel cusp forms and Siegel modular forms of half-integral weight of arbitrary degrees. As an application of the generalized Maass relation we obtain lifts from pairs of two elliptic modular forms to Siegel modular forms of half-integral weight of even degrees.

Summary: In the previous meeting, it was reported that the image by the theta operator of Igusa cusp form χ_{35} vanishes mod 23. However, the reason why such a phenomenon exists was not clarified. Therefore, we consider whether it can be shown that there exist Siegel modular forms with a similar property. In this meeting, we report that we can construct a family of Siegel modular forms satisfying such property in the case of odd degree.

Summary: We establish the joint universality theorem for a set of Dirichlet L-functions $L(s, \chi_{d_1 d}), \ldots, L(s, \chi_{d_r d})$ with real primitive characters in the d-aspect. We also obtain a multi-dimensional denseness result concerning class numbers of quadratic fields.

16:30–17:30 Talk Invited by Algebra Section

Hidehiko Mishou (Tokyo Denki Univ.) An overview of the theory of universality for zeta functions

Summary: Let X and Y be a topological space and $T_\iota : X \to Y$ ($\iota \in \mathrm{I}$) be continuous mappings. An element $x \in X$ is called universal for $\{T_\iota\}$, if the set $\{T_\iota x \in Y \mid \iota \in \mathrm{I}\}$ is dense in Y.
In the 1910s and later, the existence of universal objects have been comfirmed for many operators in the space of entire functions. In 1975, S. M. Voronin obtained the first explicit example of universal objects. Roughly speaking he showed that any non-vanishing and holomorphic function on the strip $1/2 < \Re s < 1$ can be uniformly approximated by a suitable vertical translation $\zeta(s + i\tau)$ of the Riemann zeta function $\zeta(s)$.
In the talk, I will summarize the results and the applications in the theory of universality for arithmetic zeta functions. Also, I will talk about my recent works on the joint universality for sets of several zeta functions.

September 26th (Fri) Conference Room II

9:30–11:50

Summary: This is a research report about the classification problem of the structure of ordered topological semigroups on the space $\mathbb{R}$ of all real numbers, which is an old and new problem. We determine the structure of semigroups on $\mathbb{R}$ if they are Archimedean and satisfy a certain very weak cancellation law. Moreover we show that exactly 3 cancellative topological semigroups exist on $\mathbb{R}$ and also exactly 8 ordered topological bands exist on $\mathbb{R}$ up to isomorphism.

Summary: On tiling problems of the Aztec diamonds Stanley exhibited a multivariate generalization of the Aztec diamond theorem by Elkies, Kuperberg, Larsen and Propp (1992). (See Ciucu (1998).) In this talk a new proof of Stabley's multivariate generalization of the Aztec diamond theorem is shown in terms of biorthogonal polynomials and determinants.

Summary: For an integer r greater than 1, an identity is presented which counts the number of parts modulo r of the r-class regular partitions. This identity is applied for computing the determinant of the regular character table of the symmetric group.

Summary: It is shown that, for each $d \geq 4$, there exists an integral convex polytope $\mathcal{P}$ of dimension d such that each of the coefficients of $n, n^2, \ldots, n^{d-2}$ of its Ehrhart polynomial $i(\mathcal{P}, n)$ is negative.

Summary: Let $\mathcal{P} \subset \mathbb{R}^d$ be a $(0,1)$-polytope of dimension d which contains the origin of $\mathbb{R}^d$. Suppose that the configuration $\mathcal{A}$ arising from $\mathcal{P}$ satisfies $\mathbb{Z}\mathcal{A} = \mathbb{Z}^{d+1}$ and that the toric ideal $I_{\mathcal{A}}$ of $\mathcal{A}$ possesses a squarefree initial ideal with respect to the reverse lexicographic order induced by an ordering of the variables for which the variable corresponding to the origin is the weakest. It is then proved that the equation of each facet of $\mathcal{P}$ is of the form $\sum_{i=1}^{d} a_i z_i = b$, where each a_i is an integer and where $b \in \{0, 1\}$.

Summary: In this talk, we give a sufficient condition for a toric ring $K[A]$ to be strongly Koszul in terms of the reverse lexicographic Gröbner bases of its toric ideal I_A. This is a partial extension of a result given by Restuccia and Rinaldo.
In addition, we show that any strongly Koszul toric ring generated by squarefree monomials is compressed. Using this fact, we show that our sufficient condition for $K[A]$ to be strongly Koszul is both necessary and sufficient when $K[A]$ is generated by squarefree monomials.

Summary: We introduced the notion of p_g ideals for two-dimensional normal local domain. In this talk, we talk about several properties of p_g ideals, and give an existence of p_g ideals. As an application, we prove an existence theorem for good ideals for any two-dimensiona Gorenstein normal local domain. Moreover, we classify Ulrich ideals for minimally (simple) elliptic singularities.

Summary: In this talk, we will compute Buchsbaum–Rim functions of two variables associated to a parameter matrix of a special form over a one-dimensional Cohen–Macaulay local ring, and will determine when the function coincides with the Buchsbaum–Rim polynomial. As a consequence, we have that there exists the case where the function does not coincide with the polynomial function, which should be contrasted with the ordinary Buchsbaum–Rim function of single variable.

29 Tadahito Harima (Niigata Univ.)* Completely $\mathfrak{m}$-full ideals and componentwise linear ideals 10
Junzo Watanabe (Tokai Univ.)

Summary: We show that the class of completely $\mathfrak{m}$-full ideals coincides with the class of componentwise linear ideals in a polynomial ring over an infinite field.

13:20–14:20 Talk Invited by Algebra Section

Masato Okado (Osaka City Univ.) Tetrahedron equation and quantum groups

Summary: Tetrahedron equation is a 3 dimensional analogue of the Yang–Baxter equation in 2 dimensional solvable lattice models. Recently, new connections between its solutions and quantum groups have been found. They are intertwiners of the quantum coordinate ring associated to SL_3 or Sp_4, Poincaré–Birkhoff–Witt type basis of the nilpotent part of a quantized enveloping algebra associated to finite-dimensional simple Lie algebras, and a new infinite-dimensional representation, which we call q-oscillator representation, of quantum affine algebras. In my talk I will explain what are interesting from the viewpoint of representation theory of quantum groups.

September 27th (Sat) Conference Room II

9:30–11:25

30 Yugen Takegahara (Muroran Inst. of Tech.) 2-adic properties for the numbers of involutions in the alternating groups 15

Summary: Let $\mathrm{Inv}(n)$ be the set consisting of the identity and all involutions in the alternating groups of degree n. D. Kim and J. S. Kim determined the largest power of 2 in $\sharp\mathrm{Inv}(n)$, where $n = 4k$, $4k+2$, or $4k+3$. They also conjectured that the largest power of 2 in $\sharp\mathrm{Inv}(4k+1)$, $k = 1, 2, ...$, are concerned with a certain 2-adic integer. We can give an affirmative answer to this conjecture.

31 Yuki Kanakubo (Sophia Univ.)♭ Cluster variables on double Bruhat cells and monomial realizations of crystal bases 15
Toshiki Nakashima (Sophia Univ.)

Summary: For semi simple simply connected algebraic group G and elements u, v of its Weyl group, it is known that the coordinate ring $\mathbb{C}[G^{u,v}]$ of the double Bruhat cell $G^{u,v}$ has the structure of an upper cluster algebra and the generalized minors $\Delta(k, \mathbf{i})$ are the cluster variables ([A. Berenstein, S. Fomin, A. Zelevinsky]). In this talk, for $G = SL_{r+1}(\mathbb{C})$, we consider $\Delta(k, \mathbf{i})$ as the functions on $\mathbb{C}_{\neq 0}^{l(u)+l(v)}$ by coordinate transformation. Then they become Laurent polynomials with coefficient 1. And we can express each monomial in those polynomials in terms of monomial realization of crystal.

32 Toshiyuki Abe (Ehime Univ.) A commutant of a 4-cyclic permutation orbifold model of affine vertex operator algebra of type A_1 10
Hiromichi Yamada (Hitotsubashi Univ.)

Summary: I will talk on a structure of a vertex operator algebra given as a commutant in the cyclic orbifold model of $L_{sl_2}(1, 0)$ of order 4.

33 Kenichiro Tanabe (Hokkaido Univ.) On modules with logarithmic terms over vertex algebras ····· 15

Summary: I will introduce a generalization of modules over vertex algebras and give some examples of such modules.

34 Masahide Konishi (Nagoya Univ.) Basicalization of KLR algebras ····· 15

Summary: KLR algebras are introduced to categorify the negative part of the associated quantum group. From another point of view, they are a class of infinite dimensional algebra, defined by two data: a quiver and a weight on its vertices. It is not so pathological, therefore we know we can obtain a basic algebra Morita equivalent to a KLR algebra as a quiver with relations in principle. In this talk, I will explain an explicit algorithm for that in some special cases.

35 Ayako Itaba (Tokyo Univ. of Sci.)
Takahiko Furuya (Meikai Univ.)
Katsunori Sanada (Tokyo Univ. of Sci.)
On the decomposition of the Hochschild cohomology group of a monomial algebra satisfying a separability condition ····· 10

Summary: In this talk, we consider the finite connected quiver Q having two subquivers $Q^{(1)}$ and $Q^{(2)}$ with $Q = Q^{(1)} \cup Q^{(2)} = (Q_0^{(1)} \cup Q_0^{(2)}, Q_1^{(1)} \cup Q_1^{(2)})$. Suppose that $Q^{(i)}$ is not a subquiver of $Q^{(j)}$ where $\{i, j\} = \{1, 2\}$. For a monomial algebra $\Lambda = kQ/I$ obtained by the quiver Q, when the associated sequence of paths given by I satisfies a certain separability condition, we propose the method so that we easily construct a minimal projective resolution of Λ as a right Λ^e-module and calculate the Hochschild cohomology group of Λ.

36 Tomohiro Itagaki (Tokyo Univ. of Sci.) On the cyclic homology of an algebra associated with a cyclic quiver and a monic polynomial ····· 10

Summary: The Hochschild homology and the cyclic homology of an algebra $K[x]/(f(x))$ over a commutative ring K is given by the Buenos Aires cyclic homology group, where $f(x)$ is a monic polynomial. We consider an algebra A associated with a cyclic quiver and a monic polynomial which generalizes $K[x]/(f(x))$. In this talk, we give the module structure of the Hochschild homology and the cyclic homology of A.

11:30–12:00 Research Section Assembly

14:15–15:15 Talk Invited by Algebra Section

Hiroyuki Minamoto (Osaka Pref. Univ.) ♭ Derived bi-duality and DG-completion

Summary: Duality and bi-duality are basic operations and has played prominent role in algebra and representation theory. Recently the concern with the derived duality and derived bi-duality have been growing. We show that a derived bi-duality DG-module is obtained as a tautological homotopy limit. This result gives unified proofs and generalizations of previous known results about derived bi-duality. We will also discuss derived double centralizer property, which relates to a notion of DG-completion.

15:30–17:30

37 Hiroki Miyahara (Univ. of Yamanashi) A constraction of Auslander-regular rings and its application ····· 10

Summary: Let I be a non-trivial finite multiplicative group with the unit element e and $A = \oplus_{x \in I} A_x$ an I-graded ring. We construct a Frobenius extension Λ of A and study when the ring extension A of A_e can be a Frobenius extension. Also, formulating the ring structure of Λ, we introduce the notion of I-bigraded rings and show that every I-bigraded ring is isomorphic to the I-bigraded ring Λ constructed above.

Summary: Azumaya conjectured that every exact ring has a self-duality. The conjecture is related to self-duality of finite triangular extensions. We obtain self-duality of finite triangular extensions of skew fields under certain conditions.

Summary: In this talk, we provide another sufficient condition to guarantee the existence of standard derived equivalences for derived equivalent rings.

Summary: It seems that Morita invariance judges of the important of classes of ring extensions concerned. The notion of Morita equivalence in ring extensions was introduced by Y. Miyashita, and he showed that the classes of G-Galois extensions and Frobenius extensions are Morita invariant. After that, S. Ikehata showed that the classes of symmetric extensions, QF-extensions, separable extensions, and Hirata separable extensions are Morita invariant. The purpose of this talk is to show that some classes of ring extensions are Morita invariant. Further, we will give an example of the class of ring extensions which is not Morita invariant. It may seem that the classes of almost all ring extensions are Morita invariant. But, there is a class of ring extensions which we do not know weather that is Morita invariant or not.

Summary: We classify the prelocalizing subcategories of the category of quasi-coherent sheaves on a locally noetherian scheme. In order to give the classification, we introduce the notion of a local filter of quasi-coherent subsheaves of the structure sheaf. We also classify the localizing subcategories and the closed subcategories in terms of filters.

Summary: We propose graded analogue of Hill's conjecture and Külshammer–Olsson–Robinson's conjecture concerning generalized Cartan invariants of the symmetric groups and discuss implications between them and their variants. As a support, we see our conjectures are compatible with certain localization and specialization of the base ring $\mathbb{Z}[v, v^{-1}]$.

44 Taiki Shibata (Univ. of Tsukuba) On integrals for algebraic supergroups ····· 10

Summary: Let k be a base field. An affine group scheme is a representable functor from the category of commutative k-algebras to the category of groups. If "algebras" are replaced with "superalgebras"($= \mathbb{Z}_2$-graded algebras), then we obtain the notion of an affine supergroup scheme (or simply, supergroup). Let A be the Hopf superalgebra corresponding to an algebraic supergroup G. A non-zero k-linear map $\phi : A \to k$ is called an integral for G if ϕ is A-colinear. It is known that the integral plays an important role in the representation theory of G. In this talk, we will discuss the existence and properties of integrals.

September 28th (Sun) Conference Room II

9:15–12:00

45 Tomohiro Iwami (Kyushu Sangyo Univ.) * An analogue of Clemens–Griffiths components for certain three-dimensional log pairs in the weak sense and the associated rationality criterion ··· 10

Summary: Succeeding to the author's previous work "A variant of Iskovskikh's rationality criterion for conic bundles in the case of polarized (log) pairs", in which the author slightly gave a rationality criterion for Q-conic bundles, as resulting datum of running log minimal model program for certain three-dimensional log pairs under several assumptions, the author will try to induce an analogue of Clemens–Griffiths components in the sense of A. Kuznetsov for rational Q-conic bundles, with regards to Chow motives,contributing to such a rationality,in the induced Chow–Kunneth decomposition for such conic bundles, also by some methods related to phantom categories.

46 Jo Suzuki (Osaka Univ.) Klein's fundamental second kind 2-form for the C_{ab} curves ····· 15

Summary: In this paper, we derive the exact formula for symplectic basis of cohomology and its associated Klein's fundamental second kind 2-form for so-called C_{ab} curves. Previously, a similar result was obtained for hyper-elliptic curves. Thus far, the symplectic bases were calculated numerically by solving equations because no such a formula was known for more general curves.

47 Yoshifumi Tsuchimoto (Kochi Univ.) Non commutative Kähler maifolds ····· 15

Summary: We define non commutative counterpart of projective variety equipped with a Kähler structure.

48 Hiroki Ito (Nagoya Univ.) * On the classification of involutions on Enriques surfaces ····· 15
Hisanori Ohashi (Tokyo Univ. of Sci.)

Summary: We classify involutions on Enriques surfaces with the help of lattice theory due to Nikulin. We also give geometric realizations to all types by mainly Horikawa construction. This is a joint work with Hisanori Ohashi.

49 Yuki Yamamoto (Kanazawa Univ.) Divisorial contractions to cDV points with discrepancy > 1 ····· 15

Summary: I show that every divisorial contraction to cDV point with discrepancy > 1 is a weighted blow-up, except for a few cases.

Summary: We give a sufficient condition for a first order infinitesimal deformation of a curve on a 3-fold to be obstructed. As an application, we give a new example of a generically non-reduced irreducible components of the Hilbert scheme of space curves, whose general member is contained in a smooth quartic (K3) surface. Our proof is based on a calculation of the obstructions (cup products).

Summary: We classified weak Fano bundles of rank 2 on nonsingular cubic hypersurfaces in projective 4-spaces.

Summary: In a recent research, we obtain a lower bound for the self-intersection number of an ample divisor on a three-dimensional toric threefold. In this talk, we will see that this bound is attained if and only if our divisor is the anti-canonical divisor on a toric Fano threefolds.

Summary: Let $\mathcal{F}_n$ be the set of isomorphism classes of toric Fano n-folds. We say that X and Y in $\mathcal{F}_n$ are F-equivalent if there exists a sequence of equivariant blow-ups or blow-downs from X to Y through toric Fano n-folds. In this talk, we will present the results on F-equvalent classes and some other equivalent classes for $\mathcal{F}_5$. We also consider a higher dimensional analogue of the results on equivalent classes for $\mathcal{F}_5$.

14:15–15:15 Talk Invited by Algebra Section

Isamu Iwanari (Tohoku Univ.)[♭] Tannaka duality for higher categories

Summary: I will discuss Tannaka duality theory for stable infinity-categories; a higher categorical analogue of triangulated categories. I'll describe its backgrounds, motivations, applications to mixed motives, and prospects.

Geometry

September 25th (Thu) Conference Room III

9:40–12:00

1 Hirotaka Ebisui (Oval Research Center) About theorem in an-Desargues-system (ADE Theorem) 15

Summary: We have two systems for overraping two triangles that can be called as non Desargues and Desargues systems. Namely, in Desargues system, 3 lines connected 3 corresponding vertexs of triangle, are concurrence, and in non-Desargues system, they are not concurrence. Oppositly, we call this relation as that two triangles are in Desargues or non-Desargues system. Now we can say easyly that the Desargues theorem is in Desargues system. And Hexagon theorem which was found and reported in MSJ2011 at Shinshu Univ by H. Ebisui, is defined as a theorem in non(an)-Desargues system. About this fact, we show again Hexagon theorem which is drawn or constructed in new geometry system so called non(an)-Desargues system,and some corresponding theorems.

2 Akitoshi Kawamura (Univ. of Tokyo) Weight balancing on boundaries and skeletons 15
Yoshio Okamoto
(Univ. of Electro-Comm.)
Takeshi Tokuyama (Tohoku Univ.)

Summary: Given a polygonal region containing a target point (which we assume is the origin), it is not hard to see that there are two points on the perimeter that are antipodal, i.e., whose midpoint is the origin. We prove three generalizations of this fact. (1) For any polygon (or any bounded closed region with connected boundary) containing the origin, it is possible to place a given set of weights on the boundary so that their barycenter (center of mass) coincides with the origin, provided that the largest weight does not exceed the sum of the other weights. (2) On the boundary of any 3-dimensional bounded polyhedron containing the origin, there exist three points that form an equilateral triangle centered at the origin. (3) On the 1-skeleton of any 3-dimensional bounded convex polyhedron containing the origin, there exist three points whose center of mass coincides with the origin. This talk is partly based on work presented at the 30th Annual Symposium on Computational Geometry (SoCG 2014) jointly with 10 other authors.

3 Shuzo Izumi (Kinki Univ.) Sufficiency of simplex inequalities 10

Summary: Let $z_0, ..., z_n$ be the facet areas an n-simplex. Then we have the simplex inequalities: $z_p < z_0 + ... + z_{p-1} + z_{p+1} + ... + z_n$ $(0 \leq p \leq n)$, generalizations of triangle inequalities. Conversely, suppose that numbers $z_0, ..., z_n > 0$ satisfy these inequalities. Does there exist an n-simplex with facet areas $z_0, ..., z_n$? Kakeya solved this problem affirmatively in the case $n = 3$ and conjectured that the assertion is affirmative also for $n \geq 4$. We assert that this is always affirmative.

4 Shiho Ogata (Fukuoka Univ.) Gap theorems of complete λ-hypersurfaces 10

Summary: Since n-dimensional λ-hypersurfaces in Euclidean space are critical points of the weighted area functional for the weighted volume-preserving variations, in this talk, we talk about the rigidity properties of complete λ-hypersurfaces. We give a gap theorem of complete λ-hypersurfaces with polynomial area growth. By making use of the generalized maximum principle for λ-hypersurfaces, we prove a rigidity theorem of complete λ-hypersurfaces. This is a joint work with Professor Q.-M. Cheng and Professor G. Wei.

Summary: Deforming rotation surfaces with constant mean curvature in S^3 and H^3 to $S^3 \times R$ and $H^3 \times R$ respectively, we give four classes of surfaces with mean curvature vector of constant length in $S^3 \times R$ and $H^3 \times R$. Also we obtain minimal 2-tori in $S^3 \times S^1$.

Summary: In 1993, Y.-G. Oh proposed a problem whether standard Lagrangian tori in C^n are volume minimizing under Hamiltonian isotopies of C^n. We prove that most of them do not have such property if the dimension n is greater than two.

Summary: We consider limits of triply periodic minimal surfaces in $\mathbb{R}^3$. We prove that some important examples of doubly periodic minimal surfaces can be obtained as limits of triply periodic minimal surfaces.

Summary: In this paper, we investigate a holonomy invariant anisotropic surface energy (functional) in a complete Riemannian manifold, where "holonomy invariant" means that the parametric Lagrangian (on the tangent bundle of the Riemannian manifold) used to define the anisotropic surface energy is constant along each holonomy subbundle of the tangent bundle. First we obtain the first variational formula for the functional. Next we shall introduce the notions of an anisotropic convex hypersurface, an anisotropic equifocal hypersurface and an anisotropic isoparametric hypersurface for the functional, and give examples of these hypersurfaces in the case where the ambient space is a symmetirc space. Also, we prove that the anisotropic equifocality is equivalent to the anisotropic isoparametricness in the case where the ambient space is a symmetric space of non-negative curvature.

Summary: A map $f : (M, g) \to (X, h)$ is called a bi-harmonic map if it is a solution of the variational problem defined by the square integral of the tension field τ. A submanifold Y of (X, h) is called a bi-harmonic submanifold if the inclusion map ι is a bi-harmonic map with respect to the induced metric $\iota^* h$. The equation of bi-harmonic submanifold is over-determind, but has many solutions: all minimal submanifolds are bi-harmonic submanifolds. B. Y. Chen conjectured that there are no bi-harmonic submanifolds in Euclidean spaces except minimal submanifolds. In this talk, we show that the conjecture is true for hypersurfaces under a certain generic condition.

14:15–16:10

10 Yusuke Masatani (Nagoya Univ.) On unbounded diameter of the space of Lagrangian submanifolds in bi-disks 15

Summary: By using S. Seyfaddini's idea, we prove unboundedness of Lagrangian Hofer metric associated with uncountably many Lagrangian submanifolds in standard bi-disks $(D^2 \times D^2, \bar{\omega}_0)$.

11 Mitsuhiro Imada (Keio Univ.) On complex almost contact metric structures on complex hypersurfaces of $\mathbf{C}^{2n}$ 10

Summary: Complex contact manifolds, whose definition is analogous to that of real contact manifolds, are also expected to be important, but few examples of complex contact manifolds are known so far. In this report, we show that the (standard) hyperkähler structures on $\mathbf{C}^{2n}$ induce complex almost contact metric structures on some complex hypersurfaces of $\mathbf{C}^{2n}$. Also, we discuss whether those structures satisfy the normality defined by Ishihara and Konishi.

12 Isami Koga (Kyushu Univ.)* Classification of some submanifolds of the complex Grassmannian manifold 10

Summary: Let $M \to Gr_p(\mathbb{C}^n)$ be a holomorphic isometric immersion of a compact Kähler manifold into the complex Grassmannian manifold. We assume that the pull-back bundle of the universal quotient bundle $Q \to Gr_p(\mathbb{C}^n)$ over the complex Grassmannian manifold is projectively flat. In this talk, we classify such submanifolds with parallel second fundamental form.

13 Sadahiro Maeda (Saga Univ.)* Hiroshi Tamaru (Hiroshima Univ.) Naturally reductive homogeneous real hypersurfaces in a nonflat complex space form 15

Summary: In this talk, we give some geometric characterizations of naturally reductive homogeneous real hypersurfaces in a nonflat complex space form.

14 Kazumi Tsukada (Ochanomizu Univ.) Totally complex submanifolds of a complex Grassmann manifold of 2-planes 15

Summary: A complex Grassmann manifold $\mathrm{G}_2(\mathbb{C}^{m+2})$ of all 2-dimensional complex subspaces in $\mathbb{C}^{m+2}$ has two nice geometric structures —the Kähler structure and the quaternionic Kähler structure. We study totally complex submanifolds of $\mathrm{G}_2(\mathbb{C}^{m+2})$ with respect to the quaternionic Kähler structure. We show that the projective cotangent bundle $\mathrm{P}(T^*\mathbb{C}P^{m+1})$ of a complex projective space $\mathbb{C}P^{m+1}$ is a twistor space of the quaternionic Kähler manifold $\mathrm{G}_2(\mathbb{C}^{m+2})$. Applying the twistor theory, we construct maximal totally complex submanifolds of $\mathrm{G}_2(\mathbb{C}^{m+2})$ from complex submanifolds of $\mathbb{C}P^{m+1}$. Then we obtain many interesting examples.

15 Hiroshi Iriyeh (Tokyo Denki Univ.) Takashi Sakai (Tokyo Metro. Univ.) Hiroyuki Tasaki (Univ. of Tsukuba) On the structure of the intersection of quaternionic flag manifolds in a complex flag manifold 10

Summary: We study antipodal structure of the intersections of two real forms in complex flag manifolds. In particular, in the complex flag manifold consisting of sequences of complex subspaces in a complex vector space we describe the intersection of real forms consisting of sequences of quaternionic subspaces.

16 Hiroyuki Tasaki (Univ. of Tsukuba) Sequences and estimates of antipodal subsets ····· 10

Summary: Let $P_k(n)$ be the set consisting of all subsets of cardinalities k in $\{1,\dots,n\}$. A subset A of $P_k(n)$ is *antipodal*, if for any α and β in A the cardinality of $\alpha-\beta=\{i\in\alpha \mid i\notin\beta\}$ is even. An antipodal subset of $P_k(n)$ is related to an antipodal set of the oriented real Grassmann manifold $\tilde{G}_k(\mathbf{R}^n)$, which was introduced by Chen–Nagano. We have already obtained the classification of maximal antipodal subsets of $P_k(n)$ for $k\leq 4$. We construct sequences of antipodal subsets of $P_k(n)$. Using this we show estimates of the cardinalities of antipodal subsets of $P_5(n)$.

17 Kazuyoshi Kiyohara (Okayama Univ.)* The conjugate locus on ellipoid and D_4^+ Lagrangean singularity ····· 15
Jin-ichi Itoh (Kumamoto Univ.)

Summary: In the 2008 annual meeting of MSJ we talked that, on ellipsoids with distinct axes (or more generally on certain Liouville manifolds), the conjugate locus of a "general point" has three components of singularities and they are cuspidal edges. In this talk we show that the end points of those cuspical edges are D_4^+ Lagrangean singularities (of Arnold) and no other type of singularities do appear. The D_4^+ singularities appear exactly at the points where the multiplicity of the conjugacy is greater than one.

16:30–17:30 Talk Invited by Geometry Section

Osamu Ikawa (Kyoto Inst. Tech.)* Foundations and applications of symmetric triads

Summary: The notion of a symmetric triad with multiplicities is a generalization of that of an irreducible root system with multiplicities. We shall construct symmetric triads with multiplicities from compact symmetric triads with certain conditions. We apply symmetric triads into two directions:
(1) The orbits of Hermann actions. A Hermann action is a generalization of the isotropy action of a compact symmetric space. We describe the orbit spaces of Hermann actions using symmetric triads with multiplicities, and we also study the properties of each orbit such as regular, minimal, austere and totally geodesic orbit.
(2) The intersection of two real forms in an irreducible Hermitian symmetric space of compact type, which is a joint work with M. S. Tanaka and H. Tasaki. They proved that the intersection is an antipodal set if it is discrete. We will describe the necessary and sufficient condition that two real forms intersect discretely using a symmetric triad.

September 26th (Fri) Conference Room III

10:30–10:45 Presentation Ceremony for MSJ Geometry Prize 2014

10:50–11:50 Award Lecture for MSJ Geometry Prize 2014
—Celebrating Professor Masatake Kuranishi—

Ryushi Goto (Osaka Univ.)
Kimio Miyajima (Kagoshima Univ.*) Kuranishi's masterpieces and their developments in deformation theory and CR-geometry

Summary: In this talk, we discuss Kuranishi's works and their developments focussing on deformation theory and CR-geometry.

13:15–14:15 Talk Invited by Geometry Section

Takumi Yokota (Kyoto Univ.) Convex functions and barycenter on CAT(1)-spaces of small radii

Summary: CAT(1)-spaces are metric spaces of curvature at most 1 in the sense of Alexandrov defined in terms of geodesic triangles. CAT(0)-spaces are a generalization of simply-connected complete Riemannian manifolds of non-positive curvature and convexity of their distance functions yields many interesting results. In this talk, we discuss convexity of certain functions on small metric balls in CAT(1)-spaces. This function is discovered by W. Kendall and is similar to the one used by W. Jäger and H. Kaul in the proof of uniqueness of harmonic maps between Riemannian manifolds.

As an application, we prove that any Borel probability measure on a complete CAT(1)-space of small radius admits a unique Karcher mean which is also a unique barycenter. We also see that our Karcher mean on CAT(1)-spaces shares various properties, such as Jensen's inequality, with barycenter on CAT(0)-spaces. This is a generalization of preceding results on CAT(0)-spaces and CAT(1)-spaces of small diameters by K.-T. Sturm, K. Kuwae, S.-i. Ohta, etc.

Finally, we use our barycenter to formulate an analogue of Banach–Saks property for general metric spaces. We prove that complete CAT(1)-spaces with small radii enjoy this property. This can be regarded as an extension of Kakutani's theorem on uniformly convex Banach spaces.

September 27th (Sat) Conference Room III

9:40–12:00

Summary: In this talk, we consider real hypersurfaces with ϕ-invariant Ricci tensors in a non-flat complex space form $\widetilde{M}_n(c)$. In particular, we classify Hopf hypersurfaces having weakly ϕ-invariant Ricci tensor in $\widetilde{M}_n(c)$.

Summary: Kapovich and Nagnibeda introduced the space $\mathcal{S}\mathrm{Curr}(F_N)$ of subset currents on a free group F_N of rank $N \geq 2$, which can be thought of as a measure-theoretic completion of the set of all conjugacy classes of finitely generated subgroups of F_N. We define a product $\mathcal{N}(H, K)$ of two finitely generated subgroups H and K of the free group F_N by the sum of the reduced rank $\overline{\mathrm{rk}}(H \cap gKg^{-1})$ over all double cosets HgK ($g \in F_N$), and extend the product $\mathcal{N}$ to a continuous symmetric $\mathbb{R}_{\geq 0}$-bilinear functional on $\mathcal{S}\mathrm{Curr}(F_N) \times \mathcal{S}\mathrm{Curr}(F_N)$.

Summary: We will present an Atiyah–Bott–Berline–Vergne type localization formula in the context of equivariant basic cohomology for certain Riemannian foliations on compact manifolds. It localizes some Chern–Simons type invariants, for example the volume of Sasakian manifolds or secondary characteristic classes of Riemannian foliations, to the union of closed leaves. We give various examples to illustrate our method.

Summary: We studied and talked about a star product and besides its characteristic equation to obtain the energy-eigenspace of the MIC-Kepler problem. At present, we are going to find a shape in the star product which should produce its characteristic equation for the Hamiltonian of the MIC-Kepler problem, because we reached our solutions by means of reduction of Hamiltonian systems. Since we used the Moyal product on the cotangent bundle of the principal U(1)-bundle whose base space is the three-dimensional Euclidean space except the origin, we tried to research into the reduction of star products; we would like to make a report about a reduced algebra which may be endowed with a star product derived from the Moyal product.

Summary: The free rigid body dynamics, which is the geodesic flow on $SO(3)$ with respect to a left-invariant metric, is a typical solvable example in analytical mechanics. The stability of its equilibria is well known. In this talk, a natural extension of the free rigid body dynamics to the unitary group $U(n)$ is considered. The dynamics is described by Euler equation on the Lie algebra $\mathfrak{u}(n)$, which has a bi-Hamiltonian structure, and it can be restricted to the adjoint orbit. The complete integrability and the stability of the equilibria on the generic orbits are considered by using the results of Bolsinov and Oshemkov. In particular, it is shown that all the equilibria on generic orbits are Lyapunov stable.

Summary: Supersymmetry is the symmetry between Bosons and Fermions in superstring theory. Yau and others showed that supersymmetry requires that there exists a balanced metric (i.e., Hermitian metrics satisfying $d(\omega^{n-1}) = 0$) whose Chern–Ricci curvature (Bismut curvature) vanishes on compact complex manifolds. Gauduchon conjecture is Calabi conjecture for Gauduchon metrics (i.e., Hermitian metrics satisfying $\partial\bar{\partial}(\omega^{n-1}) = 0$) on compact complex manifolds. We study on a priori estimates for the Monge–Ampère equation closely related to supersymmetry and Gauduchon conjecture under an estimate of Laplacian of a smooth solution. These estimates are important for applying continuity method to obtain a solution.

Summary: Generalized gradients are the first order differential operators naturally defined on Riemannian or spin manifolds. It is known that there exist commutation relations for gradients called Weitzenböck formulas. In this talk, we show the other commutation relations by using twisted Dirac operators and PRV theorem in representation theory. We also give some applications.

Summary: Calabi's gradient metric is a Riemannian metric on the space of Kähler metrics $\mathcal{H}$. Since $\mathcal{H}$ is an infinite dimensional space, the existence of a geodesic is not trivial. In this talk, we will show the Cauchy problem for the geodesic equation has a short time solution. Furthermore, we will show Calabi's gradient metric defines a distance function on $\mathcal{H}$.

26 Shin Nayatani (Nagoya Univ.) Rumin–Bochner formular for 1-forms on a CR manifold ····· 15

Summary: Around 1990, Michel Rumin defined a differential complex for a contact manifold, and developed the associated harmonic theory for a strongly pseudoconvex CR manifold with a fixed contact form. Rumin proved a Bochner-type formula for a harmonic one-form on such a manifold. In this talk, I discuss the sharpness of Rumin's formula with an explicit example and an application of the formula to the eigenvalue estimate of the subelliptic Laplacian. I'll also discuss a generalization of the formula to the case of two-forms.

14:15–16:00

27 Ryosuke Takahashi (Nagoya Univ.) Modified Kähler–Ricci flow on projective bundles ····· 15

Summary: In this talk, we propose a method of studying the modified Kähler–Ricci flow on special projective bundles, called admissible bundles, from the view point of symplectic geometry. As a result, we can reduce the modified Kähler–Ricci flow to a simple PDE for a time-dpendent function on the interval $[-1, 1]$. Moreover, we show that the solution of this evolution equation converges uniformly to the function corresponding to a GQE metric in exponential order under some assumptions.

28 Homare Tadano (Osaka Univ.) A lower diameter bound for closed domain manifolds of shrinking Ricci-harmonic solitons ····· 15

Summary: In this talk, we remark that the arguments by Futaki–Sano (Asian J. Math. 17, 17–31, 2013) and Futaki *et al* (Ann. Global Anal. Geom. 44, 105–114, 2013) also work well for closed domain manifolds of shrinking Ricci-harmonic solitons and the arguments also give a lower diameter bound for the domain manifolds.

29 Yohei Sakurai (Univ. of Tsukuba) Rigidity of manifolds with boundary under a lower Ricci curvature bound ····· 15

Summary: We study Riemannian manifolds with boundary under a lower Ricci curvature bound, and a lower mean curvature bound for the boundary. We prove a volume comparison theorem of Bishop–Gromov type concerning the volumes of the metric neighborhoods of the boundaries. We conclude several rigidity theorems. As one of them, we obtain a volume growth rigidity theorem. We also obtain a splitting theorem of Cheeger–Gromoll type under the assumption of the existence of a single ray.

30 Tsukasa Takeuchi (Tokyo Univ. of Sci.) Integrability in the geodesic flow for the Berger mertic ····· 10

Summary: The (1,1)-tensor field on symplectic manifold that satisfies some integrability conditions is called a recursion operator. It is known the recursion operator is a characterization for integrable systems, and gives constants of motion for integrable systems. Our aim is to construct recursion operators for the geodesic flow for the Berger metric.

31 Yu Kitabeppu (Kyoto Univ.), Sajjad Lakzian (HCM) A finite generation of the fundamental groups on metric measure spaces with small linear diameter growth ····· 10

Summary: We prove a finite generation of the fundamental groups on metric measure spaces with small linear diameter growth. This is done by using the Abresch–Gromoll inequality on RCD spaces. Another key idea is the local to global property of nonnegative Ricci curvature bound in the non-smooth setting.

Summary: In this talk, we prove the finiteness of the fundamental group of a certain class of complete globally hyperbolic Lorentzian manifolds with the positivity of the curvature tensor.

Summary: In this talk, I will give a coarsification (discretization) of isometries on Teichmuller space. I will discuss a rigidity property of the coarsification. If time permits, I will also give a motivation on this work.

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

Shin-ichi Oguni (Ehime Univ.)* The coarse Baum–Connes conjecture and coarse algebraic topology

Summary: Coarse geometry studies unbounded proper metric spaces, for example, non-compact complete riemannian manifolds and finitely generated infinite groups with word metrics, from a large-scale geometric viewpoint.

In general, a Dirac-type operator on a non-compact complete riemannian manifold is not a Fredholm operator and thus we cannot take the Fredholm index. John Roe defined an 'index' in the K-group of the Roe algebra. The K-group of the Roe algebra depends only on the coarse structure of the manifold and thus can be treated in coarse geometry. Moreover, by regarding the operator as a cycle of the coarse K-homology, John Roe encoded taking the coarse geometric index for the operator as the coarse assembly map. The coarse assembly map from the coarse K-homology to the K-group of the Roe algebra is defined for any proper metric space, and then the coarse Baum–Connes conjecture claims that the coarse assembly map is an isomorphism for any 'nice' proper metric space.

In this talk, first I will explain why the coarse Baum–Connes conjecture is interesting. Indeed I will introduce some applications to differential topology and explain that the conjecture is natural in view of coarse algebraic topology. Next I will report known results on the conjecture. Also I will confirm that the conjecture is true for some simple examples by using coarse algebraic topology as one of main tools. Finally I will introduce a result by our joint work with Tomohiro Fukaya (Tohoku University), which claims that the coarse Baum–Connes conjecture is true for the product of finitely many groups which consist of some of $CAT(0)$ groups, hyperbolic groups, polycyclic groups and appropriate relatively hyperbolic groups. Also I will explain ideas for its proof.

Complex Analysis

September 25th (Thu) Conference Room I

9:00–12:00

1 Shigeyoshi Owa (Yamato Univ.)* Notes on Carathéodory functions involving Möbius transformations · · 15

Summary: Let $\mathcal{A}$ be the class of functions $p(z)$ which are analytic in the open unit disk $\mathbb{U}$ with $p(0) = 1$. If $p(z) \in \mathcal{A}$ satisfies $\mathrm{Re}p(z) > 0$ $(z \in \mathbb{U})$, then $p(z)$ is said to be Carathéodory function in $\mathbb{U}$. For $p(z) \in \mathcal{A}$, we introduce three subclasses $\mathcal{P}(\alpha)$ for $\alpha < 1$, $\mathcal{P}(\beta)$ for $\beta > 1$, and $\mathcal{P}(\alpha, \beta)$ for $\alpha < 1$ and $\beta > 1$ of $\mathcal{A}$. Applying Möbius transformations $w(\zeta)$ for $p(z)$, we discuss some properties for Carathéodory functions $p(z)$.

2 Masanori Amano (Tokyo Tech) On the limit value of the Teichmüller distance between Jenkins–Strebel rays · 15

Summary: We consider the asymptotic behavior of two Teichmüller geodesic rays determined by Jenkins–Strebel differentials. We give the limit value of the Teichmüller distance between the rays. In particular, we obtain a condition under which the rays are asymptotic.

3 Yoshihiko Shinomiya (Waseda Univ.) On the numbers of periodic points on Veech surfaces · · · · · · · · · · · · · · · · 15

Summary: A Veech surface is a flat surface whose Veech group is a lattice in $\mathrm{PSL}(2, \mathbb{R})$. A Veech surface is arithmetic if the Veech group is commensurable with $\mathrm{PSL}(2, \mathbb{Z})$. Otherwise, the Veech surface is called an non-arithmetic Veech surface. It is known that the number of periodic points on an non-arithmetic Veech surface is finite. We will give upper bounds of the numbers of periodic points on non-arithmetic Veech surfaces.

4 Masahiro Yanagishita (Waseda Univ.) Weil–Petersson metric on square integrable Teichmüller spaces · · · · · · · 15

Summary: The square integrable Teichmüller space is the metric subspace of the Teichmüller space composed of the Teichmüller equivalence classes with square integrable Beltrami coefficient. Since this subspace has a complex structure modeled on a Hilbert space, we can introduce a Hermitian metric, which is called the Weil–Petersson metric. In this talk, we discuss its Kählerity.

5 Hiroshige Shiga (Tokyo Tech) On rigidity and finiteness for Teichmüller curves · · · · · · · · · · · · · · · · · · · 15

Summary: Let f be a holomorphic map from a Riemann surface C of finite type to the moduli space of Riemann surfaces. If the map f is a locally isometry, then the pair (C, f) is called a Teichmüller curve. We show a rigidity theorem and a finiteness theorem for Teichmüller curves.

6 Hiroshige Shiga (Tokyo Tech) Conformal invariants defined by harmonic functions on Riemann surfaces · 15

Summary: We consider conformal invariants defined by various spaces of harmonic functions on Riemann surfaces. The Harnack distance is a typical one. We give sharp inequalities comparing those invariants with the hyperbolic metric on the Riemann surface and we determine when equalities hold. We also describe the Harnack distance in terms of the Martin compactification and discuss some properties of the distance.

Summary: Let G_0 be a non-elementary Kleinian group. We consider the deformation space of $D(G_0)$, the space of quasiconformal deformations of G_0, and their complex analytic properties. We show some analytic structures of $D(G_0)$ which are improvements of results by Bers, Kra, Maskit and McMullen. In particular, we clarify that the structures for Kleinian groups with non-simply connected components are different from those for Kleinian groups without non-simply connected components.

Summary: Recently, a new approach in Loewner theory has been proposed which gives a unified treatment of both the radial and chordal version of the Loewner equations. The notion of Loewner chains are generalized in this framework, called a Loewner chain of order d. In this talk we discuss a sufficient condition that a Loewner chain of order d has a quasiconformal extension to the Riemann sphere. It is provided as a generalization of Becker's quasiconformal extension theorem.

Summary: We propose a discretization method for the quasiconformal mappings from the unit disk to itself. The disk is triangulated in a simple way and the quasiconformal mappings are approximated by piecewise linear mappings; the images of the vertices of the triangles are defined by an overdetermined system of linear equations. The linear system is sparse and its solution is obtained by standard least-squares. The least-squares solution is unique and its mapping sequence converges to the true solution in some certain cases.

Summary: In this talk, I will study the infinitesimal spaces of quasiconformal mappings on the plane via continuous flows on the space of quasiconformal mappings.

Summary: Let R be an open Riemann surface of positive finite genus g and $\{A_j, B_j\}_{j=1}^g$ be a canonical homology basis modulo dividing cycles. For each $t \in (-1, 1]$ and each j there exists a unique holomorphic differential φ_j^t on R such that $\exp(-\pi i t/2)\varphi_j^t$ is canonical semiexact in the sense of Kusunoki and the A_k period is equal to δ_{jk}. Let τ_{jk}^t be the B_k period of ϕ_j^t and fix any real g vector $\boldsymbol{a} = (a_1, a_2, \ldots, a_g)$. Then we show that $\tau_{\boldsymbol{a}}^t := \sum_{j,k=1}^g a_j a_k \tau_{jk}^t$ describes a circle when t moves in $(-1, 1]$, and that the circle has an interesting extremal property in the set of compact continuations of R.

14:10–16:50

Summary: Let C_g be the hyperelliptic curve defined by the affine equation $w^2 = z^{2g+1} - 1$ for genus $g \geq 2$. We explicitly obtain the period matrix of this curve whose all entries are elements of the $(2g + 1)$-st cyclotomic field.

Summary: Given a family $\{f_\lambda\}_{\lambda\in\Lambda}$ of polynomial maps of degree d where Λ is the set of parameters, a polynomial map f_{λ_0} is called *J-stable in Λ* if there exists a neighborhood of λ_0 in Λ such that for any element λ in the neighborhood, there exists a conjugacy between the dynamics on the Julia sets of f_λ and f_{λ_0}. The aim of this paper is to show that a polynomial map f_{λ_0} over the field $\mathbb{C}_p$ of p-adic complex numbers is J-stable in the set of polynomial maps over $\mathbb{C}_p$ if f_{λ_0} is *immediately expanding*.

Summary: We construct a transcendental entire functions of arbitrarily slow growth which has a given polynomial dynamics as its subdynamics. We also show several applications of the result, one of which is the following: there exists a transcendental entire function which has a Cremer point but its Julia set is locally connected.

Summary: It is known that the fiber Julia set of a skew product is discontinuous if there exist two saddle fixed points one of whose stable manifold intersects the unstable manifold of the other. We will explain this discontinuity by an analogous argument as in the parabolic implosion.

Summary: We give a precise representation of a reproducing kernel for the Hilbert space of all holomorphic semiexact differentials on an annulus by using the calculation of the L_1-constants with two logarithmic poles. We give an example such that the pseudoconvex variation of the annulus with complex parameter t yields the subharmonicity of the L_1-constant with t.

Summary: A uniform upper bound for the Diederich–Fornaess index is given for weakly pseudoconvex domains whose Levi-form of the boundary vanishes in ℓ-directions everywhere.

18 Satoru Shimizu (Tohoku Univ.)♭ Holomorphic equivalence problem for a class of unbounded Reinhardt domains containing the origin 15

Summary: In this talk, I talk about the holomorphic equivalence problem for (essentially) unbounded pseudoconvex Reinhardt domains. When the domains contain no coordinate hyperplanes, an affirmative answer was already given. As an opposite case to such a case, we discuss a class of unbounded Reinhardt domains containing the origin, which are said to be of broadened type. The main purpose of this talk is to give an affirmative answer to the holomorphic equivalence problem for them by making use of the way of a Liouville foliation.

19 Hiroaki Aikawa (Hokkaido Univ.)
Tsubasa Itoh (Tokyo Tech) Averaging property of capacity 15

Summary: We study the distribution of a subset of $\mathbb{R}^n$ with respect to the p-capacity. Stegenga investigated the distribution with respect to the logarithmic capacity and he proved that the averaging property holds for logarithmic capacity. We show that the same averaging property holds for the p-capacity.

20 Takao Ohno (Oita Univ.)*
Yoshihiro Mizuta (Hiroshima Inst. of Tech.) Trudinger's exponential integrability for Riesz potentials of functions in generalized grand Morrey spaces 15

Summary: Our aim in this talk is to discuss Trudinger's exponential integrability for Riesz potentials of functions in generalized grand Morrey spaces. Our result will imply the boundedness of the Riesz potential operator from a grand Morrey space to a Morrey space.

21 Takao Ohno (Oita Univ.)*
Tetsu Shimomura (Hiroshima Univ.) Trudinger's inequality for Riesz potentials of functions in Musielak–Orlicz spaces 10

Summary: In this talk we are concerned with Trudinger's inequality for Riesz potentials of functions in Musielak–Orlicz spaces.

17:00–18:00 Talk Invited by Complex Analysis Section

Yoshihiro Mizuta (Hiroshima Inst. of Tech.) Function spaces of variable exponent and Sobolev's theorem

Summary: First we show the well-known Sobolev type inequality, and then extend it to the variable exponent settings.

September 26th (Fri) Conference Room I

9:00–10:30

22 Yukinobu Adachi * On the Julia directions of the value distribution of nondegenerate transendental holomorphic maps of $\mathbf{C}^2$ to $\mathbf{C}^2$ ····· 15

Summary: We prove that for a nondegenerate holomorphic map $F = (f(x,y), g(x,y))$ where f and g are entire functions and f is a transendental one, there exists a ray $J(\theta) = \{(x,y); x = t\exp(i\theta), y = kt\exp(i\theta)(0 \leqq t < \infty)\}$ where k is an arbitrarily fixed complex number except Lebesgue measure zero set and θ is some real number depending on value k, such that $F(x,y)$, in any open cone in $\mathbf{C}^2$ with vertex $(0,0)$ containing $J(\theta)$, does not omit any algebraic curve with three irreducible components in a general position.

23 Yukinobu Adachi * On a high dimensional Rieman's removability theorem ····· 15

Summary: Let M be a (connected) complex manifold and E be a closed capacity zero set. Let X be a (connected) complex compact Kobayashi hyperbolic space whose universal covering is Stein and let f be a holomorphic map of $M - E$ to X. Then f be extended holomorphically to a map of M to X.

24 Yukinobu Adachi * On a high dimensional Riemann's mapping theorem ····· 10

Summary: We prove that the domain D in $\Gamma \times \mathbf{C}_z$ where Γ is a polydisk centered at (0) and the fiber of D over every point of Γ is a simply connected domain in $\mathbf{C}_z$ which contains a small disk $\{|z| \leq \varepsilon\}$, where ε is independent of every point of Γ, is biholomorphic to some complete Hartogs domain. And we give applications of the uniformization of some fiber spaces.

25 Masataka Tomari (Nihon Univ.) * On maximal ideal cycle and fundamental cycle of normal two-dimensional singularities with star-shaped resolution, and graded singurities ····· 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. Our interest is the identification of these. If the cordinated ring of singularity have a homogeneous reduced element in the minimal degree, then the identification can be regarded at the central curve. We can show that this condition is satisfied for Brieskorn complete intersection singularity.

26 Tatsuhiro Honda (Hiroshima Inst. of Tech.) Growth and distortion theorems for pluriharmonic mappings ····· 15
Hidetaka Hamada (Kyushu Sangyo Univ.)
Gabriela Kohr (Babeş-Bolyai Univ.)

Summary: In this talk, we give growth and distortion theorems for affine and linearly invariant families of pluriharmonic mappings of the unit ball B into $\mathbb{C}^n$. Also, we obtain two-point distortion theorems.

Summary: Let f be a normalized biholomorphic mapping on the Euclidean unit ball in $\mathbb{C}^n$ and let $\alpha \in (0,1)$. In this talk, we will show that if f is strongly starlike of order α in the sense of Liczberski and Starkov, then it is also strongly starlike of order α in the sense of Kohr and Liczberski. We also give an example which shows that the converse of the above result does not hold in dimension $n \geq 2$.

13:20–14:20 Talk Invited by Complex Analysis Section

Yukitaka Abe (Univ. of Toyama) * Analytic study of singular curves

Summary: We study singular curves from analytic point of view. We reformulate the Serre duality, a generalized Abel's theorem etc. in quite natural way from our view point, and give completely analytic proofs of them. We also reconsider Picard varieties, Albanese varieties and generalized Jacobi varieties of singular curves analytically. We call an Albanese variety considered as a complex Lie group an analytic Albanese variety. We investigate them in detail and construct several examples. We think that an analytic Albanese variety is suitable for a generalized Jacobi variety because it has similar properties to those of the Jacobi variety for a compact Riemann surface.

Functional Equations

September 25th (Thu) Conference Room V

9:00–12:00

1 Hiroshi Ogawara (Kumamoto Univ.) Differential transcendency of a formal Laurent series satisfying a rational linear q-difference equation 10

Summary: We report that a formal Laurent series satisfying a rational linear q-difference equation of first order does not satisfy any nontrivial algebraic differential equation over the rational function field unless it represents a rational function. This also provides an algebraic proof of Ishizaki's theorem on differential transcendency for a meromorphic function satisfying a linear q-difference equation, and then slightly relaxes the assumption of the theorem. We also report differential transcendency of non-rational solutions of a rational q-difference Riccati equation and a rational linear homogeneous q-difference equation of second order that have rational solutions.

2 Junya Nishiguchi (Kyoto Univ.) Stabilization of unstable steady solutions by delayed feedback control: Approach by Lambert W function 10

Summary: The delayed feedback control is a method for changing the structure and nature of solutions of original differential systems by adding a delay term. In this talk, I consider stabilization of unstable steady solutions of an ordinary differential equation $\dot{x}(t) = f(x(t))$ on the Euclidean space by the delayed feedback control. Here a delayed feedback term is represented by $K(x(t-\tau) - x(t))$ using a constant matrix K and a positive number τ. Adding this term, the original ODE becomes a delay differential equation, and we can expect the change of dynamics of the differential equation. For this purpose, I use the Lambert W function, which is the multi-valued inverse of the complex function ze^z. A main theorem shows that the stabilization is always possible if unstable eigenvalues of the steady solution consist of a unique pair of complex conjugates.

3 Kazuki Hiroe (Josai Univ.) Local Fourier transform and blowing up 10

Summary: We consider a resolution of ramified irregular singularity of formal meromorphic connections on disk via local Fourier transforms as an analogy of the blowing up of the singularity of plane curve germs. A necessary and sufficient condition for an irreducible connection to have a resolution of singularity will be determined. A relationship between Komatsu-Malgrange irregularity of connections and some curve invariants will also be discussed.

4 Kohei Iwaki (Kyoto Univ.) On WKB theoretic transformations for Painlevé transcendents on degenerate Stokes segments 10

Summary: We show that the second Painlevé equation (PII) and the third Painlevé equation (PIII'(D7)) of type D7 give a normal form of Painlevé equations on a degenerate Stokes segments connecting two different simple turning points and on a degenerate Stokes segment of loop-type, respectively. That is, any 2-parameter formal solution of a Painlevé equation is reduced to a 2-parameter formal solution of (PII) or (PIII'(D7)) on these degenerate Stokes segments by the transformation.

Summary: In 1990, Gérard–Tahara introduced the Briot–Bouquet type partial differential equation $t\partial_t u = F(t, x, u, \partial_x u)$, and they determined the structure of holomorphic and singular solutions provided that the characteristic exponent $\rho(x)$ satisfies $\rho(0) \notin \mathbf{N}^*$. In this talk we consider holomorphic and singular solutions of the following type of difference-differential equations $tD_q u = F(t, x, u, \partial_x u)$.

Summary: Let $q > 1$. In this talk we considers a linear q-difference-differential equation: it is a q-difference equation in the time variable t, and a partial differential equation in the space variable z. Under suitable conditions and by using q-Borel and q-Laplace tranforms, we consider that if it has a formal power series solution $\hat{X}(t, z)$ one can construct an actual holomorphic solution which admits $\hat{X}(t, z)$ as a q-Gevrey asymptotic expansion of order 1.

Summary: We consider the nonlinear ordinary differential equation with a parameter λ and cubic-like nonlinear term $f(u)$. It is known that under the suitable conditions on $f(u)$, there are three bifurcation curves $\lambda = \lambda_j(\xi)$ $(j = 1, 2, 3)$ which are parameterized by the maximum norm ξ of the solution u_λ associated with λ. The purpose of this talk is to study the precise global structures of $\lambda_j(\xi)$ $(j = 1, 2, 3)$.

Summary: We are interesting in wave-pinning in a reaction-diffusion model for cell polarization proposed by Y. Mori, A. Jilkine and L. Edelstein-Keshet in SIAM J. Appl. Math (2011). Wave-pinning means a phenomenon that a wave of activation of one of the species is initiated at one end of the domain, moves into the domain, decelerates, and eventually stops inside the domain, forming a stationary front. Several mathematical bifurcation results of stationary solutions are obtained by Kuto and Tsujikawa in DCDS Supplement (2013). We propose a method to represent a bifurcation sheet of a shadow-system. It determines the global bifurcation structure of stationary solutions of the shadow-system completely including even secondary bifurcation branches.

Summary: The equations considered in this talk are $x'' + h(t)\,x' + \omega^2 x = 0$ and its generalization $x'' + h(t)\,|x'|^{q-2}x' + \omega^2 x = 0$, $q \geq 2$, where the prime denotes d/dt, the damping coefficient $h(t)$ is continuous and nonnegative for $t \geq 0$, and the restoring coefficient ω is positive. A necessary and sufficient condition for the asymptotic stability of the equilibrium is obtained in consideration of the weighted damping. Our result includes many previous ones. Some examples are presented to illustrate the main result.

Summary: Using the variational method, Chenciner and Montgomery proved the existence of an eight-shaped periodic solution of the planar three-body problem with equal masses. Just after the discovery, Gerver have numerically found a similar periodic solution called "super-eight" in the planar four-body problem with equal mass.
In this talk I will prove the existence of the super-eight orbit by using the variational method. The difficulty of the proof is to eliminate the possibility of collisions. In order to solve it, we apply the scaling technique established by Tanaka and investigate the asymptotic behavior of a binary collision.

Summary: In this talk we devote to the asymptotic analysis of third order Emden–Fowler differential equation

$$x''' + q(t)|x|^{\gamma} sgn \quad x = 0, \quad q(t) > 0, \quad 0 < \gamma < 1$$

in the framework of regular variation. It is shown that in case function $q(t)$ is nearly regularly varying accurate information can be acquired about the existence of possible positive solutions of the equation and their asymptotic behavior at infinity.

Summary: We introduce applications of asymptotic theory of ODEs to that of one-dimensional hyperbolic equations via Fourier analysis. In particular, we give sufficient conditions which ensure the existence of limit functions of solutions to some hyperbolic problems.

Summary: An inverse blow-up problem is discussed. We establish a global continuation result showing that a nonlinearity realizing a blow-up time for large initial data can be continued in the direction of smaller initaial data as long as the blow-up time is Lipschitz continuous.

14 Shingo Takeuchi (Shibaura Inst. of Tech.) — Complete p-elliptic integrals and computation of π_3 ····· 10

Summary: Complete p-elliptic integrals are introduced and applied to compute π_3, a generalization of π. The strategy is same as those of Salamin (1976) and Brent (1976), but the Legendre relation and the Landen transformation are required for these new integrals.

15 Katsuyuki Nishimoto (Descartes Press Co.) * — The solutions to the Laplace's homogeneous ordinary differential equations by means of the N-fractional calculus ····· 4

Summary: In this article, the solutions to the homogeneous ordinary differential equations with linear coefficients,
$\varphi_2 \cdot (az+b) + \varphi_1 \cdot (gz+h) + \varphi \cdot (pz+q) = 0$,
$(\varphi\nu = d^\nu\varphi/dz^\nu$ for $\nu > 0, \varphi_0 = \varphi = \varphi(z)$,
$a, b, g, h, p, q; constants, agp \neq 0,)$
which are called as "the Laplace's ordinary differential equations", are discussed by means of the N (Nishimoto's)-fractional calculus (NFC-Method) (The calculus in the 21th Century).

14:15–16:15

16 Ichiro Tsukamoto (Toyo Univ.) * — On an asymptotic expression of a positive solution of $x'' = t^{\alpha\lambda-2}x^{1+\alpha}$ $(\alpha = \lambda_0,\ \lambda > 0)$ ····· 10

Summary: We state an asymptotic expression of a positive solution of the differential equation denoted in the title. This expression is valid as t tends to +0 and improves the exression stated in the meeting of the Mathematical Society of Japan at Kyoto University in 2013.

17 Tokinaga Namba (Univ. of Tokyo), Atsushi Nakayasu (Univ. of Tokyo), Nao Hamamuki (Waseda Univ.) — On cell problems for Hamilton–Jacobi equations with non-coercive Hamiltonians and its application to homogenization problems ····· 10

Summary: We study the solvability of a cell problem arising in a homogenization problem for a Hamilton–Jacobi equation whose Hamiltonian is not coercive because of its boundedness. By using a certain function, a necessary and sufficient condition to solve the cell problem is given. As its application, we also give a homogenization result.

18 Haruya Mizutani (Osaka Univ.), Nikolay Tzvetkov (Univ. Cergy-Pontoise) — Strichartz estimates for non-elliptic Schrödinger equations ····· 10

Summary: We consider the Schrödinger equation on compact manifolds equipped with possibly degenerate metrics. We prove Strichartz estimates with a loss of derivatives. The rate of loss of derivatives depends on the degeneracy of metrics. For the non-degenerate case we obtain, as an application of the main result, the same Strichartz estimates as that in the elliptic case. This extends Strichartz estimates for the Riemannian Laplacian. We also investigate the optimality of the result for the case on a product of compact Lie groups.

19 Takuya Suzuki (Univ. of Tokyo) Analyticity of semigroups generated by higher order elliptic operators in spaces of bounded functions on C^1 domains 10

Summary: Our goal is to establish the analyticity of semigroups generated by higher order divergence type elliptic operators in spaces of bounded functions with the Dirichlet condition when the domain is uniformly C^1 domain. We mainly consider resolvent estimates in L^∞ type spaces and also consider the existence and uniqueness of the resolvent equations in order to show the generation of analytic semigroups. Masuda–Stewart's method is a well known method to show the analyticity of semigroups, but this method may need the assumption that the boundary of a domain is uniformly C^{2m}. We relax the smoothness assumption of boundaries to uniformly C^1 by applying resolvent estimates in L^∞ type spaces obtained by a contradiction argument and a blow up argument.

20 Takanobu Hara (Tokyo Metro. Univ.) Potential estimates for elliptic equations with drift terms 10

Summary: We consider divergence form elliptic equations with a strongly singular drift term $-\nabla \cdot (A\nabla u) + \vec{b} \cdot \nabla u = \mu$ in a domain $\Omega \subset \mathbb{R}^n$ $(n \geq 3)$. We give a weak-type $L^1 - L^{n/(n-2),\infty}$ estimate for a solution to the Dirichlet problem with the homogeneous boundary condition. Moreover, we give a two-sided pointwise potential estimate for a weak solution.

21 Nobuyuki Kato (Nippon Inst. of Tech.) * Uniform Hölder continuity of approximate solutions to parabolic systems 10

Summary: By means of the discrete Morse flow method we construct approximate solutions to parabolic systems and generete a Cauchy–Euler polygon. From Campanato-type estimates for the approximate solutions, we derive Hölder continuity of the Cauchy–Euler polygon uniformly with respect to the approximation.

22 Tatsuki Kawakami (Osaka Pref. Univ.) * When does the heat equation have a solution with a sequence of similar
Shigeru Sakaguchi (Tohoku Univ.) level sets? 10

Summary: We consider an overdetermined Cauchy problem for the heat equation. We prove that if the problem has a non-trivial non-negative solution with a certain sequence of similar level sets, then the solution must be radially symmetric.

23 Takayoshi Ogawa (Tohoku Univ.) * Maximal L^1-regularity for a Cauchy problem to parabolic equations
Senjo Shimizu (Shizuoka Univ.) 10

Summary: We consider maximal L^1-regularity of the Cauchy problem for parabolic equations in the Besov space $\dot{B}^0_{p,1}(\mathbb{R}^n)$ with $1 \leq p \leq \infty$. The estimate obtained here is not available by abstract theory for the class of UMD since the end-point Besov space is included. We consider the endpoint estimate obtained by Danchin and show that the estimate is indeed, optimal. Besides, we discuss the optimality of maximal regularity in L^1 for the linear parabolic equation for the variable coefficient case.

24 Shuichi Jimbo (Hokkaido Univ.) * Eigenvalues of 2nd order elliptic operators in a domain with a thin tubular hole 10

Summary: In this talk I consider an eigenvalue problem of a 2nd order elliptic operator in a domain with a thin tubular hole. I present an asymptotic formula for the behavior of the eigenvalue when the hole shrinks to a lower dimensional manifold.

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

Naoki Sioji (Yokohama Nat. Univ.) A generalized Pohozaev identity and uniqueness of positive radial solutions for an elliptic equation

Summary: We introduce a generalized Pohozaev identity related to an elliptic equation. By using it, we study the uniqueness of positive radial solutions of the equation in a ball (or in R^n) under the Dirichlet boundary condition. We also study its nondegeneracy in a space of radial functions and in a space which involves nonradial functions. We apply our results to various examples like the scalar field equation, the Brezis–Nirenberg problem on a spherical cap, etc.

September 26th (Fri) Conference Room V

9:00–12:00

25 Motohiro Sobajima (Univ. of Salento), Giorgio Metafune (Univ. of Salento), Chiara Spina (Univ. of Salento) Weighted Calderón–Zygmund and Rellich inequalities · · · · · · · · · · · · · · · 10

Summary: We find necessary and sufficient conditions for the validity of weighted Rellich and Calderón–Zygmund inequalities with respect to L^p-norm ($1 \le p \le \infty$) for functions in the whole space. Moreover, weighted Rellich and Calderón–Zygmund inequalities with respect to the operators $L = \Delta + c|x|^{-2}x\cdot\nabla - b|x|^{-2}$ ($c, b \in \mathbb{R}$) are also considered.

26 Yoshifumi Mimura (Tohoku Univ.) A priori bounds of stationary solutions of two dimensional Keller–Segel system on polygonal domains · 10

Summary: We consider stationary solutions of two dimensional Keller–Segel system on polygonal domains and prove that a priori bounds of the solutions fail for specific parameters determined by the position of singular points and angles of domains. The similar results are already proved by Senba and Suzuki in 2000 when domains are open sets in $\mathbb{R}^2$ with smooth boundaries. The novelty is that foregoing specific parameters depend on angles of domains.

27 Norisuke Ioku (Ehime Univ.), Bernhard Ruf (Univ. di Milano), Elide Terraneo (Univ. di Milano) Existence, non-existence, and unconditional uniqueness for a heat equation with exponential nonlinearity in $\mathbb{R}^2$ · 10

Summary: In this talk, a heat equation with exponential nonlinearity in $\mathbb{R}^2$ is discussed. We prove a non-existence result for some initial data in an Orlicz space $\exp L^2(\mathbb{R}^2)$. In order to consider the existence of local solutions and unconditional uniqueness, we introduce the closure of $C_0^\infty(\mathbb{R}^2)$ in $\exp L^2(\mathbb{R}^2)$.

Summary: In this talk, we study the Liouville result of nontrivial stable solutions of the equation

(H) $\quad -\Delta_{\mathbb{H}} u = (\sinh d_{\mathbb{H}}(0,x))^{\alpha}|u|^{p-1}u \quad \text{in} \quad \mathbb{B}^N,$

where $\alpha > 0$, $p > 1$, $N \geq 3$. Here the operator $\Delta_{\mathbb{H}}$ denotes the Laplace–Beltrami operator on the hyperbolic space $\mathbb{B}^N$ and $d_{\mathbb{H}}(0,x)$ is the hyperbolic distance from the origin to $x \in \mathbb{B}^N$. We show that there exists an exponent $p_c(\alpha, N)$ such that the equation (H) has no nontrivial stable solutions for $1 < p < p_c$. We can expect that p_c will be critical from the asymptotic behavior of the radial solutions of (H) for $p \geq p_c$ large enough.

Summary: The Möbius energy can be decomposed into three parts, each of which is invariant under Möbius transformations. The third part is the absolute constant. Hence when we consider the energy as a variational problem, we may deal with first two parts only. We find some similarities between these parts and relatively easily get variational formulae and applicable estimates.

Summary: We are concerned with the limiting behavior of the coexistence steady-states to the Lotka–Volterra competition model as one of the cross-diffusion terms tends to infinity. Under the Neumann boundary condition, Lou–Ni (1999) derived a couple of shadow systems which characterize the limiting behaviors of the coexistence steady-states. One of the shadow system charcterizing the segregation of the competing species has been studied by Lou–Ni–Yotsutani (2004) in detail. This talk focuses on the other shadow system characterizing the shrinking of the species not endowed with the cross-diffusion effect. The bifurcation structure of nonconstant solutions to the shadow system will be stated. In particular for the 1D case, we obtain an unbounded connected set of nonconstant solutions.

Summary: We study the positive solution $u(r,\rho)$ of the quasilinear elliptic equation

$$\begin{cases} r^{-\gamma}(r^{\alpha}|u'|^{\beta}u')' + |u|^{p-1}u = 0, \quad 0 < r < \infty, \\ u(0) = \rho > 0, \ u'(0) = 0. \end{cases}$$

This class of differential operators includes the usual Laplace, m-Laplace, and k-Hessian operators in the space of radial functions. The equation has a singular positive solution $u^*(r)$. A generalized Joseph–Lundgren exponent, which we denote by p^*_{JL}, is obtained. We study the intersection numbers between $u(r,\rho)$ and $u^*(r)$ and between $u(r,\rho_0)$ and $u(r,\rho_1)$, and see that p^*_{JL} plays an important role.

32 Mieko Tanaka (Tokyo Univ. of Sci.) * Dumitru Motreanu (Univ. de Perpignan) — Generalized eigenvalue problem for (p, q)-Laplacian with indefinite weight 10

Summary: We provide existence and non-existence results of a positive solution for the (p, q)-Laplace equation under the Dirichlet boundary condition, with $1 < q < p$.

33 Mieko Tanaka (Tokyo Univ. of Sci.) * Ryuji Kajikiya (Saga Univ.) Satoshi Tanaka (Okayama Univ. of Sci.) — Bifurcation of positive solutions for the one dimensional (p, q)-Laplace equation 10

Summary: In this talk, we consider the bifurcation of positive solutions for the one dimensional (p, q)-Laplace equation under the Dirichlet boundary condition. We investigate the shape of the bifurcation diagram near the bifurcation point and near infinity. As a consequence, we prove the existence of multiple positive solutions and show the uniqueness of positive solutions for a bifurcation parameter in a certain range.

34 Daisuke Naimen (Osaka City Univ.) — On the multiple solutions of a nonlinear elliptic problem with the Dirichlet energy 10

Summary: In this talk, we consider a nonlinear elliptic equation involving the Dirichlet energy. We introduce a new approach which enables us to get multiple (possibly infinitely many) solutions. In addition, we put a positive answer to the solvability of the critical problem in high dimension which has never been solved.

35 Masato Hashizume (Osaka City Univ.) — A minimization problem with a sign changing condition 10

Summary: In this talk,we consider a minimization problem with a sign changing condition. This problem is related with "L^p Lyapunov inequality". The author proves the existence of the minimizer of the minimization problem.

36 Yasuhiro Fujita (Univ. of Toyama) * — Log-Sobolev inequality for locally Lipschitz continuous functions 10

Summary: We discuss a logarithmic Sobolev inequality for locally Lipschitz continuous functions on $\mathbb{R}^n$.

37 Atsushi Kosaka (Osaka City Univ.) Yoshitsugu Kabeya (Osaka Pref. Univ.) Tatsuki Kawakami (Osaka Pref. Univ.) Hirokazu Ninomiya (Meiji Univ.) — Asymptotic behavior of eigenvalues to the Laplace–Beltrami operator on a spherical cap in $\mathbb{S}^N$ 10

Summary: In this conference, we speak of the linear eigenvalue problem of the Laplace–Beltrami operator on a large spherical cap. If a spherical cap is sufficiently large, then we can treat the eigenvalue problem as the perturbation of the eigenvalue problem on a unit sphere.
In this study, we obtained asymptotic formulas of eigenvalues. By using the asymptotic formulas, we can exactly see the multiplicity of eigenvalues of the Laplace–Beltrami operator on a large spherical cap. This result is applied for, e.g., the investigation of a local bifurcation structure of semilinear elliptic problems on a spherical cap.

38 Soohyun Bae (Hanbat Nat. Univ.)
Yūki Naito (Ehime Univ.)
Critical phenomena in the separation property for semilinear elliptic equations 10

Summary: We consider the semilinear elliptic equation, and study separation phenomena of positive radial solutions. With respect to intersection and separation, we establish a classification of the solution structures, and investigate the structures of intersection, partial separation and separation.

39 Futoshi Takahashi (Osaka City Univ.)
Massimo Grossi (Univ. di Roma "La Sapienza")
On the location of two blow up points on an annulus for the mean field equation 10

Summary: We consider the mean field equation on two-dimensional annular domains, and prove that if P_1 and P_2 are two blow up points of a blowing-up solution sequence of the equation, then we must have $P_1 + P_2 = 0$.

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

Hideo Nakazawa ♭ (Nippon Medical School)
Scattering problems for wave equations with dissipation and related topics

Summary: In this talk, we shall overview several results related to the scattering problem for wave equations with dissipation. Our topics are given as followings. The problem of decay and non-decay of the total energy of the solution, the existence of a scattering state and the principle of limiting absorption, non-uniform decay with linear dissipation of spatial anisotropy, traveling wave solution and exponential decay of the total energy with special Coulomb-type dissipation, spectral analysis of the Schrödinger and wave equation with non-self-adjoint perturbation of rank 1, uniform resolvent estimate for stationary equation in 2D exterior domain and their applications to smoothing estimate and the principle of limiting amplitude. We shall also discuss several unsolved problems.

September 27th (Sat) Conference Room V

9:00–12:00

40 Hiroyoshi Mitake (Hiroshima Univ.) *
Hung V. Tran (Univ. of Chicago)
Analysis on the large-time behavior by the nonlinear adjoint method: obstacle problems 10

Summary: Cagnetti, Gomes, Mitake and Tran (2013) introduced a new idea to study the large time behavior for degenerate viscous Hamilton–Jacobi equations. In this talk, we apply the method to study the large-time behavior of the solution to the obstacle problem for degenerate viscous Hamilton–Jacobi equations. We establish the convergence result under rather general assumptions.

41 Hiroyoshi Mitake (Hiroshima Univ.) *
Hung V. Tran (Univ. of Chicago)
Weakly coupled systems of the infinity Laplace equations: existence, uniqueness, comparison with generalized cones 10

Summary: We derive the weakly coupled systems of the infinity Laplace equations via a tug-of-war game introduced by Peres, Schramm, Sheffield, and Wilson (2009). We establish existence, uniqueness results of the solutions, and introduce a new notion of "generalized cones" for systems. By using "generalized cones" we analyze blow-up limits of solutions.

Summary: We consider a nonlinear model equation describing the motion of a vortex filament immersed in an incompressible and inviscid fluid. In the present problem setting, we also take into account the effect of external flow. We prove the unique solvability, locally in time, of an initial value problem posed on the one-dimensional torus. The problem describes the motion of a closed vortex filament.

Summary: The nonstationary incompressible inviscid flow of ideal fluids in the whole space is considered. This is described as the Cauchy problem of the Euler equations. The mathematical meaning of the shear flow and its application are discussed. It is proved that the shear flow is a unique global-in-time strong solution in certain class due to the argument of renormalization solutions. The proof is based on the boundedness of the solutions to the linear transport equation, component-wisely.

Summary: We show that the incompressible Euler equations are not locally well-posed in the sense of Hadamard in the Besov space $B^1_{\infty,1}$. Our approach relies on the technique of Lagrangian deformations of Bourgain and Li. We show that the assumption that the data-to-solution map is continuous in $B^1_{\infty,1}$ leads to a contradiction with a well-posedness result in $W^{1,p}$ of Kato and Ponce.

Summary: We consider the eigenvalue problem of the Stokes equations in a bounded domain. Under the domain perturbation keeping its topological type, we establish the Hadamard variational formula for the eigenvalues of the Stokes equations with the Dirichlet boundary condition. Our result covers the case when the eigenvalue has multiplicity.

Summary: We consider the composition operator $S(t)\mathbb{P}\partial$ for the Stokes semigroup $S(t)$ and the Helmholtz projection $\mathbb{P}$ in a space of bounded functions. It is well known that this composition plays a fundamental role for studying the nonlinear Navier–Stokes equations on L^p. The situation is different for the case $p = \infty$ since in this case the Hemlholtz projection does not acts as a bounded operator anymore. In this talk, we show that some a priori estimate is valid for the composition operator on a space of bounded functions.

Summary: The basic model for incompressible two-phase flows with phase transitions where the interface is nearly flat in the case of non-equal densities is considered. The local well-posedness of the model in L_p-setting was proved by Prüss and Shimizu. We prove local well-posedness of the model L_p in time L_q in space setting.

Summary: In this talk, we show the global well-posedness of a free boundary problem for the Navier–Stokes equations in the L_p-L_q framework, and large time behavior of solutions. There are many results about free boundary problems for the Navier–Stokes equations in the L_2-L_2 framework, and also in the L_p-L_p framework more generally. On the other hand, the L_p-L_q framework will be used in our argument. We note that it is essential to control integrability of solutions with respect to time t.

Summary: We consider the compressible-incompressible viscous two phase problem without surface tension and phase transition case. In this talk, we would like to report Maximal L_p-L_q regularity of our problem. The essential point of our proof is to show the existence of $\mathcal{R}$-boundedness of solution operator to the resolvent problem corresponding to our problem.

Summary: We consider the compressible-incompressible viscous two phase problem without surface tension and phase transition case. In this talk, we would like to report local and global well-posedness of our problem. Our proof is based on Banach's fixed point theorem and maximal $L_p - L_q$ estimate of linearlized problem corresponding to our problem.

Summary: We show a global in time unique existence theorem for a compressible viscous fluid flow with a slip boundary condition in the L_p in time and L_q in space framework with $2 < p < \infty$ and $N < q < \infty$ under the assumption that the domain is bounded and initial data are small. Kobayashi and Zajączkowski proved the global well-posedness for a compressible viscous fluid flow with slip boundary condition in the L_2 framework. One of the merits of our approach is less regularity on initial data.

Summary: We consider the incompressible Navier–Stokes equations in a two-dimensional exterior domain Ω, with no-slip boundary conditions. Our initial data are of the form $u_0 = \alpha\Theta_0 + v_0$, where $\alpha \in \mathbb{R}$ and Θ_0 is the Lamb–Oseen vortex with unit circulation at infinity, and v_0 is a solenoidal perturbation belonging to $L^2(\Omega)^2$. When $|\alpha|$ is sufficiently small we show that the solution behaves asymptotically in time like the self-similar Lamb–Oseen vortex with circulation α. This is a global stability result, in the sense that the perturbation v_0 can be arbitrarily large.

Summary: Specific decay rates of energy of disturbance around time-dependent NS flow are discussed.

14:15–16:15

Summary: We present recent results on large-time behavior of the radially symmetric solution for Burgers equation on the exterior of a ball in multi-dimensional space, where boundary data at the far field are prescribed.
In this talk, we prove that for radially symmetric solution to the Burgers equation on multi-dimensional space, the asymptotic states are classified into four cases.
The proof is given by a standard L^2 energy method.

Summary: We consider the stability of stationary solutions to the compressible Naver–Stokes equation in a periodic layer of $\mathbb{R}^3$. There exists a spatially periodic stationary solution if the external force is spatially periodic and is sufficiently small in some Sobolev space. We show that the linearized semigroup decays in the L^2-norm in the order $t^{-\frac{1}{2}}$ if the initial data belongs to L^1 and L^2. Furthermore, it is shown that the asymptotic leading part of the semigroup is given by a 2-D heat semigroup.

Summary: We study the Timoshenko system with thermal effects in the one-dimensional whole space. We investigate the dissipative structure of the system and derive the optimal L^2 decay estimate of the solutions in a general situation. Our decay estimate is based on the detailed pointwise estimate of the solutions in the Fourier space and we observe that the decay property is of the regularity-loss type.

Summary: We consider the initial value problem for the nonlinear Timoshenko system with a memory term. The main purpose is to investigate the global existence and the optimal decay of the solutions to the nonlinear problem by employing L^2 energy method. Y. Liu and S. Kawashima (2013) showed them by employing a time-weighted L^2 energy method. We show that they can be proved without employing a time-weighted L^2 energy method under less assumptions on the initial data than those which were needed in Y. Liu and S. Kawashima (2013).

Summary: This talk is concerned with the parabolic-elliptic Keller–Segel system with singular sensitivity $\frac{\chi_0}{v}$ and logistic source $ru - \mu u^2$ in a smoothly bounded domain $\Omega \subset \mathbb{R}^2$, where $\chi > 0, r \in \mathbb{R}, \mu > 0$. It is shown that in this two-dimensional setting, the absorptive character of the logistic kinetics is sufficient to enforce global existence of classical solutions even for arbitrarily large $\chi_0 > 0$ and any $\mu > 0$ and $r \in \mathbb{R}$. It is moreover shown that if in addition $r > 0$ is sufficiently large then all these solutions are uniformly bounded.

Summary: This talk deals with a fully parabolic chemotaxis system with singular sensitivity $\frac{\chi_0}{v}$. The main result solves the open problem that the solution is uniform-in-time bounded for sufficiently small $\chi_0 > 0$, which was conjectured by Winkler (2011).

Summary: We deal with a degenerate chemotaxis-Navier–Stokes system with rotation on a bounded domain in 2 dimension. As to the known result, Tao–Winkler (2012) proved global existence and boundedness in a chemotaxis-Stokes system with arbitrary porous medium diffusion. This talk extends the result for global existence of weak solutions to that for a chemotaxis-Navier–Stokes system with rotation.

Summary: In this talk, we shall bring a focus onto the parabolic-parabolic and parabolic-elliptic Keller–Segel systems of the singular and degenerate types and show uniqueness of weak solutions in the class of Hoelder continuous functions.

Summary: It has remained open for several decades whether finite-time blowup is a generic feature in the parabolic-parabolic Keller–Segel system in two dimensional domains. An affirmative answer was recently given by the speaker and Winkler. However their proof cannot work in the degenerate Keller–Segel system in the higher dimensions. In this talk, we give a new proof to their theorem which can be applied also to such a case.

63 Noriko Mizoguchi (Tokyo Gakugei Univ.)
Philippe Laurençot (Univ. de Toulouse / CNRS)
Finite-time blowup for the parabolic-parabolic Keller–Segel system with critical diffusion 10

Summary: It is known that a similar phenomenon to that in the two-dimensional Keller–Segel system appears in the parabolic-elliptic simplification with degenerate critical diffusion in the higher dimensions. One can take the same approach for the global existence of solution even in the parabolic-parabolic system. However there have been no results on the existence of solutions blowing up in finite time in the parabolic-parabolic system. In this talk, we give a criterion for finite-time blowup to initial data and then show that the criterion is satisfied by a large class of initial data.

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

Kotaro Tsugawa (Nagoya Univ.) Local well-posedness for fifth-order nonlinear dispersive equations

Summary: We consider the Cauchy problem for fifth order dispersive equations on the torus. We assume that the nonlinear part is a polynomial of $u, \partial_x u, \partial_x^2 u$ and $\partial_x^3 u$ and does not include any constants and linear terms. The equations include the fifth order KdV equation, the fifth order modified KdV equation and some equations in physics. In this talk, we discuss on conditions to the nonlinear terms. We first give a necessary and sufficient condition for the local well-posedness when the initial data is sufficiently smooth. Next, we show the local well-posedness with low regularity initial data when the nonlinear term satisfy a cancellation property. In both studies, the main difficulty comes from the derivative loss in the nonlinear terms. Remark that the linear part does not have any smoothing effect since the torus is compact. It seems difficult to show the well-posedness by the standard energy method or the standard fixed point argument when the nonlinear part include $\partial_x^2 u$ or $\partial_x^3 u$. To avoid the difficulty, we combine the energy method and the normal form reduction in the first result and combine the fixed point argument and the normal form reduction in the second result.

September 28th (Sun) Conference Room V

9:00–12:00

64 Takashi Kagaya (Hokkaido Univ.) A local existence on a free boundary problem for quasilinear parabolic equation 10

Summary: We prove a local existence on a free boundary problem for quasilinear parabolic equation whose spatial dimension is one. The parabolic equation has Dirichlet and Neumann boundary conditions at each boundary points. This free boundary problem arises in various applications such as the heat equation and the curvature flow. If the equation has no lower order term, the local existence on this free boundary problem is well known. We consider the case for the equation with lower order terms, and examine how the maximal existence time depends on initial data and lower order terms.

Summary: Since a prostate tumor is influenced by androgen, continuous androgen suppression (CAS) therapy is the most famous therapy of prostate cancer in Japan. However the relapse of tumors often occurs in spite of under CAS therapy. Recently, clinical studies suggested that intermittent androgen suppression (IAS) therapy may delay or prevent the relapse. In the IAS therapy, medication is stopped when the size of tumor decreases less than a lower threshold, and resumed when the size exceeds an upper threshold. We deal with a hybrid system describing IAS therapy and prove mathematically that the size of tumor remains in some bounded interval for any time under IAS therapy.

Summary: In this talk we consider the solvability for the Cauchy problem of heat equations in $\mathbb{R}^N$ $(N \geq 2)$ with singular lower order terms $\partial u/\partial t = \Delta u - \beta|x|^{-2}x \cdot \nabla u + c|x|^{-2}u + f$, where $\beta \in \mathbb{R}, c \leq (N-2-\beta)^2/4$, u_0 is an initial value and f is an inhomogeneous term. We give a result which generalizes the one of Baras and Goldstein (1984) from $\beta = 0$ to $\beta \neq 0$ and improves the one of Arendt, Goldstein and Goldstein (2006).

Summary: We discuss blow-up problems for a semilinear parabolic system equation. We characterize the blow-up set by using the zero of solutions.

Summary: We consider the surface diffusion flow equation on the half line when the curve is represented by the graph of a smooth function. We impose two boundary conditions. The first boundary condition is the contact angle condition and the second boundary condition is the linearized version of the no-flux condition. We construct a bounded self-similar solution to this problem. We further prove the stability of this self-similar solution.

Summary: We study a singular limit problem of the Allen–Cahn equation with Neumann boundary conditions and general initial data of uniformly bounded energy. We prove that the time-parametrized family of limit energy measures is Brakke's mean curvature flow with a generalized right angle condition on the boundary.

Summary: Existence of blow-up solutions to initial value problems for a discrete analogue of a d-dimensional semilinear heat equation is investigated. We prove that a parameter α in the partial difference equation plays exactly the same role as the parameter of nonlinearity does in the semilinear heat equation. That is, we prove non-existence of non-blow-up solutions for $0 < \alpha \leq 2/d$, and, for $\alpha > 2/d$, existence of non-blow-up solutions for sufficiently small initial data.

Summary: We study free boundary problems of nonlinear diffusion equations. For monostable, bistable, and combustion types of nonlinearities, Du and Lou (to appear in J. Eur. Math. Soc.) obtained a rather complete description of the long-time dynamical behavior of the problem and revealed sharp transition phenomena between spreading ($u(t,x) \to 1$ as $t \to \infty$) and vanishing ($u(t,x) \to 0$ as $t \to \infty$). They also determined the asymptotic spreading speed of the fronts when spreading happens. In this talk, we give a much sharper estimate for the spreading speed, and we show that the asymptotic profile of solution depends only on the nonlinearity when spreading happens.

Summary: In this talk, we consider a semilinear heat equation with a nonlinear absorption term. It is shown that if the power of the nonlinearity is in some range, there is no time-dependent singular solution. On the other hand, in other range, two types of time-dependent singular solutions exist, and any singularity is removable if it is weaker than the order of the fundamental solution of the Laplace equation.

Summary: The initial value problem for the drift-diffusion equation in the whole space is studied. The dissipation on this equation is given by the half Laplacian. It is proved that the solution to this equation decays as time variable tends to infinity. Moreover the asymptotic expansion of the solution is established.

Summary: We are concerned with the time global behavior of solutions to the degenerate drift-diffusion system. Our aim is to classify the global existence of the weak solution and the finite time blow up of the solution by the initial condition in between two critical exponents.

Summary: We establish the time local well-posedness of a multi-component parabolic-elliptic drift-diffusion model in two space dimensions in a scaling critical weighted space. In order to show the critical well-posedness, we introduce a refined version of Brezis–Gallouet inequality in term of the Besov space and apply it to the some weighted estimate in two dimensions.

Summary: This paper studies traveling fronts to cooperation-diffusion systems in $\mathbb{R}^N$ for $N \geq 3$. We consider $(N-2)$-dimensional smooth surfaces as boundaries of strictly convex compact sets in $\mathbb{R}^{N-1}$, and define an equivalence relation between them. We prove that there exists a traveling front associated with a given surface and that it is asymptotically stable for given initial perturbation. The associated traveling fronts coincide up to phase transition if and only if the given surfaces satisfy the equivalence relation.

Summary: We show compactness of 2D normalized Ricci flow orbit for any compact Riemannian surface without boundary. Hence if the stationary state admits only the trivial solution, then the non-stationary solution converges to a constant. This is an improvement of our previous result in 2010.

14:15–16:15

Summary: We consider ill-posedness of the Cauchy problem for the Chern–Simons–Dirac system in one spatial dimension. Bournaveas, Candy, and Machihara proved that local in time well-posedness in $H^s(\mathbb{R}) \times H^r(\mathbb{R})$ with $-1/2 < r \leq s \leq r+1$. We showed well-posedness holds if s and r satisfy $|s| < 1/2$, $r = -1/2$ or $s = 0$, $-1 \leq r \leq -1/2$. In this talk, we show that these results are optimal in the sense that the Cauchy problem is ill-posed in $H^s(\mathbb{R}) \times H^r(\mathbb{R})$ if s and r do not satisfy these conditions. We deal with both massless and massive cases for the ill-posedness.

Summary: We study the unconditional uniqueness property for periodic nonlinear dispersive equations by successive applications of integration by parts in the time variable, which we call Normal Form Reduction (NFR). We first give an abstract framework of infinite NFR scheme, and then apply it to the nonlinear Schrödinger equations (NLS) with power-type nonlinearities of odd order, a cubic NLS with a derivative in the nonlinearity, and the modified Benjamin–Ono equation.

Summary: We study the scattering operator S for the three dimensional Dirac equation with a cubic nonlinearity. It has been proved that S can be defined on a neighborhood of 0 in the Sobolev space $H^{s_0}(\mathbb{R}^3;\mathbb{C}^4)$ for any $s_0 > 1$. We prove that for any $M \in \mathbb{N}$ and $s \geq \max\{s_0, M\}$, there exists some neighborhood U of 0 in the weighted Sobolev space $H^{s,M}(\mathbb{R}^3;\mathbb{C}^4)$ such that $S(U) \subset H^{s,M}(R^3;\mathbb{C}^4)$.

Summary: We consider the nonlinear Schrödinger equation with p-th power absolute value nonlinearlity. Let the initial value λf belong to $H^s(\mathbb{R}^d)$ where $\lambda > 0$ is a parameter and $s = 0$ or 1. It is well known that this is locally well-posed in H^s when $1 < p \leq 1 + 4/(d - 2s)$. In the case $1 < p \leq 1 + 4/(d - 2s)$, we prove that if λ is sufficiently large and $f \in H^s$ has a singularity near the origin, then the H^s-solution blows up in finite time and the lifespan has the upper bound by a polynomial order of λ. In the opposite case $p > 1 + 4/(d - 2s)$, we also prove that if $f \in H^s$ has a singularity near the origin, then the local H^s-solution does not exist.

Summary: In this talk, we consider the final state problem for a system of nonlinear Schrödinger equations with three wave interaction in two dimensions. In our previous study, we constructed a solution of a two component system which describes the mass transition phenomenon by using the hyperbolic functions. We show the existence of a solution to a three component system describing the mass transition phenomenon periodically in time by using the Jacobi elliptic functions.

Summary: The Cauchy problem for Schrödinger equations with weighted nonlinear terms is considered. Local and global solutions are shown in Sobolev spaces.

Summary: In this talk, we consider a system of weakly coupled semilinear damped wave equations. We determine the critical exponent for any space dimensions. We also give estimates of the lifespan of solutions from above for subcritical nonlinearities.

85 Hironari Miyoshi (Waseda Univ.)
Masayoshi Tsutsumi (Waseda Univ.) Convergence of hydrodynamical limits for generalized Carleman models 10

Summary: We consider a generalized Carleman's model describing the time evolution of one dimensional gas composed of two kinds of particles that move parallel to x-axis with constant and equal speeds, either in the positive x-direction with density u, or in the negative x-direction with density v with initial and homogeneous boundary conditions. The existence of time global solutions in $L^1(0,1) \times L^1(0,1)$ and a nonlinear diffusion limit under the usual parabolic scaling is established for this problem.

86 Kyouhei Wakasa (Hokkaido Univ.) * The lifespan of solutions to nonlinear wave equations with weighted functions in 1D 10

Summary: We consider the initial value problem for nonlinear wave equations with weighted functions in one space dimension. Kubo & Osaka & Yazici (2013) showed that the solution exists globally in time if the initial data are odd functions. On the other hand, they showed that the solution blows up in finite time if the initial data are not odd functions. Also, they have obtained the estimate of the lifespan which is the maximal existence time of solutions, however the sharpness was not clarified. Our aim in this talk is to get the sharp upper and lower bounds of the lifespan in such case.

87 Koichi Taniguchi (Chuo Univ.) *
Tsukasa Iwabuchi (Chuo Univ.)
Tokio Matsuyama (Chuo Univ.) Scattering problem for semilinear wave equation with a potential in an exterior domain 10

Summary: We consider the scattering problem for the initial-boundary value problem to semilinear wave equation with a potential in an exterior domain Ω. Here, Ω is a compliment of a convex and compact obstacle $\mathcal{O}$ in $\mathbb{R}^3$. First, we will inform global existence theorems, and then, wave operators and scattering operators will be constructed.

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

Shinya Okabe (Tohoku Univ.) ♭ A fourth order parabolic obstacle problem

Summary: In this talk, we show a recent joint work with M. Novaga (Pisa University) on the obstacle problem for the parabolic biharmonic equation. We let $\Omega \subset \mathbb{R}^N$ be a bounded domain with smooth boundary, and we let $f : \Omega \to \mathbb{R}$ be the obstacle function satisfying

$f \in C^2(\bar{\Omega}), \qquad f < 0 \qquad \text{on} \quad \partial\Omega.$

For an initial datum $u_0 : \Omega \to \mathbb{R}$ such that

$u_0 \in H_0^2(\Omega), \qquad u_0 \geq f \qquad \text{a.e. in} \quad \Omega,$

we shall consider the following fourth order parabolic obstacle problem:

$$\begin{aligned}
&u_t(x,t) + \Delta^2 u(x,t) \geq 0 && \text{in} \quad \Omega \times \mathbb{R}_+,\\
&u_t(x,t) + \Delta^2 u(x,t) = 0 && \text{in} \quad \{(x,t) \in \Omega \times \mathbb{R}_+ \mid u(x,t) > f(x)\},\\
&u(x,t) = 0, \quad \nabla u(x,t) \cdot \nu^{\Omega}(x) = 0 && \text{on} \quad \partial\Omega \times \mathbb{R}_+,\\
&u(x,t) \geq f(x) && \text{in} \quad \Omega \times \mathbb{R}_+,\\
&u(x,0) = u_0(x) && \text{in} \quad \Omega,
\end{aligned}$$

where ν^{Ω} denotes the unit outer normal of $\partial\Omega$.

The purpose of this talk is to investigate the regularity properties of solutions to the obstacle problem via an implicit time discretization. Since our motivation for the problem rose from a geometric obstacle problem, we wish to mention the geometric obstacle problem.

Real Analysis

September 27th (Sat) Conference Room I

9:00–11:45

1 Toshikazu Watanabe (Nihon Univ.)
Masashi Toyoda (Tamagawa Univ.)
On fixed point theorems for generalized contractive type mappings in partially ordered sets 15

Summary: Nieto and Lopez consider fixed point theorems for contractive mappings in partially ordered sets. On the other hand, Weissinger proved the contractive mapping which include the Banach contraction mappings. In this paper, we consider fixed point theorems for Weissinger type contractive mappings and Kannan mappings in partially ordered sets.

2 Yasunori Kimura (Toho Univ.)
Approximation of a common fixed point of mappings on a complete geodesic space 15

Summary: The shrinking projection method is an approximation scheme of a common fixed point of mappings, and it is known that this method has a kind of rigidness toward the calculation errors. In this talk, we consider the shrinking projection method with errors in the setting of complete geodesic spaces and discuss the convergence property of this scheme.

3 Shin-ya Matsushita (Akita Pref. Univ.)
Li Xu (Akita Pref. Univ.)
On Douglas–Rachford method 15

Summary: In this talk, we are concerned with the Douglas–Rachford method for solving the convex feasibility problem.

4 Sachiko Atsushiba (Univ. of Yamanashi)
Convergence theorems for nonlinear mappings by Halpern's type iterations 15

Summary: In this talk, we study Halpern's type iterations for nonlinear mappings in Banach spaces. Then, we prove strong convergence theorems for uniformly asymptotically regular nonexpansive semigroups in Banach spaces. Furthermore, we give some convergence theorems for the nonlinear mappings.

5 Mikio Kato (Kyushu Inst. of Tech.*)
Takayuki Tamura (Chiba Univ.)
On the uniform non-ℓ_1^n-ness of direct sums of Banach spaces 15

Summary: We shall characterize the uniform non-ℓ_1^n-ness of direct sums of Banach spaces.

6 Kiyohisa Tokunaga (Fukuoka Inst. of Tech.)
Proof of integral by parts based on the definition of Riemann integral 15

Summary: The definite integral is defined as the limit at infinity of sum of sequences. The well-known theorem of single integral by parts for a 1-variable function is derived from this definition.

Summary: We introduce a new notion of the perturbation of nonlinear integral functionals to formulate a functional form of the convergence theorems for nonlinear integrals in nonadditive measure theory. As its direct consequences, we obtain the bounded convergence theorems for typical nonlinear integrals, which show that the autocontinuity of a nonadditive measure is equivalent to the validity of the bounded convergence theorems for the Choquet, the Sugeno, and the Shilkret integrals as well as their symmetric and asymmetric extensions.

Summary: A comparison of integral and discrete Ostrowski's inequalities in the plane is considered. An integral inequality is described by Legendre's elliptic integrals. A natural discrete analogue of the inequality is also given. The main point is to find a suitable decomposition of the radius in polar coordinates.

Summary: In this paper we propose the laws of natural statistical physics and give the new formulations in the following three cases :
(1) The case where the Schrödinger operator has only the discrete spectrum.
(2) The case where the Schrödinger operator has only the continuous spectrum.
(3) The case where the physical system is composed of particles moving periodically.

Summary: In this paper, we study the concepts of natural probability and natural random variable and give the new formulations.
For a given normalized L^2-function ψ on $\boldsymbol{R^n}$, $(n \geq 1)$, we define the orthogonal probability measure $\psi_A = \chi_A \psi$ on the probability space $(\boldsymbol{R^n}, \mathcal{M}_n, \mu)$ to be a natural probability measure. Here $\mathcal{M}_n$ is the σ-additive family of all Lebesgue measurable sets on $\boldsymbol{R^n}$ and μ is the σ-additive measure
$\mu(A) = \int_A |\psi(\boldsymbol{r})|^2 d\boldsymbol{r}$, $(A \in \mathcal{M}_n)$.
We define the vector-valued natural random variable $\boldsymbol{r} = \boldsymbol{r}(\omega)$ on a certain probability space $\Omega(\mathcal{B}, P)$ whose probability distribution law is defined by the L^2-density ψ so that the fundamental relation $P(\{\rho \in \Omega; \boldsymbol{r}(\rho) \in A\}) = \mu(A)$ holds. Further we study the fundamental properties of these concepts.
Further we study two other cases of these concepts.

12:10–12:30 Presentation Ceremony for MSJ Analysis Prizes 2014

14:15–16:20

11 Hiroki Saito (Saitama Univ.) Kakeya maximal operator (no dilation) with radial weights on the plane 15

Summary: We consider the weighted "small" Kakeya maximal operator is defined to be

$$K^a_{N,w}f(x) := \sup_{x\in R}\frac{1}{w(R)}\int_R |f(y)|w(y)\,dy$$

where the supremum is taken over all rectangles with sizes $a \times aN$ containing x. In this talk, we shall prove

$$\|K^a_{N,w}f\|_{L^2(w)} \le C\sqrt{\log N}\|f\|_{L^2(w)},$$

for a certain radial weight w.

12 Takeshi Iida (Fukushima Nat. Coll. of Tech.) Weighted estimates of higher order commutators generated by BMO-functions and the fractional integral operator on Morrey spaces 15

Summary: The purpose of this paper is to investigate the weighted estimates of commutators generated by BMO-functions and the fractional integral operator on Morrey spaces. In particular, the conditions of indices is the Olsen type conditions. The main result is generalized the Sawano Sugano and Tanaka result to a weighted setting.

13 Satoko Sugano * (Kobe City Coll. of Tech.) On a Calderón–Zygmund operator of higher order Schrödinger type 15

Summary: We consider higher order Schrödinger type operators with nonnegative potentials. We assume that the potential belongs to the reverse Hölder class which includes nonnegative polynomials. We show that an operator of higher order Schrödinger type is a Calderón–Zygmund operator.

14 Katsuo Matsuoka (Nihon Univ.) On the generalization of fractional integrals and λ-CMO spaces 10

Summary: In this talk, we will extend the boundedness of fractional integrals I_α for the non-homogeneous central Morrey spaces $B^{p,\lambda}(\mathbb{R}^n)$ over the whole of λ such that $-n/p \le \lambda < \infty$. In order to show the above, we will introduce the generalized λ-CMO spaces $\Lambda^{(d)}_{p,\lambda}(\mathbb{R}^n)$ and the generalized fractional integrals $\tilde{I}_{\alpha,d}$.

15 Yoshihiro Sawano (Tokyo Metro. Univ.) ♭
Takeshi Iida (Fukushima Nat. Coll. of Tech.)
Hitoshi Tanaka (Univ. of Tokyo)
Atomic decomposition for Morrey spaces 15

Summary: We propose here a non-smooth decomposition of Morrey spaces. We content ourselves with stating two main decomposition results.

16 Yoshihiro Sawano (Tokyo Metro. Univ.) ♭
Mitsuo Izuki (Okayama Univ.)
Eiichi Nakai (Ibaraki Univ.)
Wavelet characterization and modular inequalities for weighted Lebesgue spaces with variable exponent 15

Summary: We consider the wavelet characterization of the space $L^{p(\cdot)}(w)$ with $w \in A_{p(\cdot)}$.

17 Fumi-Yuki Maeda (Hiroshima Univ.*) * Sobolev and Trudinger type inequalities for potentials of functions in grand Musielak–Orlicz–Morrey spaces 15
Yoshihiro Mizuta (Hiroshima Inst. of Tech.)
Takao Ohno (Oita Univ.)
Tetsu Shimomura (Hiroshima Univ.)

Summary: We define (generalized) grand Musielak–Orlicz–Morrey space on a bounded open set in $\mathbf{R}^N$ and give a Sobolev type inequality as well as a Trudinger type inequality for potentials of functions in such spaces.

18 Fumi-Yuki Maeda (Hiroshima Univ.*) * Growth properties of Musielak–Orlicz integral means for Riesz potentials 15
Yoshihiro Mizuta (Hiroshima Inst. of Tech.)
Tetsu Shimomura (Hiroshima Univ.)

Summary: In this talk we are concerned with growth properties of integral means for Riesz potentials of functions in Musielak–Orlicz spaces.

16:40–17:40 Talk Invited by Real Analysis Section

Kenichi Mitani (Okayama Pref. Univ.) On geometrical constants of Banach spaces

Summary: In this talk, we describe some recent results on James constant, von Neumann–Jordan constant and the skewness of Banach spaces. These constants play an important role in the description of various geometrical structures of Banach spaces. We first discuss James and von Neumann–Jordan constants for absolute normalized norms. We also exhibit some connections between the skewness and James constant for general Banach spaces.

September 28th (Sun) Conference Room I

9:00–11:50

19 Akio Ito (Kinki Univ.) Optimal control problems for mathematical model for the process of brewing Japanese Sake with unknown terminal time 15
Nobuyuki Kenmochi (Bukkyo Univ.)
Yusuke Murase (Meijo Univ.)

Summary: Our mathematical model for the process of brewing Japanese Sake is a system of differential equations with a constraint condition, and whose terminal time is depend upon the solution self. The system was solved by Y. Murase and A. Ito in 2013 with putting homogeneous Neumann boundary conditions and Robin boundary condition for heat equation. Our next objective is optimal control problem for the model. In this talk, we talk about existence theorem of optimal control and optimal solution characterized by certain cost function which is corresponding to phenomena.

Summary: This talk deals with a chemotaxis system modeling tumor invasion in a smoothly bounded domain $\Omega \subset \mathbb{R}^N$, $N \leq 3$. This system was recently proposed as a modified tumor invasion model in which the role of an active extracellular matrix is taken into consideration. Moreover, the existence and uniqueness of local-in-time classical solutions to the model was proved in the general case $N \in \mathbb{N}$. This talk clarifies boundedness and asymptotic behavior of solutions to the model in the physically relevant case when $N \leq 3$.

Summary: This talk deals with the chemotaxis system with nonlinear diffusion and superlinear growth term $f(b) = |b|^{\alpha-1}b$ when $n \leq 3$. It is shown that if $\alpha \leq 4$ $(n = 1)$, $\alpha < 1 + \frac{4}{n}$ $(n = 2, 3)$, then there exists a local solution to this system for any large data. In the case of Lipschitz growth, Marinoschi (*J. Math. Anal. Appl.* 2013; 402: 415–439) established the existence of local solutions to this system with sufficiently small initial data and showed that under a stronger assumption on the chemotactic sensitivity there exists a global solution with large initial data. This talk develops the local solvability with Lipschitz growth to the one with superlinear growth and allows the system to have a local solution with large initial data without any stronger assumption. The key to including the superlinear growth lies in the Yosida approximation of f.

Summary: The main purpose of this talk is to study Cauchy problem for complex Ginzburg–Landau equation (CGL) by focusing on its parabolicity. In former studies, (CGL) is always treated as a single equation over complex spaces. However in this approach, one can not make most use of the parabolicity of (CGL). So here we regard the real part of (CGL) as the principal part governed by the subdifferential operator and the pure imaginary part as its perturbations. By this approach we can show a new smoothing effect of (CGL) which ameliorates former results.

Summary: We consider the large time behavior of solutions of some system which describes double-diffusive convection in some porous medium. In our previous works, it has already been showed that there exist a unique global solution of this system under the homogeneous Dirichlet or Neumann boundary condition. In this talk, we discuss the existence of global attractor of the system. Especially, for the homogeneous Neumann boundary condition case, we need some restriction on the external forces and mass of the initial data. We focus on the differences between two cases, i.e. Dirichlet and Neumann boundary condition cases.

Summary: This talk is concerned with a system of heat equations with hysteresis and Navier–Stokes equations in two-dimensional domains. There are some studies on the system of heat equations and Navier–Stokes equations in which the temperature (the solution to heat equations) is controlled by obstacle functions. In this talk, the control of the temperature is precisely described by introducing hysteresis. This talk provides the existence of solutions along the abstract theory for evolution equations with subdifferential operators.

Summary: This talk is concerned with the Cauchy–Dirichlet problem for a doubly nonlinear parabolic equation involving variable exponents and provides some theorems on existence and regularity of strong solutions. In the proof of these results, we also analyze the relations occurring between Lebesgue spaces of space-time variables and Lebesgue–Bochner spaces of vector-valued functions, with a special emphasis on measurability issues and particularly referring to the case of space-dependent variable exponents.

Summary: The abstract Cauchy problem for weakly continuous operators is discussed in a general Banach space. A class of weakly continuous operators is introduced by using sets of functionals. An existence theorem for weakly differentiable solutions and its applications to concrete PDEs are given.

Summary: We consider the initial-boundary value problem for a randomly forced scalar conservation law with a multiplicative noise on a bounded convex domain D in R^d: $du + \mathrm{div}(A(u))\ dt = \Phi(u)\ dW(t)$ in $(0,T) \times D$, $u(0,\cdot) = u_0(\cdot)$ on D, $u \cong u_b$ on $(0,T) \times \partial D$. We introduce a notion of kinetic formulations in which the kinetic defect measures on the boundary of a domain are truncated. In such a kinetic formulation we give a result of uniqueness and existence.

Summary: The m-accretivity and m-sectoriality of the minimal and maximal realizations of second-order elliptic operators of the form $Au = -\mathrm{div}(a\nabla u) + F \cdot \nabla u + Vu$ in $L^p(\mathbb{R}^N)$ are shown, where the coefficients a, F and V are unbounded. The result may be regarded as an endpoint assertion of my previous result in 2012 and an improvement of that in Metafune et al. (2010). Moreover, an L^p-generalization of a self-adjoint problem posed by T. Kato in 1981 is also discussed.

14:15–15:40

29 Hiroshi Watanabe (Salesian Polytech.)
Ken Shirakawa (Chiba Univ.)
Large time behavior for mathematical models of grain boundary motions involving isothermal solidifications 15

Summary: We consider coupled systems of Allen–Cahn type equations and PDE models of grain boundary motions. In this light, these systems can be regarded as interactive mathematical models of the grain boundaries motions under isothermal solidifications. In this talk, we discuss the large time behavior of solutions to our systems. Moreover, we also mention about some improvements to approximating arguments, associated with the Γ-convergence of governing energies.

30 Ken Shirakawa (Chiba Univ.)
Hiroshi Watanabe (Salesian Polytech.)
Energy-dissipative solutions to models of grain boundary motions under isothermal solidifications 15

Summary: In this talk, we consider parabolic type systems of the ϕ-η-θ model, that is known as a phase-field model of grain boundary motion under an isothermal solidification. The main objective is to confirm the reproduction ability of the smoothing effect and energy-dissipation in our systems. With this view, the main results will be concerned with the existence of special kind of solution, called energy-dissipative solution. Although each of our systems has specific difficulties in mathematics, the main results are proved on the basis of the time-discretization for a common approximating problem. As a consequence, we provide a uniform finding method for energy-dissipative solutions to wide scope of nonstandard parabolic systems, associated with the ϕ-η-θ model.

31 Noriaki Yamazaki (Kanagawa Univ.)
Takeshi Fukao (Kyoto Univ. of Edu.)
Mohammad Hassan Farshbaf-Shaker (WIAS)
Singular limit of Allen–Cahn equation with constraints and its Lagrange multiplier 15

Summary: We consider the Allen–Cahn equation with constraint. Our constraint is the subdifferential of the indicator function on the closed interval, which is the multivalued function. In this talk we give the characterization of the Lagrange multiplier to our equation. Moreover, we consider the singular limit of our system and clarify the limit of the solution and the Lagrange multiplier to our problem.

32 Takeshi Fukao (Kyoto Univ. of Edu.)
Pierluigi Colli (Univ. di Pavia)
Cahn–Hilliard equation with dynamic boundary conditions and mass constraints on the boundary 15

Summary: The well-known Cahn–Hilliard equation has the structure of the mass conservation under the suitable boundary condition. In the case when the equation is treated with the dynamic boundary condition, the total mass on the inside of the domain and its trace on the boundary should be conserved. The new issue is the setting of the mass constraint on the boundary. The effet of this additional constraint is characterized by the Lagrange multiplier, that is, there are two Lagrange multipliers, one is for the inside of the domain, the other is for the boundary.

Summary: In this talk we consider the free boundary problem which is a mathematical model for adsorption phenomena in porous media. On this problem the modeling process was proposed and the well-posedness was already discussed. Here, under some condition for the growth rate of wetting area we show a result on large time behavior of a solution to the problem. Also, we can provide some conjectures on the rate of convergence of the solution for large time from observations for our numerical results.

16:00–17:00 Talk Invited by Real Analysis Section

Kentarou Yoshii (Tokyo Univ. of Sci.) On the hyperbolic type linear evolution equations

Summary: Set $I := [0, T]$. Let $\{A(t); t \in I\}$ be a family of closed linear operators in a complex Hilbert space X. Then we consider the abstract Cauchy problem for linear evolution equations of the form

$$\text{(ACP)} \qquad \begin{cases} (d/dt)u(t) + A(t)u(t) = f(t), & t \in I, \\ u(0) = u_0 \in Y. \end{cases}$$

Here Y is another Hilbert space, embedded densely and continuously in X.
One of those methods to solve (ACP) depends on the unique existence of *evolution operator* for (ACP)

$$\{U(t, s);\ 0 \le s \le t \le T\}.$$

If the evolution operator for (ACP) is known, then it is expected that the function $u(\cdot)$ given by the Duhamel formula

$$u(t) := U(t, 0)u_0 + \int_0^t U(t, s)f(s)\, ds$$

is a unique solution of (ACP).
Our purpose in this talk is to obtain the sufficient condition guaranteeing the existence of evolution operator.

Functional Analysis

September 25th (Thu) Conference Room IV

14:15–16:35

1 Hiroaki Niikuni * (Maebashi Inst. of Tech.) Spectral band structure of periodic Schrödinger operators on generalized degenerate zigzag nanotubes 15

Summary: In this talk, we consider periodic Schrödinger operators on the dumbell-like metric graph, which is a periodic graph consisting of lines and rings. Let one line and two rings be in the basic period cell. We see the relationship between the structure of graph and the band-gap spectrum.

2 Hironobu Sasaki (Chiba Univ.)
Shoji Shimizu (Tokyo Tech)
Akito Suzuki (Shinshu Univ.) Spectral analysis for mean-field Schrödinger opearators 10

Summary: We consider a time-dependent Schrödinger operator H_t which appears in recent study for mean-feild analysis of quantum many-body systems. We show some basic spectral properties of H_t.

3 Shougo Ito (Shinshu Univ.)
Akito Suzuki (Shinshu Univ.) The spectrum of a discrete Schrödinger operator with a non-decaying potential 15

Summary: In this talk, we study the spectrum of a discrete Schrödinger operator $H = H_0 + V$ on $\mathbb{Z}^d (d \geq 2)$ with a potential defined by $V = v \sum_{x_n=(n,0,\ldots,0),\ n\in\mathbb{Z}} |x_n\rangle\langle x_n|$ $(v > 0)$. In the case of $d = 2, 3$, there exists a positive γ_d^+ such that: (1) if $v \leq \gamma_d^+$, then the spectrum $\sigma(H)$ equals $[-2d, \lambda^+]$ with some $\lambda^+ > 2d$; (2) if $v > \gamma_d^+$, then $\sigma(H) = [-2d, 2d] \cup [\lambda^-, \lambda^+]$ with some $\lambda^+ > \lambda^- > 2d$. For $d \geq 4$, there exists a positive γ_d^- such that $\sigma(H) = [-2d, 2d]$ holds if $v \leq \gamma_d^-$.

4 Hiroshi Ito (Ehime Univ.) The nonrelativistic limit for Dirac operators with a potential diverging at infinity 15

Summary: We consider Dirac operators with a bounded magnetic potential and an unbounded electric potential diverging at infinity. Under the assumption that the potentials are dilation analytic, resonances of the operator are defined as eigenvalues of the dilated operator. In this talk we show that if the speed of light goes to infinity (the nonrelativistic limit), resonances of the Dirac operator exist near resonances of two Pauli operators.

5 Mitsuteru Kadowaki (Ehime Univ.)
Hiroshi Isozaki (Univ. of Tsukuba)
Michiyuki Watanabe (Niigata Univ.) Asymptotic behavior in far field of the resolvent for wave propagation in two-layered media 15

Summary: In this talk, we report a result for asymptotic behavior in far field of the resolvent for wave propagation in two-layered media of three dimensions. It is well-known that asymptotic behavior in far field of the resolvent for wave propagation in homogeneous medium of whole space. Moreover that is very useful to study obstacle or Schrödinger scattering and inverse scattering problem. However, it was not established that sharp study for asymptotic behavior in far field of the resolvent for wave propagation in two-layered media because of the existence of refracted (transmitted) waves.

Summary: The time-ordered exponential plays a fundamental role in perturbative calculation. We introduce a method for constructing the time-ordered exponential on the complex plane for unbounded operators, and its applications to quantum field theory.

Summary: Supersymmetry is a symmetry corresponding to replacing bosons by fermions. We investigate the Wess–Zumino model which is one of the simplest example of supersymmetric quantum field theory. We show the existence of the ground state in two different cases: where the particles are massive and where these are massless.

Summary: We find a relation between cumulants in noncommutative probability and the Campbell–Hausdorff formula in free Lie algebras. Combinatorics of set compositions (or ordered set partitions) is the main tool in the result.

Summary: Recently Dou and Du obtained several uncertainty rlations for non-hermitian type. We show that their results can be given as corollaries of our uncertainty relations for generalized metric adjusted skew informations.

17:00–18:00 Talk Invited by Functional Analysis Section

Tetsu Mizumachi (Kyushu Univ.) Stability of line solitons for the KP-II equation

Summary: In this talk, we discuss nonlinear stability of line soliton solutions of the KP-II equation. The KP-II equation is a two dimensional generalization of the KdV equation which takes into account of slow variations of waves in the transversal direction.
If the perturbation to line solitons are periodic in the transversal direction, the line soliton solution is stable in the same manner as 1-soliton solutions of the KdV equation.
However, with respect to localized transversal perturbations in $\mathbb{R}^2$, the modulating speed and the phase shift cannot be uniform in the transversal direction. Modulation equations of the local amplitude and the local phase shift of the crest of the line solitons are described by a system of 1D wave equations with diffraction terms.

September 26th (Fri) Conference Room IV

10:00–11:50

10 Ryo Tabata (Hiroshima Univ.) The behavior of $n \times n$ Immanants as $n \to \infty$ 15

Summary: When λ is a Young diagram, $T_\lambda = \max T_\lambda(A) = \max_{A \geq 0}(\overline{d}_\lambda(A) - \det A)/(\mathrm{per} A - \det A)$ measures how large $\overline{d}_\lambda(A)$ can be on the determinant-permanent line segment. The celebrated permanental dominance conjecture asserts that $T_\lambda \leq 1$ for all λ. Conjecturally the maximum value is attained by $Y_n = (n/(n-1)\delta_{ij} - 1/(n-1))$ and we study the behavior of $T_\lambda(Y_n)$ as $|\lambda| \to \infty$. We give precise values when λ's are hooks, random young diagrams, and $\lim_{n\to\infty} T_{(k^n)}(Y_n)$. We also discuss the relation with Pierce's conjecture, which says that the maximum permanent of singular correlation matrices is attained bu Y_n.

11 Hideto Nakashima (Kyushu Univ.) Explicit formula of the basic relative invariants of homogeneous cones 15

Summary: In a study of homogeneous convex cones, the basic relative invariants play an important role. It is known that they are obtained inductively as the irreducible factors of Vinberg polynomials (Ishi 2001). In this talk, we give an explicit formula which calculates the basic relative invariants all at once with Vinberg polynomials by using data related to the homogeneous cones.

12 Toshihiko Matsuki (Ryukoku Univ.) Classification of orthogonal multiple flag varieties of finite type 15

Summary: Let G be the split orthogonal group of degree $2n+1$ over an arbitrary field $\mathbb{F}$ of characteristic not 2. In this talk, we classify multiple flag varieties $G/P_1 \times \cdots \times G/P_k$ of finite type. Here a multiple flag variety is called of finite type if it has a finite number of G-orbits with respect to the diagonal action of G when $|\mathbb{F}| = \infty$.

13 Toshihiko Matsuki (Ryukoku Univ.) Orbits on orthogonal triple flag varieties 15

Summary: Let G be the split orthogonal group of degree $2n+1$ over a field $\mathbb{F}$ of characteristic not 2. In this talk, we describe G-orbits on the triple flag variety $\mathcal{M} = \mathrm{Fl}_{(\alpha)} \times \mathrm{Fl}_{(\beta)} \times \mathrm{Fl}_{(n)}$. Here $\mathrm{Fl}_{(\alpha)}$ denote the flag variety consisting of α-dimensional isotropic subspaces in $\mathbb{F}^{2n+1}$.

14 Atsumu Sasaki (Tokai Univ.) A Cartan decomposition for Cayley type homogeneous spaces 15

Summary: We explain how to find an abelian B satisfying $G = KBH$ for Cayley type homogeneous spaces G/H. Here, K is a maximal compact subgroup of G. We note that G/H is non-symmetric. Then, our result gives a kind of generalizations of Cartan decomposition for symmetric spaces to non-symmetric ones.

15 Hideyuki Ishi (Nagoya Univ.)* Siegel type integral on a regular convex cone 15

Summary: The Laplace transform of a power of the determinant over the cone of positive definite symmetric matrices is called the Siegel integral. The formula is generalized to integrals over general homogeneous cones by Gindikin, while the analogous integrals are considered over regular cones of symmetric matrices with prescribed zeros by Roverato. In this talk, we introduce a new class of regular convex cones and consider the Siegel type integral over the cones, which unifies Gindikin's and Rovelato's formulas.

13:10–14:10 Talk Invited by Functional Analysis Section

Hiroshi Oda (Takushoku Univ.) Connections between representation theories for real reductive Lie groups and graded Hecke algebras

Summary: The representation theory for real reductive Lie groups G and that for graded Hecke algebras $\mathbf{H}$ are very similar. For example, the Langlands classification for G versus Evens' classification of irreducible $\mathbf{H}$-modules, and the Helgason–Fourier transform versus the Opdam–Cherednik transform. In addition Ciubotaru and Trapa constructed for various classical G functors sending G-modules to modules of the corresponding $\mathbf{H}$. We unify many parallel objects and phenomenons in two representation theories by introducing the notion of *radial pair*s. A radial pair is a pair of a $(\mathfrak{g}_{\mathbb{C}}, K)$-module and an $\mathbf{H}$-module satisfying axioms which are formally the same as a generalized Chevalley restriction theorem and a generalized radial part formula. Related to this we construct three functors sending $\mathbf{H}$-modules to $(\mathfrak{g}_{\mathbb{C}}, K)$-modules.

September 27th (Sat) Conference Room IV

9:00–12:00

16 Hiromichi Miyake On compactness in L^1 15

Summary: Recently, we discussed a method of constructing a separated locally convex topology τ on L^1 with the assumption that the reference measure is σ-finite. In this talk, we show a characterization of compactness for the weak topology of L^1 associated with the topology τ and apply similar arguments to study some conditions for strong and weak compactness in L^1, respectively. We also discuss (weak) almost periodicity of linear contractions on L^1.

17 Kazuyuki Wada (Hokkaido Univ.) Existence of a ground state for a self-interaction model of a complex scalar field with spacial cut-off 15

Summary: We consider the Hamiltonian H of a charged scalar field with seif-interaction. Here, we assume that the mass of boson is just zero. By introducing a spacial cut-off function, H is realized as a linear operator on a boson Fock space. Under certain conditions, H is bounded-below, self-adjoint. Moreover, H has a ground state for arbitrary coupling constants under an infrared regularily condition.

18 Kei Ji Izuchi (Niigata Univ.)* Topological structure of the space of weighted composition operators between different Hardy spaces 15
Shûichi Ohno (Nippon Inst. of Tech.)

Summary: We consider properties related to weighted composition operators boundedly acting from the classical Hardy space H^p to H^q for $1 \leq q < p < \infty$. Especially, we shall completely determine path connected components in the set of weighted composition operators and explicitly characterize by function-theoretic properties of analytic self-maps.

19 Shûichi Ohno (Nippon Inst. of Tech.)* Composition operators related to the Dirichlet space 10

Summary: The Hilbert–Schmidtness of composition operators acting between the classical Hilbert Hardy space and the Dirichlet space is known. We here consider boundedness and compactness of composition operators acting between their spaces.

Summary: Let $\{\varphi_n(z)\}_{n\geq 0}$ be a sequence of inner functions satisfying that $\zeta_n(z) := \varphi_n(z)/\varphi_{n+1}(z) \in H^\infty(z)$ for every $n \geq 0$ and $\{\varphi_n(z)\}_{n\geq 0}$ has no nonconstant common inner divisors. Associated with it, we have a Rudin type invariant subspace $\mathcal{M}$ of $H^2(\mathbb{D}^2)$. The ranks of $\mathcal{M} \ominus w\mathcal{M}$ for $\mathcal{F}_z$ and $\mathcal{F}_z^*$ respectively are determined, where $\mathcal{F}_z$ is the fringe operator on $\mathcal{M} \ominus w\mathcal{M}$. Let $\mathcal{N} = H^2(\mathbb{D}^2) \ominus \mathcal{M}$. It is also proved that the rank of $\mathcal{M} \ominus w\mathcal{M}$ for $\mathcal{F}_z^*$ equals to the rank of $\mathcal{N}$ for T_z^* and T_w^*.

Summary: In this talk, we will give the characterization of the tempered distributions supported by a regular closed set on the Heisenberg group by means of the heat kernel method.

Summary: Recently, Zou obtained the generalized results on the bounds for Tsallis relative operator entropy. In this talk, we give precise bounds for Tsallis relative operator entropy. We also give precise bounds of relative operator entropy.

Summary: As a tangent vector for the geodesics of a certain geometry of positive-definite matrices, relative entropies for operators were introdused and have been discussed. So I introduce basic entropies for operators (or matrices) corresponding to those in the classical information theory. We observe some good properties for these entropies.

Summary: For $-1 \leq t \leq 1$, Lim–Pálfia defined a new family of operator power means of positive definite matrices and subsequently by Lawson–Lim their notion and most of their results extend to the setting of positive invertible operators on a Hilbert space. Each of these means except $t \neq 0$ arises as a unique positive invertible solution of a non-linear operator equation and satisfies all desirable properties of power arithmetic means of positive real numbers. The purpose of this talk is to extend the range in which operator power means due to Lawson–Lim–Pálfia are defined. We investigate some properties of operator power means for $t \in (-2, 2)\backslash[-1, 1]$.

25 Hiroaki Tohyama (Maebashi Inst. of Tech.)
Hiroshi Isa (Maebashi Inst. of Tech.)
Masatoshi Ito (Maebashi Inst. of Tech.)
Eizaburo Kamei
Masayuki Watanabe (Maebashi Inst. of Tech.)
Operator valued α-divergence and noncommutative ratio 15

Summary: Kamei showed some kind of the additivity for relative operator entropy $S(A|A \sharp_t B) = tS(A|B)$ for $t \in [0,1]$. In regard to this, we show some results which have been obtained for operator valued α-divergence. Recently, we have introduced an notion of noncommutative ratio on the path $A \natural_w B$. In this talk, we also show some results obtained by applying noncommutative ratio to operator valued α-divergence.

26 Masaru Nagisa (Chiba Univ.)
Albania Nugraha Imam (Chiba Univ.)
Characterization of diagonality of operators 10

Summary: We can consider Shur product of bounded linear operators on a Hilbert space. Using this product, we have already get the condition for an operator, which implies its diagonality. In this talk, we consider the algebra $B(\ell^p, \ell^q)$ $(1 \leq q \leq p \leq \infty)$ of bounded linear operators which has a usual product (composition of maps) and a Schur product, and has two structures as a Banach algebra. So we can also consider the similar condition of an operators in $B(\ell^p, \ell^q)$, which implies its diagonality.

14:15–16:45

27 Kengo Matsumoto * (Joetsu Univ. of Edu.)
Hiroki Matui (Chiba Univ.)
Continuous orbit equivalence of topological Markov shifts and dynamical zeta functions 15

Summary: For continuously orbit equivalent one-sided topological Markov shifts (X_A, σ_A) and (X_B, σ_B), we directly construct an isomorphism between their ordered cohomology groups $(\bar{H}^A, \bar{H}^A_+)$ and $(\bar{H}^B, \bar{H}^B_+)$. We show that the cocycle functions for the continuous orbit equivalences give rise to positive elements of their ordered cohomology groups, so that the zeta functions of continuously orbit equivalent topological Markov shifts are related. The set of Borel measures is shown to be invariant under continuous orbit equivalence of one-sided topological Markov shifts.

28 Yasushi Nagai (Keio Univ.)
Distribution of patches in tilings and properties of spectrum of the corresponding dynamical systems 15

Summary: Tiling is a cover of Euclidean space by tiles such as polygons that overlap only on their borders. Given a tiling, one can construct a topological dynamical system. This dynamical system is often uniquely ergodic, namely it admits a unique invariant measure. In this talk we investigate a relation between tiling and the spectrum of this measure theoretic dynamical system. It is known that we can deduce pure discrete spectrum of this dynamical system from information of distribution of patches in certain tiling. Here a patch is a configuration that appears in a tiling. In this talk we conversely deduce a property on distribution of patches from a spectral property of the corresponding dynamical system.

Summary: The Bost–Connes system, which describes the relation between quantum statistical mechanics and class field theory, was first constructed by Bost and Connes for the rational field, and generalized for arbitrary number fields by the contribution of many researchers. In this talk, we will introduce a generalization of the Bost–Connes sysmtem for local fields of characteristic zero, and introduce some properties.

Summary: We study amenable minimal Cantor systems of free groups. We show for every free group, (explicitly given) continuum many Kirchberg algebras are realized as the crossed product of an amenable minimal Cantor system of it. In particular this shows there are continuum many Kirchberg algebras such that each of which is decomposed to the crossed products of amenable minimal Cantor systems of any virtually free group. We also give computations of K-groups for the diagonal actions of the boundary action and the odometer transformations. These computations with Matui's theorem classify their topological full groups.

Summary: In this talk we will introduce the tracial Rokhlin property for an inclusion of separable simple unital C*-algebras $P \subset A$ with finite index in the sense of Watatani, and prove theorems of the following type. Suppose that A belongs to a class of C*-algebras characterized by some structural property, such as the Jiang–Su absorption. Then P belongs to the same class. We show that an action α from a finite group G on a simple unital C*-algebra A has the tracial Rokhlin property in the sense of Phillips if and only if the canonical conditional expectation $E\colon A \to A^G$ has the tracial Rokhlin property for an inclusion $A^G \subset A$.

Summary: We consider a pair of the C^*-algebra generated by a complex dynaical system and its maximal abelian subalgebra. We study a relation between isomorphisms of such pairs and continuous orbit equivalence.

Summary: We study the relative position of three subspaces in a infinite-dimensional Hilbert space. We give a condition that it has a Brenner type decomposition with a finite-dimensional double triangle part.

Summary: We discuss various definitions of the Haagerup approximation property for an arbitrary von Neumann algebra. As a consequence, we give a simple and direct proof that the definition given by M. Caspers and A. Skalski is equivalent to our original one defined by using the standard form. Our strategy is to use the one-parameter family of positive cones due to H. Araki. This is based on a joint work with Reiji Tomatsu.

17:00–18:00 Talk Invited by Functional Analysis Section

Yasuhiko Sato (Kyoto Univ.)♭ Classification theorem of C*-algebras and the Toms–Winter conjecture

Summary: In 1989, G. A. Elliott showed that a certain class of amenable C*-algebras can be classified by their K-groups. Following this success, he initiated the program to classify amenable C*-algebras via K-theoretic invariants. In his program, it has become necessary to invoke some regularity property of the classifiable C*-algebras in various manners, after the appearance of pathological examples constructed by Villadsen, Rørdam and Toms.

With the aim of characterizing classifiable C*-algebras, in 2008, Toms and Winter have conjectured that the following three fundamental properties are equivalent for all separable, simple, amenable C*-algebras: strict comparison, absorption of the Jiang–Su algebra, and finite nuclear dimension (or finite decomposition rank for stably finite cases). Recently, this conjecture has attracted a fair amount of attention from experts in operator algebras. Actually, it is known that an affirmative answer to this conjecture induces a solution of Rosenberg's conjecture and also of the Blackadar–Kirchberg conjecture, which are concerned with quasidiagonality of amenable C*-algebras.

In my talk, I report on the recent progress of the Toms–Winter conjecture and its application to the classification theorem for amenable C*-algebras.

Statistics and Probability

September 25th (Thu) Conference Room VII

9:30–11:50

Summary: We show that any freely selfdecomposable probability distribution is unimodal. This is the free probabilistic analog of Yamazato's result in [Ann. Probab. 6 (1978), 523–531].

Summary: We consider a class of deterministic nonlinear integral equations. We begin with constructing a branching model, define a star-product and construct a tree-based star-product functional. By stydying mathematical structure of the functional, we prove that the function given by expectation of the functional with respect to the law of a branching process satisfies the original integral equations.

Summary: In financial mathematics, it is known as Jouini–Schachermayer–Touzi's theorem that for any convex risk measure on L^∞ with the σ-additive dual representation, (1) the Lebesgue property (order-continuity), (2) the weak compactness of sublevels of the conjugate on L^1 and the attainment of the supremum in the dual representation are equivalent. We provide a couple of generalization of this result which applies to any finite-valued monotone convex function on a lattice ideal of L^0 (including all Orlicz spaces) forming a dual pair with its order-continuous dual space with slightly different a priori lower semicontinuity assumptions and the choice of penalty function.

Summary: To estimate volatilities of d-dimensional Itô semi-martingales, Malliavin and Mancino proposed Fourier series type estimators composed of the finite observations of d-dimensional Itô semi-martingale. Recently, Akahori et al. introduced Fourier series type estimators which are positive semi-definite. We discuss about the consistency of these positive semi-definite Fourier type estimators for the volatility.

5 Shigeyoshi Ogawa (Ritsumeikan Univ.) A direct inversion formula for natural SFT ····· 10

Summary: We are concerned with the question whether and how a random function $f(t,\omega)$ is determined by its image of a stochastic transformation called SFT (stochastic Fourier transformation) $\mathcal{T}_* f(t,\omega)$, which was introduced by the author in 1990, in the study of stochastic integral equation of Fredholm type. The question of inversibility of the SFT has been studied again in the framework of homogeneous chaos and some affirmative answers as well as the inversion schemes were given (cf. Ogawa 2013, Ogawa–Uemura 2013, 2014). In this talk, by limitting ourselves to the case of causal functions and trigonometric basis, we are to show an elementary approach to the question, an approach that does not rely on the homogeneous chaos framework, and give a direct formula for the inversion of the natural SFT.

6 Hiroya Hashimoto * (Sanwa Kagaku Kenkyusho Co.)
Takahiro Tsuchiya (Univ. of Aizu)
A note on convergence rates for stability problems of SDEs under Nakao–Le Gall condition ····· 15

Summary: We consider the stability problems of one dimensional stochastic differential equations when the diffusion coefficients satisfy the so called Nakao–Le Gall condition. A bounded rate of strong convergence in the sense of L^1 are given by the Yamada–Watanabe method.

7 Hideki Tanemura (Chiba Univ.)
Hirofumi Osada (Kyushu Univ.)
Infinite-dimensional stochastic differential equations arising from Airy random point fields ····· 10

Summary: We identify infinite-dimensional stochastic differential equations (ISDEs) describing the stochastic dynamics related to Airy random point fields with $\beta = 1, 2, 4$. We prove the existence and uniqueness of the ISDEs.

8 Hideki Tanemura (Chiba Univ.)
Hirofumi Osada (Kyushu Univ.)
Strong solutions of infinite-dimensional stochastic differential equations and tail σ-fields ····· 10

Summary: We present a new method to construct unique strong solutions of infinite-dimensional stochastic differential equations (ISDEs) describing interacting Brownian motions (IBMs). Our method can be applied to IBMs related to random matrix theory.

9 Takafumi Amaba (Ritsumeikan Univ.) An integration by parts on space of loops ····· 10

Summary: We consider to construct a measure on space of loops in $\mathbb{C}^*$ (strictry speaking, a space of paths in a coefficient body), surrounding the origin by employing the utility of the (alternate) Loewner–Kufarev equation. We discuss about a simple integration by parts formula under the measure.

10 Kouji Yano (Kyoto Univ.)
Yuko Yano (Kyoto Sangyo Univ.)
Renormalized zero resolvents for one-dimensional diffusions ····· 15

Summary: For a one-dimensional diffusion on an interval for which 0 is the regular reflecting left boundary, the renormalized zero-resolvent, denoted by h_0, is studied. It is reported that, for the process stopped upon hitting 0, the function h_0 is excessive and the h_0-transform can be regarded as a conditional process to avoid zero.

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

Atsushi Takeuchi (Osaka City Univ.) Integration by parts formula for jump processes

Summary: It is well known that the Malliavin calculus is a powerful tool in stochastic analysis, and the integration by parts formula plays a crucial role in the argument. Most of works concern only diffusion processes without any jumps. Although it is a natural question whether a similar approaches can be taken in case of jump processes, there are a lot of diffuculties to do it. Moreover, there are some approaches to the Malliavin calculus for jump processes, depending on the interests. In this talk, we shall give a brief review of some recent results concerning the integration by parts formula for jump processes.

15:30–16:30 Talk Invited by Statistics and Probability Section

Hiroki Takahashi (Keio Univ.)* On the destruction of Smale's horseshoe in the Henon map (and what comes afterwards)

Summary: An important problem in dynamics (qualitative theory of ordinary differential equations) is to describe how Smale's horseshoe loses its stability through continuous modifications of the system. The loss of stability of Smale's horseshoe through homoclinic bifurcations is modeled by a certain parametrized family of planar diffeomorphisms, called the Henon maps. I will talk about recent results on the dynamics of the strongly dissipative Henon maps around the first bifurcation parameter, with special emphasis on their geometric and probabilistic aspects.

September 26th (Fri) Conference Room VII

9:30–11:30

Summary: We consider a two dimensional reflecting random walk on the nonnegative integer quadrant. It is assumed that this reflecting random walk has skip free transitions. We are concerned with its time reversed process assuming that the stationary distribution exists. In general, the time reversed process may not be a reflecting random walk. In this paper, we derive necessary and sufficient conditions for the time reversed process also to be a reflecting random walk. These conditions are different from but closely related to the product form of the stationary distribution.

Summary: We deal with the inner boundary of random walk range, that is, the set of those points in a random walk range which have at least one neighbor site outside the range. We consider the number of the inner boundary points of random walk range and the question; how many times does a simple random walk revisit the most frequently visited site among the inner boundary points?

Summary: For a strongly local regular Dirichlet space arising from a resistance form and with a complete geodesic metric and a *sub-Gaussian* type two-sided heat kernel estimate, we present a two-sided estimate of the Neumann heat kernel on inner uniform subdomains in terms of the natural inner geodesic metric of the domains. Besides the change of the metric, the Neumann heat kernel estimate involves no difference from the global heat kernel estimate. This result is meant mainly for inner uniform domains of fractals with spectral dimension less than 2 and is applicable to Brownian motion on affined nested fractals and 2-dimensional generalized Sierpiński carpets.

Summary: For every positive number σ, there exists a sequence $\{n_k\}$ of intergers satisfying $n_{k+1}-n_k \in \{0,1\}$ such that the law of the iterated logarithm for $\sum \cos(2\pi n_k x)$ with limsup constant σ holds.

Summary: We consider the percolation problem for spin configurations of the Ising model on the triangular lattice. We derive an RSW-type bound for crossing probabilities when the external field is zero and the inverse temperature is not more than the critical one. As an application, we can obtain power estimates of the one-arm probability and the two-point connectivity function from below, at the critical inverse temperature.

Summary: We consider limiting behaviors of multi-dimensional diffusion processes in multi-parameter random environments, which are sets of values at different d points of one-dimensional α-stable or (r,α)-semi-stable Lévy processes. They imply conditions of random environments for the dichotomy of recurrence and transience of multi-dimensional diffusion processes formed by d independent one-dimensional diffusion processes in α-stable or (r,α)-semi-stable Lévy processes. Their limiting behaviors are quite different from those of multi-dimensional standard Brownian motions. We also consider a direct product of a one-dimensional diffusion process in a reflected non-positive Brownian environment and a one-dimensional standard Brownian motion. For the two-dimensional diffusion process, we show the transience property.

Summary: We consider the free energy of the directed polymers in random environment in 1+2 dimension. It is known that the free energy is strictly negative if the inverse temperature β is not zero when spatial dimension d is 1 or 2. In this talk, we give new bounds of the free energy as $\beta > 0$ small.

18 Takeyuki Sasai (Univ. of Tokyo)
Kenshi Miyabe (Meiji Univ.)
Akimichi Takemura (Univ. of Tokyo)
A game-theoretic proof of Erdős–Feller–Kolmogorov–Petrowsky law of the iterated logarithm for fair coin tossing 15

Summary: We give a game-theoretic proof of the celebrated Erdős–Feller–Kolmogorov–Petrowsky law of the iterated logarithm for fair coin tossing. As many other game-theoretic proofs of the laws in probability theory, our game-theoretic proof is explicit and gives insights on what happens when the law is violated.

11:45–12:15 Research Section Assembly

September 27th (Sat) Conference Room VII

9:30–12:00

19 Satoshi Suzuki (Shimane Univ.)
Daishi Kuroiwa (Shimane Univ.)
Surrogate duality and its constraint qualifications 15

Summary: In this talk, we study a constraint qualification which completely characterizes surrogate strong and min-max duality for quasiconvex programming. We show that the closed cone constraint qualification for surrogate duality is a necessary and sufficient constraint qualification for surrogate strong and min-max duality via quasiconvex programming. Also, we compare our constraint qualification with previous ones for Lagrange and surrogate duality.

20 Toshiharu Fujita (Kyushu Inst. of Tech.)
Mutually dependent Markov decision processes with associative criteria 10

Summary: In this study, we consider in mutually dependent Markov decision processes (MDMDP) with associative criteria. The MDMDP model is structured upon finite-stage Markov decision processes. At each stage, the reward in one decision process is given by the optimal values of other decision process, whose initial state is determined by the current state and decision in the original process. We introduce an associative criterion to each MDMDP and derive recursive equations by dynamic programming with an invariant imbedding technique.

21 Yoshihiro Suto (Waseda Univ.)
Yan Liu (Waseda Univ.)
Masanobu Taniguchi (Waseda Univ.)
Parameter estimation by a contrast function based on interpolation error 15

Summary: Interpolation is an important issue for a variety of fields in statistics (e.g., missing data analysis). In this research, the asymptotics of a contrast function estimator defined by pseudo interpolation error for Gaussian stationary process are investigated. We estimate parameters of the process by minimizing the pseudo interpolation error written in terms of a fitted parametric spectral density and the periodogram based on observed stretch. The estimator has the consistency and asymptotic normality. Although the criterion for the interpolation problem is known as the best in the sense of smallest mean square error for past and future extrapolation, it is shown that the estimator is asymptotically inefficient in general, which leads to an unexpected result.

Summary: We elucidate the second-order asymptotic properties of frequency domain generalized method of moments (GMM) estimators for second order stationary processes. The process concerned is essentially nonparametric one, and we focus on the estimation problem of the pivotal quantity of the process, which is defined as a solution of over-identified spectral restrictions. The Edgeworth expansion for the GMM estimator up to second-order is given. We also discuss asymptotic efficiency of the GMM estimator by making a comparison between the limit distributions of the GMM estimator and a quasi-maximum likelihood estimator.

Summary: Nowadays, the quantile estimation becomes a notable method in statistics for its robustness against the existence of moments of random variables. In this talk, we extend the idea of quantile in time domain to that in frequency domain. The objective function for the quantile estimator in time domain can be naturally extended into frequency domain. The quantile estimator in frequency domain has the consistency. However, asymptotic normality of the quantile estimator based on the bare periodogram does not hold, which is obviously different from the quantile theory for time domain. We give the asymptotic properties of the estimator. The modified estimator for asymptotic normality will also be provided.

Summary: A general approach to test the time-homogeneity of ergodic stochastic process models is presented. It is based on weak convergences of stochastic integrals taking values in L^2 spaces, and it enables us to use the Anderson–Darling type weight function which cannot be treated by a weak convergence theory for martingales taking values in ℓ^∞ spaces. The result is applied to some time-homogeneity testing problems of ergodic diffusion processes and stress release models with continuous observations.

Summary: For the LR statistic, the Bartlett adjustment is applicable, i.e., a simple mean adjustment through multiplication by a constant of the form 1+b/N yields an improvement of the null distribution. On the other hand, the Bartlett-type adjustment is a higher-order asymptotic method for improving the chi-squared approximation to the null distributions of various statistics rather than the LR statistic. In this talk, we propose a bootstrap-based Bartlett-type adjustment, which is an extension of a bootstrap-based Bartlett adjustment for the LR statistic.

Summary: In this talk we obtain an asymptotic representation a kernel type estimator of a hazard function. The hazard function estimator takes a form of a ratio of two kernel type estimators. The convergence rates of them are different, and so we cannot see an effect of the slow order rate estimator under an ordinal asymptotic setting. Using the higher order asymptotic representation, we can discuss an effect of the slow order rate estimator.

Summary: This paper deals with a variable selection procedure in a multivariate linear regression model with normality assumption, which is called a normal multivariate linear regression model, by minimizing a model selection criterion. A model selection criterion considered in this paper is a log-likelihood-based information criterion which is defined by adding a penalty term to the negative twofold maximum log-likelihood. A purpose of this paper is to clarify a sufficient condition of the penalty term in the log-likelihood-based information criterion to satisfy an asymptotically Kullback–Leibler (KL) loss efficiency property from the HD asymptotic framework, such that $(n, p) \to \infty$ simultaneously under the condition $p/n \to c_0 \in (0, 1)$. Then, we can study whether AIC, $\mathrm{AIC}_{\mathrm{c}}$, BIC, CAIC and HQC are asymptotically KL loss efficient or not, when the HD asymptotic framework is used.

Summary: It is very important to estimate the probability of the data series accurately for applying MDL information criterion. For discrete data, it is known that the methods based on universal coding in information theory have high precision (universal Bayesian measures) and they are used in MDL. Recently, Ryabko extended the universal Bayesian measures for discrete data to continuous data and one gets to be able to apply MDL for not only discrete data but also continuous data. In this presentation, we give the rates of convergence for the generalization error of the universal Bayesian measures for continuous data and show that they achieve the optimal rate under a certain condition.

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

Hironori Fujisawa (Inst. of Stat. Math.) Divergence-based robust statistics

Summary: Many estimation methods have been proposed for robust statistics. In this talk, some divergece-based methods are discussed. The density power divergence was proposed by Basu et al. (1998). This is based on the idea that the density values for outliers are small. The largest characteristic is that the density power divergence is easily applicable for any continuous probability density function. The density power divergence belongs to a separable class of Bregman divergences. Fujisawa and Eguchi (2008) proposed another type of divergence, which was called the gamma-divergence. This divergence belongs to a larger class of Bregman divergence. The robust estimator based on the gamma divergence can show a sufficiently small latent bias even if the ratio of outlier is not small. This solves an important open problem that has not been unsolved for a long time. Kanamori and Fujisawa (2014) proposed an extended class of divergence from the point of view of affince invariance of data transformation, which was called the Hölder divergence. This divergence does not belong to a class of Bregman divergence. Recently, Kanamori and Fujisawa (2014) pointed out a close relation between the gamma and Hölder divergences by virtue of unnormalized model.

15:30–16:30 Talk Invited by Statistics and Probability Section

Yoichi Miyata (Takasaki City Univ. of Econ.) On asymptotic properties of Bayesian type estimators

Summary: Roughly speaking, nonstationary processes can be classified into three main groups: (i) nonstationary mixing processes, (ii) processes with deterministic trends, and (iii) unit root processes. In this talk, we will consider general conditions and rather easily verified conditions that ensure asymptotic posterior normality, strong consistency of the Bayesian type estimators and their asymptotic normality in possibly misspecified models for stationary processes, (i), and (ii). We will illustrate our main results with a heterogeneous AR model, a Logit model, and a finite mixture model.

September 28th (Sun) Conference Room VII

9:30–11:20

29 Hidekazu Tanaka (Osaka Pref. Univ.) Some results on gamma parameter estimation 15
Nabendu Pal (Univ. Louisiana at Lafayette)
Wooi K. Lim (William Paterson Univ.)

Summary: This talk deals with improved estimation of gamma parameters from a decision-theoretic point of view. First, we study the second order properties of three estimators of shape parameter —(i) the maximum likelihood estimator (MLE), (ii) a bias corrected version of the MLE, and (iii) an improved version (in terms of mean squared error) of the MLE. It is shown that all the three estimators mentioned above are second order inadmissible. Also, we obtain second order admissible estimators which are second order better than the above three estimators. Similarly, in estimating scale parameter, we consider the second order admissibilities of some estimators and propose second order admissible estimators.

Summary: For a T-variate density function, we define the point-symmetry, quasi-point-symmetry of order k ($< T$) and the marginal point-symmetry of order k, and gives the theorem that the density function is T-variate point-symmetric if and only if it is quasi-point-symmetric and marginal point-symmetric of order k. The theorem is illustrated for the multivariate normal density function.

Summary: In this paper, we asymptotically compare with the least square estimator (LSE) and the maximum likelihood estimator (MLE) of coefficient matrices in high-dimensional GMANOVA model, when the sample size n and the number of response variables p simultaneously approach ∞ under the condition that $c_{n,p} = p/n \to c_0 \in [0, 1)$.

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. (2014) gave an asymptotic distribution of the largest eigenvalue estimator derived by the noise-reduction methodology that was created by Yata and Aoshima (2012). In this talk, we provide an estimator of the first eigenvector by using the noise-reduction methodology. We show that the estimator enjoys the consistency property in a mild condition. We consider testing the equality of covariance matrices between two classes and propose a new test statistic by applying both the largest eigenvalue estimator and the first eigenvector estimator. We verify the proposed test statistic improves the power as the dimension grows.

Summary: We consider the problem of testing the mean vector in one-sample problem when the data have k-step monotone pattern missing observations. Jinadasa and Tracy (1992) obtained closed form expressions for the maximum likelihood estimators of the mean vector and the covariance matrix of a multivariate normal distribution with a k-step monotone missing data pattern. We propose a simplified Hotelling's T^2 type statistic by evaluating the covariance matrix of the maximum likelihood estimator of the mean vector in the case of a k-step monotone missing data. Further, we give an approximate upper percentile of the T^2 type statistic and investigate the accuracy by Monte Carlo simulation.

34 Kazuyoshi Yata (Univ. of Tsukuba) Makoto Aoshima (Univ. of Tsukuba) High-dimensional PCA for a mixture model and its applications ····· 15

Summary: In this talk, we consider PCA (Principle Component Analysis) for mixture models in high-dimension, low-sample-size (HDLSS) settings. We show that the first true eigenvalue, eigenvector and its PC scores hold consistency properties when the underlying distribution has a two-class mixture model. Next, we derive a geometric representation of the dual sample covariance matrix constructed by HDLSS data from the mixture model. With the help of the geometric representation, we propose a new clustering method for a high-dimensional mixture distribution. Finally, we extend the clustering method to a general case when three or more classes are mixed.

35 Masato Naganawa (Tokyo Univ. of Sci.) Kouji Tahata (Tokyo Univ. of Sci.) Sadao Tomizawa (Tokyo Univ. of Sci.) Extended linear asymmetry model for square contingency tables with ordered categories ····· 10

Summary: The issues of various symmetry rather than independence arise naturally for the analysis of square contingency tables. So the models, that indicate the structure of symmetry and asymmetry, have been proposed, for example, the symmetry model (Bowker, 1948), the quasi-symmetry model (Caussinus, 1965), and the marginal homogeneity model (Stuart, 1955). In this talk, we propose the models that indicate the structure of asymmetry. The model includes various symmetry and asymmetry models in the special cases. An example is given.

14:15–16:10

36 Masanori Sawa (Kobe Univ.) Developing the theory of designs on measure spaces, I ····· 15

Summary: In this talk, I introduce the notion of cubature formulas or designs on measure spaces, generalizing various related objects in statistical experiments, numerical analysis, and algebraic combinatorics. Many examples will be given emphasizing how general our notion is. The idea of cubature on measure spaces originally goes back to an outstanding work by Kôno in 1962 on the construction of optimal experimental designs on the cube.

37 Masatake Hirao (Aichi Pref. Univ.) Masanori Sawa (Kobe Univ.) Characterizing optimum designs in terms of finite irreducible reflection groups, II ····· 10

Summary: In this talk we give a geometric characterization of D-optimal experimental designs on the unit ball that consist of corner vectors associated with finite irreducible reflection groups A_n and D_n.

38 Kohei Yamada (Nagoya Univ.) Some results related to a remark of Graham and Lovász ····· 10

Summary: Let G be an undirected connected graph without loops and multiedges, and let $n_+(G)$ and $n_-(G)$ be the number of positive and negative eigenvalues, respectively, of the distance matrix of G. Graham and Lovász [Adv. in Math., Vol.78, 1978] posed a problem of whether there exists a graph with $n_-(G) < n_+(G)$. Recently, Azarija [Discrete Math.,315-316, pp.65–68, 2014] proved that the Paley graph of order at least 13 is such an example. In this talk, I present some observations on graphs with $n_+(G) = n_-(G)$.

Summary: Difference systems of sets (DSS) are combinatorial structures introduced by Levenshtein in 1971, which are a generalization of cyclic difference sets and arise in connection with code synchronization. A DSS is a collection of t disjoint subsets $Q_i, 0 \le i \le t-1$, of any finite abelian group G of order $q = ef+1$ such that every element of $G\backslash\{0\}$ appears at least ρ times in the multiset $\{a-b|a \in Q_i, b \in Q_j, 0 \le i \ne j \le t-1\}$. In this talk, we will talk about parameter ρ of DSS with $e = 4, 6$. Additionally, we define new blocks with size 2 and present the conditions that these blocks form a DSS.

Summary: A Steiner quadruple system denoted by SQS(v), is a pair $(V, \mathcal{B})$, where V is a finite set of v elements, and $\mathcal{B}$ is a set of 4-subsets of V, called blocks or quadruples, such that each 3-subset of V appears exactly once in $\mathcal{B}$. An SQS(v) admitting a cyclic permutation whose stabilizer of any block is trivial is said to be strictly cyclic, denoted by sSQS(v). In this talk, we consider an sSQS($2p$) over $\mathbb{Z}_{2p}$ admitting all the units of $\mathbb{Z}_{2p}$ as multipliers, which is said to be affine-invariant. We show that the blocks of an affine-invariant sSQS($2p$) can be obtained from a rainbow 1-factor of a special kind of hypergraphs.

Summary: We consider a fractional 2^m factorial design derived from a simple array (SA) such that the $(\ell+1)$-factor and higher-order interactions are assumed to be negligible, where $\ell = 2, 3$. Under these situations, if the main effect is estimable, and furthermore some of the remaining non-negligible factorial effects may or may not be estimable, then a design is said to be of resolution $\mathrm{R}^*(\{1\}\,|\,\Omega_\ell)$. Using the algebraic structure of the TMDPB association scheme, we give a necessary and sufficient condition for an SA to be a balanced fractional 2^m factorial design of resolution $\mathrm{R}^*(\{1\}\,|\,\Omega_\ell)$, where the number of assemblies is less than the number of non-negligible factorial effects.

Summary: The existence of pairwise additive balanced incomplete block (BIB) designs, denoted by PAB(v, k, λ), has been discussed with direct and recursive constructions in Matsubara et al. (2007, 2013). Especially, when k is an odd integer, PAB($v, k, (k-1)/2$) are said to be *minimal*. On the other hand, Wilson (1975) proved an asymptotic existence of pairwise balanced designs. In this talk, an asymptotic existence of pairwise additive minimal BIB designs is shown by use of Wilson's theorem.

Summary: The validity of affine α-resolvability in 2-associate PBIB desings is considered. Some history is reviewed. Finally we will show that there does not exist an affine α-resolvable triangular design with $\lambda_1 = 0$ or $\lambda_2 = 0$.

Applied Mathematics

September 25th (Thu) Conference Room VIII

9:30–11:30

1 Hiroshi Nozaki (Aichi Univ. of Edu.) Linear programming bounds for regular graphs ····· 15

Summary: We develop a linear programming method to obtain bounds for the number of vertices of a connected regular graph. This method especially need only the information of the distinct eigenvalues of a graph. As an application of this bound, we prove that a connected k-regular graph satisfying $g > 2d - 1$ has the minimum second largest eigenvalue of all k-regular graphs of the same size, where d is the number of distinct non-trivial eigenvalues, and g is the girth.

2 Toshiaki Adachi (Nagoya Inst. of Tech.) * Kähler graphs ····· 10
Tuerxunmaimaiti Yaermaimaiti (Nagoya Inst. of Tech.)

Summary: As a discrete model of a Kähler manifold admitting Kähler magnetic fields, we introduce the notion of Kähler graphs. We show some examples of Käher graphs and give a condition that we can construct a vertex-transitive finite Kähler graphs.

3 Toshiaki Adachi (Nagoya Inst. of Tech.) * (1,1)-Laplacians for Kähler graphs ····· 10
Tuerxunmaimaiti Yaermaimaiti (Nagoya Inst. of Tech.)

Summary: For Kähler graphs we define their (p, q)-Laplacians by use of (p, q)-colored paths. We particularly consider $(1, 1)$-Laplacians and study eigenvalues for Kähler graphs defined by complement graphs and those of product types. We give examples of pairs of $(1, 1)$-isospectral Kähler graphs.

4 Iwao Sato (Oyama Nat. Coll. of Tech.)
Norio Konno (Yokohama Nat. Univ.)
Yusuke Higuchi (Showa Univ.)
Etsuo Segawa (Tohoku Univ.)
A zeta function with respect to the transition matrix of a discrete-time quantum walk on a graph ····· 15

Summary: From the viewpoint of quantum walks, the Ihara zeta function of a finite graph can be said to be closely related to its evolution matrix. In this note we introduce another kind of zeta function of a graph, which is closely related to, as to say, the square of the evolution matrix of a quantum walk. Then we give to such a function two types of determinant expressions and derive from it some geometric properties of a finite graph. As an application, we illustrate the distribution of poles of this function comparing with those of the usual Ihara zeta function.

5 Yuusuke Suzuki (Niigata Univ.)
Kenta Noguchi (Keio Univ.)
Extension to triangulations with some properties from quadrangulations ····· 15

Summary: For a given triangulation G on a surface F^2, we can extend G to a triangulation T by adding a diagonal edge in every face of G. Now the problem is to find a triangulation T with some properties. In this talk, we show that for a given simple 2-connected planar quadrangulation G with $|V(G)| \geq 6$, we can extend G to a 4-connected triangulation.

6 Ginji Hamano (Tokyo Denki Univ.)
Takayuki Hibi (Osaka Univ.)
Hidefumi Ohsugi
(Kwansei Gakuin Univ.)
Existence of a regular unimodular triangulation of the edge polytopes of finite graphs 15

Summary: Let G be a fundamental FHM-graph and P_G the edge polytope of G. Ohsugi has obtained a necessary and sufficient condition for P_G to possess a regular unimodular triangulation. However, this condition is not so easy to apply to a given graph only by looking at the graph.
In this lecture, for a fundamental FHM-graph G, we will give several criteria for the existence of a regular unimodular triangulation of P_G in terms of some simple data of the graph. We also apply our criteria to some examples, including the complete graph K_6 with 6 vertices, and show that their edge polytopes possess a regular unimodular triangulation.

7 Yusuke Suyama (Osaka City Univ.) Numbering of vertices of simplicial 2-spheres 10

Summary: Let K be a triangulation of the 2-sphere. We assign numbers to vertices of K on the basis of a certain rule. We determine the number of triangulations with at most 9 vertices, such that all vertices can be numbered by the rule.

8 Kenta Ozeki
(Nat. Inst. of Information / JST ERATO)
Dong Ye (Middle Tennessee State Univ.)
A decomposition of cubic graphs 15

Summary: A decomposition of a graph G is a set $E_1, \ldots, E_k$ of disjoint edges such that the union of them form the edge set $E(G)$ of G. It was conjectured by Hoffmann–Ostenhof that every cubic graph has a decomposition E_1, E_2, E_3 such that E_1 is a spanning tree, E_2 is a matching, and E_3 is a family of cycles. (Note that a matching and a family of cycles desired here are not necessarily spanning subgraphs.) We prove that the conjecture is true for 3-connected plane cubic graphs.

14:15–17:00

9 Kazuhiko Ushio (Kinki Univ.) Balanced C_5-foil designs and related designs 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_5-foil designs and related designs.

10 Jun Fujisawa (Keio Univ.)
Hiroki Seno (Yokohama Nat. Univ.)
Matching extension in projective planar graphs 15

Summary: A matching M of G is said to be extendable in G if M is a subset of a perfect matching of G, and a graph with at least $2m+2$ vertices in which every matching of size m is extendable is called m-extendable. Moreover, a graph with at least $2m+2$ vertices is said to be distance d m-extendable if any matching M with $|M| = m$ in which the edges lie pair-wise distance at least d is extendable. In this talk we introduce the following result: Every 5-connected triangulation of the projective plane with an even order is distance 3 7-extendable, and there exist infinitely many 5-connected triangulations of the projective plane with an even order which are not distance 3 8-extendable.

11 Kiyoshi Yoshimoto (Nihon Univ.)
Ralph J. Faudree (Univ. of Memphis)
Hao Li (Univ. de Paris Sud)
Locating sets of vertices on Hamiltonian cycles 15

Summary: Let $k \geq 2$ be a positive integer and $X = \{x_1, \ldots, x_k\}$ and $Y = \{y_1, \ldots, y_k\}$ be a pair of disjoint sets of vertices in a graph G. In this talk, we consider the existence of a Hamiltonian cycle of G such that all of the vertices of X precede the vertices of Y for appropriate initial vertex and orientation of the cycle.

12 Akira Saito (Nihon Univ.)
Kazuki Sano (Nihon Univ.)
Spanning trees homeomorphic to a small tree 15

Summary: In this talk, we will present a sufficient condition for a connected graph to have a spanning tree which is homeomorphic to a tree of a bounded order. The result is a natural extension of a classical result for the existence of a hamiltonian path, known as Ore's Theorem. We also discuss the sharpness of the result.

13 Kiyoshi Ando
(Nat. Inst. of Information / JST ERATO)
A degree sum and forbidden subgraph condition for k-contractible edges 10

Summary: If a k-connected graph G has no $K_1 + C_4$ and the degree sum of each connected subgraph of G of order 3 is greater than $3k + 1$, then G has a k-contractible edge.

14 Atsuhiko Mizusawa (Waseda Univ.)
Diogo Kendy Matsumoto (Waseda Univ.)
A construction of smooth travel groupoids on finite graphs 15

Summary: In this talk, we show a way to construct smooth travel groupoids from given finite graphs. This gives an answer to Ladislav Nebeský's question "does there exists a connected graph that has no smooth travel groupoid?" on finite graphs.

15 Shinya Fujita (Yokohama City Univ.)
Michitaka Furuya (Tokyo Univ. of Sci.)
András Gyárfás (A. Rényi Inst. of Math.)
Ágnes Tóth (A. Rényi Inst. of Math.)
A note on covering edge colored hypergraphs by monochromatic components 10

Summary: For $r \geq 2$, $\alpha \geq r - 1$ and $k \geq 1$, let $c(r, \alpha, k)$ be the smallest integer c such that the vertex set of any non-trivial r-uniform k-edge-colored hypergraph $\mathcal{H}$ with $\alpha(\mathcal{H}) = \alpha$ can be covered by c monochromatic connected components. Here $\alpha(\mathcal{H})$ is the maximum cardinality of a subset A of vertices in $\mathcal{H}$ such that A does not contain any edges. An old conjecture of Ryser is equivalent to $c(2, \alpha, k) = \alpha(r - 1)$ and a recent result of Z. Kiraly states that $c(r, r - 1, k) = \lceil \frac{k}{r} \rceil$ for any $r \geq 3$.
Here we make the first step to treat non-complete hypergraphs, showing that $c(r, r, r) = 2$ for $r \geq 2$ and $c(r, r, r + 1) = 3$ for $r \geq 3$.

16 Takahiro Matsushita (Univ. of Tokyo) On the topology of neighborhood complexes and the chromatic numbers of graphs ····· 15

Summary: Lovasz introduced the neighborhood complex $N(G)$ of a graph G. He showed that for a graph G, the connectivity of $N(G)$ gives a lower bound for the chromatic number $\chi(G)$ of G. Then a natural question arises: how effective is to detemine the topology of the neighborhood complex to compute the chromatic number? For example, is there a topological invariant which is equivalent to the chromatic number? In this talk, we discuss such a problem.

17 Katsuhiko Kuribayashi (Shinshu Univ.) On the strong homotopy for quasi-schemoids ····· 15

Summary: A quasi-schemoid is a small category with a particular partition of the set of morphisms. We define a homotopy relation on the category of quasi-schemoids and study the fundamental properties of the homotopy.

18 Sho Suda (Aichi Univ. of Edu.)
Michio Seto (Shimane Univ.)
Tetsuji Taniguchi (Matsue Coll. of Tech.) Gram matrices of reproducing kernel Hilbert spaces over graphs I ···· 10

Summary: We will define a structure of reproducing kernel Hilbert spaces for simple connected graphs. Since graphs are isomorphic if and only if corresponding Hilbert spaces are isomorphic, studying the space is important. In this talk, using the data of the corresponding Gram matrix, we obtain the inequalities for some values on graphs and characterize the some graphs as objects which attain the inequalities.

19 Michio Seto (Shimane Univ.)*
Sho Suda (Aichi Univ. of Edu.)
Tetsuji Taniguchi (Matsue Coll. of Tech.) Gram matrices of reproducing kernel Hilbert spaces over graphs II ··· 10

Summary: We study graph homomorphisms from a viewpoint of reproducing kernel Hilbert space theory. In particular, de Branges–Rovnyak theory is introduced into graph theory. We describe graph homomorphisms with Gram matrices of de Branges–Rovnyak spaces.

September 26th (Fri) Conference Room VIII

9:30–11:30

20 Ryuichi Ohori (Univ. of Tokyo)
Takehito Yoshiki (Univ. of Tokyo) Walsh figure of merit is efficiently approximable ····· 10

Summary: Walsh figure of merit (WAFOM) is a quality criterion for a quasi-Monte Carlo integration method, introduced by Matsumoto, Saito and Matoba. They define WAFOM as the sum over the orthogonal complement of the digital net, and compute WAFOM by iterating over the digital net itself. As a further improvement of their method we show an effective approximation method which is easier to implement and faster in computation.

Summary: For the study of quasi-Monte Carlo (QMC) rules for numerical integration of high smooth integrands defined over the s-dimensional unit cube, to analyze the decay of the b-adic Walsh coefficients is important. Josef Dick gave the decay of the Walsh coefficients of functions in Sobolev spaces in 2008. In this talk, we introduce another method to analyze the decay of the Walsh coefficients of smooth functions using iterate integration by parts which improves the bound on Walsh coefficients in some cases.

Summary: A digitally shifted point set is a point set which can be identified with a subset $P + \sigma$ for an element $\sigma \in Z_b^{s\times n}$ and a subgroup $P \subset Z_b^{s\times n}$, where Z_b denotes the cyclic group of order b. We shall choose σ uniformly and randomly from $\sigma \in Z_b^{s\times n}$. The randomized QMC integration by $P+\sigma$ is the approximation of $I(f) := \int_{x\in[0,1)^s} f(x)\,dx$ by $I_{P+\sigma}(f) := 1/|P+\sigma| \sum_{x\in P+\sigma} f(x)$. In this talk, we consider the root mean square error $ME_P(f) := 1/b^{sn} \sum_{\sigma\in Z_b^{s\times n}} (I(f) - I_{P+\sigma}(f))^2$. If $ME_P(f)$ is small, $I_{P+\sigma}(f)$ can be small averagely. For a sufficiently smooth integrand f, we obtain a quality measure called Walsh figure of merit $W(P;\mu)$, which gives an upper bound for $ME_P(f)$. We show that $W(P;\mu)$ is computable, and find a point set P with $W(P;\mu)$ small by computer search.

Summary: We consider multivariate numerical integration by quasi-Monte Carlo methods. Typical quasi-Monte Carlo point sets are low-discrepancy point sets based on the t-values of (t, m, s)-nets. In particular, Sobol' sequences are famous examples and widely used in computational finance. In this talk, we focus on Sobol' sequences with better two-dimensional projections constructed by Joe and Kuo (2008). We investigate the t-values of higher dimensional projections, and give some remarks.

Summary: In this paper we consider additive decompositions by proper monotone set functions, i.e., monotone set functions with proper support, and investigate whether it is possible to have such decompositions for monotone, supermodular set functions, which we call a "decomposability question". We propose a computational approach by formulating the polytope of monotone, supermodular set functions by means of hyperplanes, and by examining the corresponding vertices of polytope for further decomposability over proper monotone set functions. This enables us to numerically resolve the decomposability question in a finite steps of procedure. We have tested the proposed method for five- and six-element sets; we have obtained a positive answer to the question for a five-element set, and a negative one for a six-element set.

25 Minoru Fujimoto (Seika Science Lab.) Kunihiko Uehara (Tezukayama Univ.) NP Complete problem by quadratic residue problem ····· 15

Summary: We study the quadratic residue problem known as an NP complete problem by way of the prime number and show that a nondeterministic polynomial process does not belong to the class P because of a random distribution of solutions for the quadratic residue problem.

26 Takuya Ikuta (Kobe Gakuin Univ.) Complex Hadamard matrices attached to some association schemes ·· 15

Summary: Recently, we classified type-II matrices attached to some association schemes. We have 6 infinite families of type-II matrices, among which are 4 families of our complex Hadamard matrices. To check whether our complex Hadamard matrices are inequivalent to the tensor product of known examples, we introduce the Haagerup set for type-II matrices and the Nomura algebra for our complex Hadamard matrices. In this talk, we mainly present how to compute the Haagerup set and the Nomura algebra for our complex Hadamard matrices. This is based on a joint work with Akihiro Munemasa.

13:00–14:00 Talk Invited by Applied Mathematics Section

Etsuo Segawa (Tohoku Univ.) Spectral mapping of quantum walks

Summary: For a given finite graph $G = (V, E)$, we present a spectral mapping theorem onto a discrete-time quantum walk on $\ell^2(D)$ from the underlying cellar automaton on $\ell^2(V)$, where D is the set of the symmetric arcs generated by E. Firstly, we show that the cellar automaton satisfies a difference of a wave equation, and provides the real parts of the spectrum of the quantum walk at each time $n \in \mathbb{N}$. We denote this inherited eigenspace of the quantum walk from the underlying cellar automaton by $\mathcal{L}$. Secondly, we show that in the Grover walk case, which is intensively studied from the view points of quantum search algorithms and scattering theories, the orthogonal complement eigenspace $\mathcal{L}$ is generated by a homological structure of the graph. Finally, we extend our notion to an infinite abelian covering graph. As an application, we discuss the following typical stochastic properties of quantum walks; localization and linear spreading.

September 27th (Sat) Conference Room VIII

9:30–11:55 Special Session "Moving boundary problems and its numerical and mathematical analysis"

Tetsuya Ishiwata (Shibaura Inst. of Tech.) Motion of polygonal curves by crystalline curvature flow ····· 45

Summary: In this talk we consider the motion of planar polygonal curves governed by generalized crystalline curvature flow with a driving force: $\beta(N_j)V_j = U - g(H_j)$, where V_j, N_j and H_j denote an outward velocity, an outward normal vector and a crystalline curvature of the j-th *facet* of solution curve, respectively. Here, "facet" means a lines segment of solution curve $\Gamma(t)$. The positive function β and U describe an anisotropy of the mobility and a driving force, respectively. We consider 2 cases. One is the case when solution curves are closed. The other is the case when solution curves have infinity length. For both cases, we disuss a behavior of polygonal curves, especially, we mainly consider a deformation of solution curves.

Summary: We consider a polygonal analogue of the Hele-Shaw moving boundary problem with surface tension based on a framework of polygonal motion proposed by Benes–Kimura–Yazaki (2009). This is a generalization of the crystalline motion for the curvature flow which was originally proposed by Angenent–Gurtin (1989) and J. E. Taylor (1993).
A key idea is to introduce a polygonal Dirichlet-to-Neumann map. We study variational properties of the polygonal Dirichlet-to-Neumann map and show that our polygonal Hele-Shaw problem is an almost complete analogue of the original problem. Local solvability of a polygonal Hele-Shaw problem is proved by means of the variational structure. We also give several polygonal versions of moving boundary problems such as the curvature flow, the Hele-Shaw flow and the Stokes flow etc. with some numerical examples. Our polygonal motions exactly satisfy properties of curve shortening and/or area preservation.
This is a joint work with Shigetoshi Yazaki (Meiji University) and Daisuke Tagami (Kyushu University).

Summary: Multifluid and multiphase flows with surface tension are encountered frequently in scientific and engineering problems. Recently we have developed an energy-stable Galerkin-characteristics scheme to two-fluid flow problems with surface tension, where each flow is governed by the Navier–Stokes equations. After presenting excellent features of this scheme, we simulate numerically some multiphase flow problems such as rising bubbles and falling droplets by the use of it.

14:15–16:30

Summary: In this study, we were interested in quantifying and modeling the ecliptic phase during virus infection. One simple mathematical approach describing this phase is modeling by delay differential equations (DDE). However, unfortunately, the distribution of the ecliptic phase was poorly understood. Here, from cell culture experiments with simian/human immunodeficiency virus (SHIV), we quantified the distribution of the ecliptic phase and found that the phase obeys gamma distribution. Based on this experimental result, we made a mathematical model including the distribution by DDE and estimated viral parameters from previously published experimental data. Our analyses showed that modeling the ecliptic phase affected estimation of the virus infection rate (therefore, basic reproductive number) but not the virus production rate and the death rate of infected cells.

Summary: In this talk, we focus on an age-space-structured SIS epidemic model which is formulated as a nonlinear diffusion system of partial differential equations. In order to apply a traditional approach of integral operators, we use the Feynman–Kac formula in probability theory and express the solution of the system explicitly in terms of expected value. After that we reformulate the problem of existence of the solution to a fixed-point problem for a nonlinear operator and show that such a fixed-point exists if and only if the spectral radius of the next generation operator, that is, the well-known basic reproduction number R_0 is greater than unity.

Summary: In this talk, we generalize the concept of persistence modules on A_n quivers to commutative ladder quivers. This class of persistence modules frequently appears in topological data analysis, and the theory and algorithm proposed in this talk can be applied to these practical problems. A new algebraic framework deals with persistence modules as representations on associative algebras and the Auslander-Reiten theory is applied to develop the theoretical and algorithmic foundation.

Summary: In topological data analysis, the idea of persistence modules on commutative ladders is a recent development extending the ideas of persistent homology to a more general setting. In particular, it can be used to study common robust topological features. In this talk, we discuss the computation of persistence modules on commutative ladders of finite type, focusing on the use of Morse reductions to reduce computation times.

Summary: A coverage problem in sensor networks was partially solved by V. de Silva and R. Ghrist by using homology. In this talk, we apply persistent homology to the coverage problem, and present a coverage theorem with perturbation.

Summary: At universities, mathematics lecturers have to change their teaching materials and methods according to students' mathematical skills, and also have to make them understand mathematics. In this paper, we apply the questionnaire analysis in some undergraduate mathematics lectures for the method of students' needs analysis using the Kano model, and report the results.

Summary: Development of technology for detecting of the cancer lesions from digitized pathological specimens has been studied for a long time. This type of system has been developed based on the pattern recognition technology. Because the cancer tissues have too various forms, this technology does not work well.
Here we introduce a new method. By using a mathematical theory (homology theory), our system has been designed. Our method can estimate the contact degree of elements in the tissue of unit area. We may consider that, by the loss of contact inhibition, cancer lesions are included in high contact degree area. We have tried this method to pathological images and obtained satisfactory good results.

34 Kazuaki Nakane (Osaka Univ.) Image analysing method via homology II —for general structures— 15

Summary: There are structures that are formed with a certain order. For these kind of structures, research is progressing from both the theory and experiment. There are many examples we cannot find the rule of structures at first glance. In these cases, it is difficult to make mathematical description. Some of the structures, we apply the topological method and attempt to classify. The structures are constituted by the contact between the components. Homology can also be considered the concept of evaluating the degree of contact. We set the size of the unit area and calculate the indexes which are depended on the Betti numbers. This is the principle that quantify the degree of contact.

16:45–17:45 Talk Invited by Applied Mathematics Section

Yoshihito Oshita (Okayama Univ.) Motion of droplets driven by curvature and potential

Summary: We consider the motion of small droplets driven by the curvature and the potential in a bounded domain and show that the center of the droplets moves along a solution of some reduced equation in a small volume fraction limit and compare its homogenization limit as well.

September 28th (Sun) Conference Room VIII

9:30–11:50

35 Shunzi Horiguchi (Niigata Sangyo Univ.) The conditional expressions III which compare convergences of Ttsuchikura–Horiguchi method (the first extended recurrence formula of Yoshimasu Murase–Newton's type) 10

Summary: We obtained extension of Newton–Raphson method (Ttsuchikura–Horiguchi method). We give the conditional expressions III which compare convergences of Ttsuchikura–Horiguchi method (the first extended recurrence formula of Yoshimasu Murase–Newton's type).

36 Shunzi Horiguchi (Niigata Sangyo Univ.) The numerical computations of the conditional expressions III which compare convergences of Ttsuchikura–Horiguchi method (the first extended recurrence formula of Yoshimasu Murase–Newton's type) 10

Summary: We give the numerical computations of the conditional expressions III which compare convergences of Ttsuchikura–Horiguchi method (the first extended recurrence formula of Yoshimasu Murase–Newton's type).

37 Issei Oikawa (Waseda Univ.) A hybridized discontinuous Galerkin method with reduced stabilization 15

Summary: In this talk, we propose reduced stabilization of the hybridized discontinuous Galerkin methods. We show error estimates and numerical results. A new theoretical tool for analysis of the proposed method is also proposed.

Summary: We consider the characteristics finite element method for the Navier–Stokes equations. The conventional scheme cannot be implemented precisely because the composite function terms are not polynomials. In the analysis of the conventional scheme, however, it is assumed that the terms are integrated exactly. We have developed a scheme free from quadrature errors that can be precisely implemented for the convection-diffusion equations. Here we show that the scheme can be extended to the Navier–Stokes equations to achieve an optimal convergence result.

Summary: The penalty method for Stokes problem with slip boundary condition is concerned. We derive the optimal error estimate of penalty method. The smooth boundary is approximated by straight polygonal lines, then finite element method is applied to solve the penalty problem. The error estimate of finite element approximation is achieved. Some numerical experiments are presented to verify our theoretical results.

Summary: Maximal regularity is one of fundamental concepts in theory of partial differential equations. It, for example, provides us a convenient way to establish the well-posedness for a wide class of nonlinear equations. Therefore, it is natural to ask whether a discrete analogue of maximal regularity is available. Furthermore, we are interested in application of discrete maximal regularity to error analysis of various discretization of nonlinear equations. In this paper, we first prove a maximal regularity result for time-discrete abstract Cauchy problem in a UMD space. Then, we also report an application of such discrete maximal regularity result to the finite element method for the heat equation and obtain reasonable a priori estimate.

Summary: As an open boundary condition (a kind of artificial boundary conditions) for viscous incompressible fluids flow simulation, we propose a unilateral boundary condition. With our boundary condition, the Navier–Stokes equation satisfies an energy inequality so that we can avoid numerical instability in 3D simulations. In this paper, we restrict ourselves to a model Stokes problem and report some results on the finite element approximation.

42 Yuuki Ueda (Univ. of Tokyo)
Norikazu Saito (Univ. of Tokyo)
On a high-accurate successive time-discretization method based on B-spline interpolation functions 15

Summary: Recently, K. Takizawa and T. Tezduyar proposed a new time discretization method, which they call space-time computation techniques with continuous representation in time (ST-C), for fluid-structure interaction problem. The method is based on B-spline interpolation functions and, consequently, is highly accurate. In this paper, we examine the successive projection technique (SPT), which is a most basic technique among ST-C, and report the well-posedness of the algorithm and a certain error estimation.

43 Khoji Ohtsuka
(Hiroshima Kokusai Gakuin Univ.)
Solution of the shape optimization problem with Generalized J-integral by adjoint method 15

Summary: Let Ω be a domain on which the boundary value problem is defined and $u(\Omega)$ the solution. We study the shape optimization problem to find the shape which is optimal in that it minimizes the cost functional $\int_\Omega g(u(\Omega))dx$ with the volume constraint, $|\Omega|$=constant. In this study, we talk how to solve shape optimization problems with Generalized J-integral coming from fracture mechanics, H1-gradient method proposed by Prof. Azegami and adjoint method.

14:15–16:15

44 Koichi Anada
(Waseda Univ. Senior High School)
Tetsuya Ishiwata
(Shibaura Inst. of Tech.)
Some features for blow-up solutions of a nonlinear parabolic equations 15

Summary: In previous studies we have shown some conjectures for behavior of blow-up solutions to a nonlinear parabolic equations. They are very important features to investigate behavior of solutions near their blow-up time. The purpose of our paper is to prove one of them that we call weak eventual monotonicity.

45 Takiko Sasaki (Univ. of Tokyo)
Norikazu Saito (Univ. of Tokyo)
Blow-up of finite difference solutions for nonlinear Schrödinger equations 15

Summary: The purpose of this paper is to establish a numerical method for computing blow-up solutions of one-dimensional nonlinear Schrödinger equations with power nonlinearlities. There are various techniques for computing blow-up solutions of nonlinear heat and wave equations. However, a little is known for the nonlinear Schrödinger equations. In this paper, we propose a finite difference scheme that can approximate the blow-up phenomena. Thus, after having established converge results, we show that the numerical blow-up time actually converges to the blow-up time of the the nonlinear Schrödinger equation under consideration.

46 Daisuke Tagami (Kyushu Univ.)
An iterative domain decomposition method for eddy current problems with the gauge condition 15

Summary: An iterative domain decomposition method is introduced into eddy current problems, which is formulated by a mixed method with the Lagrange multiplier. By introducing the mixed method, a two-subdomain problem is equivalent to the conventional one-domain problem, and yields an interative domain decomposition method of eddy current problems. Moreover, to mathematically justify the previous formulation, the formulation based on the mixed method has been established a connection with the previous one.

Summary: We construct the variational structure-preserving numerical scheme for the one phase Hele-Shaw flow and examine its effectivity numerically. We modify the CSM invariant scheme in order to satisfy the area-preserving property by posing a condition that the weighted average of charges is equal to 0.

Summary: We study a three-dimensional dynamical system defined by ordinary differential equations. Craik has shown that an exact solution to 3D Navier–Stokes equation is constructed by using a solution to the equations. Craik and Okamoto have found out that almost all orbits of the system are unbounded and an unstable periodic orbit plays an important role in determining the destination of an unbounded orbit. We prove the existence of such a periodic orbit by a method of numerical verification based on interval arithmetic. When passing through the vicinity of the periodic orbit, an orbit draws a four-leaf. If one adds damping terms to the system, one can observe a four-leaf chaotic attractor. We also study the route to four-leaf chaos.

Summary: Where there is an adhesion of a stable or unstable limit cycle to a saddle equilibrium point in nonlinear systems, the limit cycle is made up into separatrix loop. It is known the computational method of parameter values for shaping the limit cycle into the separatrix loop by using numerical integration on the alpha branch streaming out from the equilibrium point. The alpha branch is likely to happen because the instability of the alpha branch is to prevent the branch returning to in the neighborhood of equilibrium point, as a result a new computational method using bisection method is brought in.

Summary: Can two unstable waves make a stable pulse? This problem was solved affirmatively by Nii and Sandstede–Scheel, independently. In particular, The stability of pulse is connected with absolute spectrum. But, their results depends on the codimension of a bifurcation. In this talk, we show that an extension between the stability of pulse and the absolute spectrum with higher codimension bifurcation.

16:30–17:30 Talk Invited by Applied Mathematics Section

Takeshi Takaishi
(Hiroshima Kokusai Gakuin Univ.)

A phase-field model for crack growth and its numerical verification

Summary: A phase field model for crack growth in two or three dimensional isotropic elastic material is proposed by the author and Kimura. A phase-field to represent the shape of the crack with a regularization parameter $\epsilon > 0$ is introduced in the model. The phase field model is derived as a gradient flow of this regularized energy that is approximated by the Francfort–Marigo type energy using the idea of Ambrosio and Tortorelli. The model is convenient to study the mathematical property of crack growth for theoretical and numerical analysis, such as the equilibrium profiles of the phase-filed. Numerical results shows the two or three-dimensional structure of crack surface.

Topology

September 25th (Thu) Conference Room VI

9:20–12:00

1 Kazuaki Higa (Kochi Univ.)
Ryo Kato
Katsumi Shimomura (Kochi Univ.)

A surviving condition on permanent cycles in the Adams E_2-term · · · · 10

Summary: For a nontrivial element in the Adams spectral sequence, we give a new condition for surviving to the stable homotopy groups of spheres. It may be seen as a generalization of many works of Xiugui Liu and collaborators.

2 Kentaro Miyazawa (Kochi Univ.)
Katsumi Shimomura (Kochi Univ.)

On the action of Greek letter element β_1 in the stable homotopy groups of spheres · 10

Summary: In this talk, we consider the action of β_1 in the stable homotopy groups of spheres using the method's of Ravenel's small descent spectral sequence.

3 Norihiko Minami
(Nagoya Inst. of Tech.)

On the Beilinson–Rosenblyum isogeny theorem of the Hurewicz functor for infinite loop spaces · 15

Summary: I shall offer a slightly streamlined proof of the Beilinson–Rosenblyum isogeny theorem of the Hurewicz functor for infinite loop spaces. Universal torsion order estimates of the kernel and the cokernel of the Hurewicz homomorphism functor are also slightly improved.

4 Saki Itagaki (Kochi Univ.)
Yutaka Hemmi (Kochi Univ.)

Correspondence between categories of finite topological spaces and finite simplicial complexes · 10

Summary: There is a functor from the category of finite topological spaces $\mathcal{F}top$ to the category of finite simplicial complexes. This functor is faithful but is not full. To make this functor full, we consider a weaker version of continuity of maps between finite topological spaces and consider an extend category $\mathcal{F}top_{ex}$ of $\mathcal{F}top$. Moreover, we can define the homotopy in $\mathcal{F}top_{ex}$ so that two finite topological spaces have the same homotopy type in $\mathcal{F}top_{ex}$ if and only if the corresponding simplicial complexes have the same strong homotopy type.

5 Takahiro Matsushita (Univ. of Tokyo)

The simplicial sets related to the Hom complexes of graphs · · · · · · · · · · 10

Summary: For a positive integer r, an r-set we say in this talk is a set X with a subset of the r-times direct product X^r of X. For r-sets X and Y, we construct the poset $\mathrm{Hom}(X, Y)$ called the Hom complex, and the simplicial set $\mathrm{Sing}(X, Y)$ called the singular complex. We show that their geometric realizations are homotopy equivalent. The Hom complex of r-sets is the generalization of the Hom complexes of graphs which have been applied to the graph coloring problem in graph theory.

Summary: Let G be a Lie group and BG a classifying space of G. Then we can recognize a characteristic class of principal G-bundles as an element in H*(BG). In general BG is a very huge space so we can not use the ordinary de Rham cohomology theory on it. However if use the simplicial de Rham theory due to mainly Bott–Shulman–Stasheff and Dupont, we can exhibit a cocycle which represents an element in H*(BG) as a differential form on a simplicial manifold NG. In this presentation I will exhibit a cocycle in a simplicial de Rham complex which represents the Dixmier–Douady class in the sense of Carey–Crowley–Murray. It is a characteristic class of a principal G-bundle whose fiber has a central U(1)-extension.

Summary: Let $G^{\xi}_{*}(X)$ be the fibre-restricted Gottlieb group with respect to a fibration $\xi : X \to E \to Y$ in CW complexes. It is a subgroup of the Gottlieb group $G_{*}(X)$ of X. When $Y = BS^1$ and X is the product of odd-spheres, we illustrate a variety of Gottlieb poset, which is the poset of subspaces $G^{\xi}_{*}(X) \otimes \mathbb{Q}$ in $G_{*}(X) \otimes \mathbb{Q}$.

Summary: We investigate the loop homology of a simply-connected Noetherian Hopf spaces. It turns out that non-triviality of the loop product characterizes the finiteness of the cohomology of such Hopf spaces.

Summary: We describe a necessary and sufficient condition for a toric manifold to admit a spin structure. This implies that a toric manifold admits a spin structure if and only if its real part is orientable. It is known that a Delzant polytope can be constructed from a simple graph, so that one can associate a toric manifold to a simple graph. We characterize simple graphs whose associated toric manifolds admit spin structures.

Summary: We study intersection numbers in the toric manifold associated with the fan determined by the Weyl chambers for the root system of type A. We give a combinatorial formula for intersection numbers of certain subvarieties which are naturally indexed by elements of the Weyl group. These numbers describe the ring structure of the cohomology of the toric manifold.

11 Tatsuya Horiguchi (Osaka City Univ.)
Megumi Harada (McMaster Univ.)
Mikiya Masuda (Osaka City Univ.)
The equivariant cohomology rings of Peterson varieties ····· 10

Summary: Let G be a complex semisimple linear algebra group and let Pet be the Peterson variety in the flag variety G/B. The main theorem gives an efficient presentation of the S-equivariant cohomology ring of the Peterson variety as a quotient of a polynomial ring by an ideal J generated by quadratic polynomials. Here the group S is a certain circle subgroup of a maximal torus T of G. Our description of the ideal J uses the Cartan matrix and is uniform across Lie types. Our result generalizes a previous theorem of Fukukawa–Harada–Masuda, which was only for Lie type A.

12 Takayuki Yamaguchi (Hiroshima Univ.)
Tomonori Fukunaga (Hokkaido Univ.)
Takaaki Yamanoi (Hokkaido Univ.)
Complete classification of Gauss words of rank less than or equal to 5 by universal finite type invariant ····· 10

Summary: We show complete classification of Gauss words of rank less than or equal to 5, which is obtained by the universal finite type invariant of degree 7. We also show truncated Polyak algebras of Gauss words of rank less than or equal to 7. The invariant and the truncated Polyak algebras have been calculated by our computer program.

14:15–15:25

13 Yukinobu Yajima (Kanagawa Univ.)*
Yasushi Hirata (Kanagawa Univ.)
The D-space property of infinite products ····· 10

Summary: It is proved by an elementary submodel that any countable product of subparacompact $\mathcal{DC}$-like spaces is a D-space. More generally, we prove that any uncoutable product of subparacompact $\mathcal{DC}$-like spaces is a D-space if and only if each factor of the product is compact except contably many ones.

14 Tatsuhiko Yagasaki (Kyoto Inst. Tech.)
Taras Banakh (Ivan Franko Nat. Univ. of Lviv)
Kotaro Mine (Univ. of Tokyo)
Katsuro Sakai (Kanagawa Univ.)
Homeomorphism groups of non-compact surfaces endowed with the Whitney topology ····· 15

Summary: We study topological type of the homeomorphism group $\mathcal{H}(M)$ of any non-compact connected surface M endowed with the Whitney topology and show that the identity connected component $\mathcal{H}_0(M)$ of $\mathcal{H}(M)$ is homeomorphic to the product $l_2 \times \mathbb{R}^\infty$.

15 Takashi Shimomura (Nagoya Univ. of Econ.)
Ergodic measures and graph circuits of a sequence of covers ····· 10

Summary: We have shown that every 0-dimensional system is an inverse limit of a sequence of finite directed graph covers. In this expression, all invariant measures are expressed as a limit of barycenters of circuits of each finite directed graph. Consider the case in which each system of all circuits of a graph is linearly independent. Then, a condition for the invariant measure to be ergodic is given. This condition seems to mean that the time average and the space average coincide.

16 Takashi Shimomura (Nagoya Univ. of Econ.) Combinatorial construction of completely scrambled compact system 10

Summary: Since Li and Yorke developed the notion of scrambled sets in the study of chaotic systems, there has been some discussion as to how large such sets can be. In 1997, Mai reported a non-compact example that is completely scrambled, i.e., the scrambled set is the whole space, and conjectured that there was no compact example. Huang and Ye later disputed this conjecture. They constructed a compact, 0-dimensional completely scrambled system. They also reported the existence of locally equicontinuous transitive examples. We construct a set of examples that are completely scrambled, transitive and not locally equicontinuous.

17 Takamitsu Yamauchi (Ehime Univ.) On coarse geometric infinite-dimensionality of the countable direct sum of the integers 15

Summary: Asymptotic property C is an infinite-dimensional property in coarse geometry in the sense that every metric space with finite asymptotic dimension has asymptotic property C. It was introduced by Dranishnikov as a coarse geometric analogue of Haver's property C in dimension theory. In this talk, we discuss a question of Dranishnikov and Zarichnyi which asks whether the countable direct sum of the integers has asymptotic property C.

15:45–16:45 Talk Invited by Topology Section

Brian Bowditch (Univ. of Warwick / Tokyo Tech) * Rigidity results for spaces associated to a surface

Summary: A quasi-isometry between two metric spaces is a map which preserves their large-scale geometry, or more precisely, distances to within fixed linear bounds. An important aspect of geometric group theory is to describe the possible quasi-isometries between various naturally occurring spaces. For example, it was shown recently by Behrstock, Kleiner, Minsky and Mosher that (apart from a few exceptional cases) the mapping class group of a compact orientable surface is quasi-isometrically rigid. That is, any self quasi-isometry of (a Cayley graph of) the mapping class group agrees, up to bounded distance, with left multiplication by an element of the group. We aim to describe some of the ideas behind this, as well as some strengthenings and variations to other spaces such at the Weil–Petersson metric on Teichmüller space. Our approach makes use of the theory of median algebras.

September 26th (Fri) Conference Room III

10:30–10:45 Presentation Ceremony for MSJ Geometry Prize 2014

10:50–11:50 Award Lecture for MSJ Geometry Prize 2014
—Celebrating Professor Masatake Kuranishi—

Ryushi Goto (Osaka Univ.)
Kimio Miyajima (Kagoshima Univ.*) Kuranishi's masterpieces and their developments in deformation theory and CR-geometry

Summary: In this talk, we discuss Kuranishi's works and their developments focussing on deformation theory and CR-geometry.

Conference Room VI

13:00–14:15

18 Masaaki Suzuki (Meiji Univ.)
Takuya Sakasai (Univ. of Tokyo)
Shigeyuki Morita (Univ. of Tokyo*/Tokyo Tech*)
Integral Euler characteristic of Out F_{11} ····· 10

Summary: The integral Euler characteristic of Out F_{11} is -1202.

19 Shunsuke Tsuji (Univ. of Tokyo)$^{\flat}$
The logarithms of Dehn twists on non-orientable surfaces ····· 15

Summary: We introduce a Lie algebra associated with a non-orientable surface, which is an analogue for the Goldman Lie algebra of an oriented surface. As an application, we deduce an explicit formula of the Dehn twist along an annulus circle on the surface as in Kawazumi–Kuno and Massuyeau–Turaev.

20 Nariya Kawazumi (Univ. of Tokyo)
The Turaev cobracket, the Enomoto–Satoh traces and the divergence cocycle in the Kashiwara–Vergne problem ····· 15

Summary: We interpret the divergence cocycle in the Kashiwara–Vergne problem and the Enomoto–Satoh obstructions for the surjectivity of the Johnson homomorphisms as some part of a regular homotopy version of the Turaev cobracket.

21 Tomohiko Ishida (Kyoto Univ.)
Masatoshi Sato (Gifu Univ.)
A twisted first homology of the handlebody mapping class group ····· 10

Summary: We compute first homology of the handlebody mapping class group with twisted coefficient.

22 Tomohiko Ishida (Kyoto Univ.)
Vanishing of volume flux groups ····· 10

Summary: We give a sufficient condition for vanishing of volume flux groups, which was first proved by Kędra–Kotschick–Morita in another way.

September 27th (Sat) Conference Room VI

9:20–11:50

23 Inasa Nakamura (Univ. of Tokyo)
Two-dimensional braids over a surface link ····· 10

Summary: For an oriented surface link S, we can take a satellite construction called a 2-dimensional braid over S, which is a surface link in the form of a covering over S. We demonstrate that 2-dimensional braids over surface links are useful for showing the distinctness of surface links.

Summary: We prove that any descending diagram presents a trivial welded knot. This implies that the crossing change is an unknotting operation in the category of welded knots. As an application, we prove that there is an embedding of the product of a θ-graph and a circle whose constituents present three given ribbon knotted torus in 4-space.

Summary: Boyle classified 1-handles attached to surface-knots, that are closed and connected surfaces embedded in the Euclidean 4-space, in the case that the surfaces are oriented and 1-handles are orientable with respect to the orientations of the surfaces. We classify 1-handles attached to surface-knots in the case that the surface-knots are oriented and 1-handles are non-orientable, and in the case that the surface-knots are non-orientable.

Summary: We solve a strong version of Kirby's problem 3.6 (D), that is, we show that for any integer γ, there exist infinitely many mutually distinct knots such that 2-handle additions along them with framing γ yield the same 4-manifold.

Summary: We define X_n to be the 4-dimentional handlebody represented by the Kirby diagram which is a simple link of two left handed trefoil knots with framing (0, n), and define M_n to be the boudary of X_n. Note that M_n is a homology 3-sphere. It is known that M_{-6} bounds a contractible 4-manifold. First we show that we can get a homotopy $K3$ surface by using M_{-6} and Kirby Calculus. Next we show that a knot is not a slice knot and if n is larger than 0, M_n does not bound any contractible 4-manifolds by using adjunction inequality.

Summary: In the study of (topological, 4-dimensional) Lefschetz fibrations, to investigate (-1)-sections of a given Lefschetz fibration is a fundamental and important problem concerning Lefschetz pencils, hence symplectic topology. On the other hand, Yukio Matsumoto originally constructed a genus-2 Lefschetz fibration with eight singular fibers, and then, Cadavid and Korkmaz independently generalized it to the higher genera. Those Lefschetz fibrations has played a great role in the development of the theory. In this talk, we show explicit monodromies of those fibrations which describe a set of disjoint (-1)-sections. The number of the (-1)-sections involved is the largest ever known, and possibly maximal.

29 Takuya Ukida (Tokyo Tech) A genus zero Lefschetz fibration on the Akbulut cork ····· 10

Summary: We construct a genus zero positive allowable Lefschetz fibration over the disk (a genus zero PALF for short) on a cork introduced by Akbulut and describe the monodromy as a positive factorization in the mapping class group of a fiber. We also examine the monodromies of genus zero PALFs on infinitely many exotic pairs of compact Stein surfaces such that one is obtained by applying a cork twist to the other.

30 Takahiro Oba (Tokyo Tech) Diffeomorphism types of Stein fillings and mapping class groups ····· 15

Summary: Classification of Stein fillings of a given contact manifold has been discussed as a crucial problem in contact geometry. In particular, it is important to examine which contact manifold has a unique Stein filling. Uniqueness of Stein fillings had often been clarified by symplectic geometry before 2010, while it is sometimes proved by using combinatorics in mapping class groups after 2010. In this talk, considering Lefschetz fibrations over D^2 and mapping class groups, I will present a condition for a Stein fillable integral homology 3-sphere to have a unique Stein filling. Moreover I will mention a result of weak fillings of the same manifold.

31 Naohiko Kasuya (Univ. of Tokyo) On contact submanifolds of the odd dimensional Euclidean spaces ···· 15

Summary: We prove that a closed co-oriented contact 3-manifold can be a contact submanifold of some contact structure on $\mathbb{R}^5$, if and only if the first Chern class is trivial. We also prove that a closed co-oriented contact $(2m+1)$-manifold (M^{2m+1}, ξ) can be a contact submanifold of the standard contact structure on $\mathbb{R}^{4m+1}$, if it satisfies one of the following conditions: (1) m is odd ($m \geq 3$) and $H_1(M^{2m+1}; \mathbb{Z}) = 0$, (2) m is even ($m \geq 4$) and M^{2m+1} is 2-connected, (3) $m = 2$ and M^5 is simply-connected.

32 Tomohiro Horiuchi (Chuo Univ.) Leafwise holomorphic automorphisms of Reeb components ····· 15

Summary: The aim of this study is to classify the structures of the Reeb component as a Levi flat CR manifold, by considerating the leafwise holomorphic automorphisms.

14:15–15:40

33 Kuniyuki Takaoka (Waseda Univ.) LR number of spherical closed curves ····· 10

Summary: Given an oriented spherical closed curve with n transverse crossing points, we assign a cyclic word of length $2n$ on two letters L standing left and R standing right by reading the crossing sign so that each crossing point is read once L and once R. The LR number is the number of appearence of the subword LR. In this talk, we completely determine oriented spherical closed curves whose LR number is less than or equal to three.

Summary: A triple chord is a circle and three chords whose endpoints are on the circle and any two chords are mutually intersect. A chord diagram of a spherical curve consists of a circle and chords, each of which connects the preimages for every double point. In this talk, we consider a relationship between the number of triple chords as sub-chord diagrams and an equivalence relation called strong (1, 2) homotopy for spherical curves.

Summary: The second Reidemeister move can be decomposed into two types, respectively called strong or weak. This talk gives a necessary and sufficient condition that two spherical curves are equivalent by a finite sequence consisting of the first and the strong second Reidemeister moves. Similarly, we obtain a necessary and sufficient condition in the weak case. We also define an integer-valued invariant with respect to the first and the strong second Reidemeister moves.

Summary: The Arnold invariant J^+ for generic plane curves counts the number of local moves called direct self-tangency perestroika in a generic regular homotopy from a standard curve to a given one. In this talk we will give infinitely many regular homotopic curves with the same J^+ which cannot be mutually related by any generic regular homotopies without direct self-tangency perestroika.

Summary: Long embeddings $\mathbb{R}^{4k-1} \hookrightarrow \mathbb{R}^{6k}$ are classified by Haefliger invariant. We show that Haefliger invariant behaves as it is of order two. As a byproduct we obtain an invariant for long generic immersions $\mathbb{R}^{4k-1} \looparrowright \mathbb{R}^{6k-1}$ which can be lifted to embeddings $\mathbb{R}^{4k-1} \hookrightarrow \mathbb{R}^{6k}$.

Summary: The notion of lowerable vector field was introduced by Arnol'd for studying bifurcations of wave front singularities. Is the module of lowerable vector fields finitely generated in general? In this talk, we give a partial affirmative answer to this problem.

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

Masaharu Ishikawa (Tohoku Univ.) Stable maps and branched shadows of 3-manifolds

Summary: The stable maps play an important role in the study of smooth manifolds, especially used for obtaining topological information of the source manifold from the types of their singularities as seen in Morse theory. We are studying stable maps from orientable 3-manifolds to a plane. A shadow is a polyhedron equipped with a half integer on each region. The 3-manifold represented by a shadow is a kind of circle bundle over the polyhedron. F. Costantino and D. Thurston regarded the Stein factorization of a stable map as a shadow and used it to construct a shadow from a triangulation of a 3-manifold.
The aim of our study is to get information of "complexity" of 3-manifolds from stable maps. We show that the stable map complexity is equal to the branched shadow complexity for a compact orientable 3-manifold possibly with torus boundaries; the former is the minimal number of singular fibers of codimension 2 of stable maps of the 3-manifold and the latter is the minimal number of vertices of its branched shadows. These complexities estimate the volume from above and below in case the manifold is hyperbolic. We also classify hyperbolic links in the 3-sphere whose exteriors have the complexity 1 in terms of Dehn surgeries. This is joint work with Yuya Koda.

September 28th (Sun) Conference Room VI

9:20–12:00

Summary: The odd writhe is a numerical invariant of virtual knots defined by L. Kauffman. S. Satoh and K. Taniguchi introduced a series of numerical invariants of a virtual knot, called n-writhes. They are a refinement of the odd writhe. The n-writhes are related to the index polynomial defined by Y. Im, K. Lee and Y. Lee and A. Henrich and the affine index polynomial definined by Kauffman. We discuss a generalization of them to a twisted knot.

Summary: A *state* of a virtual knot diagram D is a union of circles obtained from D by splicing all real crossings. Let $s_n(D)$ be the number of states of D consisting of n circles. The *n-state number* of a virtual knot K is the minimal number of $s_n(D)$ for all possible virtual knot diagrams of K. In this talk, we consider a set of virtual knots whose n-state number is equal to i for each non-negative integer i and study the finiteness of the set.

Summary: A Delta-crossing tangle is a tangle of three arcs with three crossings, which is appeared in a Delta move. A Delta-crossing diagram is a diagram which can be decomposed into Delta-crossing tangles joined by simple arcs. We prove that every knot has a Delta-crossing diagram, and then investigate the Delta-crossing number which is the minimum number of Delta-crossing tangles among all Delta-crossing diagrams of the given knot. We obtain upper and lower bounds on the number in terms of the ordinal crossing number and genus.

Summary: Let $L = L_1 \cup L_2 \cup ... \cup L_n$ be a link in $\mathbb{R}^3$ such that L_i is a trivial link for each $1 \leq i \leq n$. Let P_1, P_2, ..., P_n be mutually distinct flat planes in $\mathbb{R}^3$ such that no two of them are parallel. Then there is a link $L' = L'_1 \cup L'_2 \cup ... \cup L'_n$ in $\mathbb{R}^3$ such that L is ambient isotopic to L' and $L'_i \subset P_i$ for each $1 \leq i \leq n$.

Summary: A handlebody-knot is a handlebody embedded in the 3-sphere. It is a fundamental problem to give a suitable orientation for handlebody-knot. We introduce a circulatory orientation and discuss fundamental moves for handlebody-knots.

Summary: In 1998, it was shown by Ozawa that if a knot in the 3-sphere admits an essential free 2-tangle sphere, then its essential tangle sphere is unique. We discuss if the result above could be generalized.

Summary: Let G be a finitely generated group with a finite generating set S. For $g \in G$, let $l_S(g)$ be the length of the shortest word over S representing g. The growth series of G with respect to S is the series $A(t) = \sum_{n=0}^{\infty} a_n t^n$, where a_n is the number of elements of G with $l_S(g) = n$. If $A(t)$ can be expressed as a rational function of t, then G is said to have a rational growth function.
We calculate explicitly the rational growth functions of (p, q)-torus link groups for any $p, q > 1$. As an application, we show that their growth rates are Perron numbers.

Summary: Milnor introduced a family of invariants for ordered oriented links, called $\bar{\mu}$-invariants. Moreover, Habegger–Lin showed that Milnor's invariants are invariants of string link, called μ-invariants. Polyak showed a relation between the $\bar{\mu}$-invariants of length 3 sequence and Conway polynomials. We show that any μ-invariant of length $\leq k$ can be represented as a combination of HOMFLYPT polynomials if all μ-invariant of length $\leq k-2$ vanish. This result is an extension of Polyak's result.

Summary: We calculate the third Ohtsuki inavariant of every Brieskorn–Hamm manifold which is a rational homology 3-sphere. By the result, we show that the third Ohtsuki invariants of Brieskorn–Hamm homology 3-spheres are negative.

Summary: In this talk we discuss the twisted Alexander polynomial associated to parabolic representations of 2-bridge knots. We also give an affirmative answer to a conjecture of Dunfield, Friedl and Jackson for infinitely many hyperbolic knots.

Summary: In this talk we consider a homology 3-sphere M obtained by Dehn surgery along a torus knot and a $SL(2,\mathbb{C})$-irreducible representation of $\pi_1(M)$. Here Reidemeister torsion $\tau_\rho(M)$ can be defined as a complex number. By using Reidemeister torsion $\tau_\rho(M)$ for ρ, we define the semi-torsion plolynomial $\sigma_M(t) = \prod_\rho (t - \frac{1}{2}\tau_\rho)$. In 1980's D. Johnson computed this polynomial for the homology 3-sphere surgeried along (2,3)-torus knot. In this talk we give a formula for this polynomial for a homology 3-sphere along a torus knot. It is a generalization of D. Johnson's formula.

Summary: We study Voronoi diagrams with the spiral sequence $S = \{\zeta^j = r^j e^{\sqrt{-1}j\theta} : j \in \mathbb{Z}\}$ of a covering space M_v of $\mathbb{C}^* := \mathbb{C}\backslash\{0\}$, where $v \in \mathbb{Z}\backslash\{0\}$. They are intimately related to the phyllotaxis and continued fractions. Generically, the tiles are hexagons, while they are quadrilaterals in the degenerate case. For each multiplicity v, the set B_v of generators $\zeta \in M_v$ of quadrilateral multiple tilings is the union of branches of real algebraic curves parameterized by θ. Their union $B = \bigcup_v B_v$ is a dense subset of the unit disk. Moreover, we consider the shapes of quadrilateral tiles when $\theta/2\pi v$ is fixed and r tends to 1. If $\theta/2\pi v$ is a quadratic irrational, then the limit set of the shape parameters is a finite set. In particular, if $\theta/2\pi v$ is linearly equivalent to the golden section $\tau = \frac{1+\sqrt{5}}{2}$, then the limit shape is the square.

Summary: Let M be the cone manifold obtained as the product of the torus with a single cone point of cone angle $\theta \in (0, 2\pi)$ and the interval. We introduce the side parameter for the space of cone hyperbolic structures on M whose holonomy representations are real.

Infinite Analysis

September 25th (Thu) Conference Room IX

10:00–12:00

Summary: We introduce some multivariate analogues of Meixner, Charlier and Krawtchouk polynomials, and establish their main properties, that is, duality, degenerate limits, generating functions, orthogonality relations, difference equations, recurrence formulas and determinant expressions. A particularly important and interesting result is that "the generating function of the generating function" for the Meixner polynomials coincides with the generating function of the Laguerre polynomials, which has reviously not been known even for the one variable case. Actually, main properties for the multivariate Meixner, Charlier and Krawtchouk polynomials are derived from some properties of the multivariate Laguerre polynomials by using this key result.

Summary: We investigate the existence and the orthogonality of the generalized Jack symmetric functions which play an important role in the proof of the AGT conjecture. We show their orthogonality by deforming them to the generalized Macdonald symmetric functions. In addition we talk about a possibility to describe the q-deformed AGT conjecture with help of the generalized Macdonald symmetric functions.

Summary: Multi-indexed Jacobi polynomials are defined by the Wronskian of four types of eigenfunctions of a deformed Pöschl–Teller Hamiltonian. We give a correspondence between multi-indexed Jacobi polynomials and pairs of Maya diagrams, and we show that any multi-indexed Jacobi polynomial is essentially equal to some multi-indexed Jacobi polynomial of two types of eigenfunction. As an application, we show a Wronskian-type formula of some special eigenstates of the deformed Pöschl–Teller Hamiltonian.

Summary: We present a fourfold series expansion representing the Askey–Wilson polynomials. To obtain the result, a sequential use is made of several summation and transformation formulas for the basic hypergeometric series, including the Verma's q-extension of the Field and Wimp expansion, Andrews' terminating q-analogue of Watson's ${}_3F_2$ sum, Singh's quadratic transformation.

5 Ayumu Hoshino (Kagawa Nat. Coll. of Tech.)
Masatoshi Noumi (Kobe Univ.)
Junichi Shiraishi (Univ. of Tokyo)
An explicit formula for Koornwinder polynomial with one row diagram and a proof of Lassalle's conjectures 15

Summary: We present an explicit formula for the Koornwinder polynomial of type BC_n with one row diagram. When the parameters are specialized, we recover Lassalle's formula for Macdonald polynomials of type B_n, C_n and D_n with one row diagram, thereby proving his conjectures.

6 Yosuke Saito (Tohoku Univ.)
Modular double of the Ding–Iohara–Miki algebra obtained from the double sine function 15

Summary: From the kernel function defined by the double sine function, we obtain two free field realizations of the Ding–Iohara–Miki algebra which commute with each other. Similar situations have been observed in studies of modular doubles of quantum groups.

14:15–15:30

7 Youichi Shibukawa (Hokkaido Univ.)
Hopf algebroids associated with dynamical Yang–Baxter maps 15

Summary: We introduce construction of Hopf algebroids by means of dynamical Yang–Baxter maps.

8 Youichi Shibukawa (Hokkaido Univ.)
Rigid tensor categories associated with dynamical Yang–Baxter maps 15

Summary: We introduce rigid tensor categories associated with dynamical Yang–Baxter maps.

9 Masanori Ando (Wakhok Univ.) *
An understanding and its application of the similarity in the generating functions of partitions and strict partitions 15

Summary: The generating functions of partitions and strict partitions are similar. It is trivial in the generating function. However we understand this similarity as combinatorics using simple set theory. And we generalize it to q-identity called Uchimura type.

10 Saburo Kakei (Rikkyo Univ.)
Kenji Kajiwara (Kyushu Univ.)
Toda hierarchy and motion of plane curves by modified KdV hierarchy 15

Summary: A relation between the Goldstein–Petrich hierarchy for plane curves and the Toda lattice hierarchy is investigated. A representation formula for plane curves is given in terms of a special class of τ-functions of the Toda lattice hierarchy.

15:45–16:45 Talk Invited by Infinite Analysis Special Session

Soichi Okada (Nagoya Univ.) Schur-type Pfaffians and their applications to symmetric function

Summary: The evaluation of determinants or Pfaffians plays a key role in combinatorics, representation theory, infinite analysis, and so on. In this talk, we consider generalizations of Schur's Pfaffians $\mathrm{Pf}((x_i - x_j)/(x_i + x_j))$ and $\mathrm{Pf}((x_i - x_j)/(1 - x_i x_j))$. We can express these Schur-type Pfaffians in terms of generalized Vandermonde determinants. By using these formulae, we derive King's column-length restricted version of Littlewood's identities for summations of Schur functions, and Worley's formulae expressing near-staircase Schur's P-functions in terms of Schur functions. Also we discuss extensions and variations of them.

September 26th (Fri) Conference Room IX

10:00–12:00

11 Takeshi Morita (Osaka Univ.) A relation between the divergent bilateral basic hypergeometric series ${}_2\psi_2(a, 0; b_1, b_2; q, x)$ and the basic hypergeometric series ····· 15

Summary: We give the new relation between the bilateral basic hypergeometric series around the origin and the unilateral basic hypergeometric series around the origin by the using of the q-Borel–Laplace transformations.

12 Shin Isojima (Hosei Univ.) Ultradiscrete limit of special function solutions of the Painlevé III equation ····· 15

Summary: The Painlevé III equation possesses a class of special solutions in a determinantal form with the Bessel function elements. In this talk, its ultradiscrete analog is constructed by procedure of ultradiscretization with parity variables.

13 Tomoyuki Takenawa (Tokyo Univ. of Marine Sci. and Tech.) Schlesinger transformations and difference Painlevé equations ····· 15

Summary: Schlesinger transformations are algebraic transformations of a Fuchsian system that preserve its monodromy representation and act on the characteristic indices of the system by integral shifts. One of the important reasons to study such transformations is the relationship between Schlesinger transformations and discrete Painlevé equations. Based on a recent work with A. Dzhamay and H. Sakai, we derive discrete Schlesinger evolution equations describing discrete dynamical systems generated by elementary Schlesinger transformations and give their discrete Hamiltonian description w.r.t. the standard symplectic structure on the space of Fuchsian systems. As an application, we explicitly derive difference Painlevé equations of type $D_4^{(1)}$, $A_2^{(1)*}$ and $A_1^{(1)*}$ from Schlesinger transformations.

14 Kohei Iwaki (Kyoto Univ.), Tomoki Nakanishi (Nagoya Univ.) Exact WKB analysis and cluster algebras ····· 15

Summary: We develop the mutation theory in the exact WKB analysis using the framework of cluster algebras. As we vary the phase of Stokes curves, the Stokes graph changes the topology when a Stokes segment appears. We call this phenomenon the mutation of Stokes graphs. Such a mutation of the Stokes graph causes a Stokes phenomenon for Voros symbols. We show that the Voros symbols mutate as variables of a cluster algebra with surface realization. As an application, we obtain the identities of Stokes automorphisms associated with periods of cluster algebras.

15 Masataka Kanki (Rikkyo Univ.)
Tetsuji Tokihiro (Univ. of Tokyo)
Takafumi Mase (Univ. of Tokyo)
Jun Mada (Nihon Univ.)
Co-primeness condition as an integrability criterion for discrete equations 15

Summary: We study the Laurent property, the irreducibility and co-primeness of discrete integrable and non-integrable equations. First we study a discrete integrable equation related to the Somos-4 sequence, and also a non-integrable equation as a comparison. We prove that the conditions of irreducibility and co-primeness hold only in the integrable case. Next we apply this method to the nonlinear partial difference equations, such as the discrete KdV equation and the discrete Toda equation. We conclude that co-primeness of the terms can be used as a new integrability criterion, which is a mathematical re-interpretation of the confinement of singularities in discrete equations.

16 Akishi Kato (Univ. of Tokyo)
Yuji Terashima (Tokyo Tech)
Quiver mutation loops and partition q-series 15

Summary: A quiver mutation loop is a loop in a quiver exchange graph. We define partition q-series for quiver mutation loops, and show that they enjoy various remarkable properties such as pentagon identities, and modular properties, and relation with fermionic character formulas of certain conformal field theories. The partition q-series are defined solely in terms of combinatorial data and are independent of the details of the system under study.

13:00–14:00 Talk Invited by Infinite Analysis Special Session

Yousuke Ohyama (Osaka Univ.) Classical Analysis on the q-Painlevé equations

Summary: The Painlevé equations are found by Paul Painlevé in 1898. He classified all of second order nonlinear ordinary differential equations without movable branch points. Sakai showed that all of initial value spaces of the Painlevé equations are rational surfaces with some condition. He classified all of such surfaces, and showed that all of elliptic, q-analogue, difference and differential Painlevé equations can be unified in his classification.

There are many researches on the q-Painlevé equations in these twenty years, such that Bcklund transformations, special solutions and their determinant representations. But the properties of generic transcendental solutions are unrevealed. In this talk, we study analytic properties of the q-Painlevé transcendents. We review the Riemann–Hibert–Birkhoff correspondence and study connection formula of the q-Painlevé equations.