

 **Mathematical Society of Japan**

2013 ANNUAL MEETING

Titles and Short Summaries of the Talks

March, 2013

at Kyoto University

2013 Mathematical Society of Japan

ANNUAL MEETING

Dates: March 20th–23rd, 2013

Venue: Kyoto University, Yoshida-South Campus

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21st (Thu)	Algebra 9:00–12:00	Topology 9:30–12:00	Geometry 9:20–11:50	Functional Equations 9:30–12:00	Functional Analysis 9:30–12:15	Applied Mathematics 9:30–11:35	Found. of Math. and History of Math. 9:30–11:40	Real Analysis 9:00–11:55 12:55–13:25	Statistics and Probability 9:00–11:50 13:20–14:30
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	MSJ Prizes Presentation (Clock Tower 1F) (14:50–15:20)								
	Plenary Talks (Clock Tower 1F) MSJ Spring Prize Winner (15:30–16:30) Yoshihiro Tonegawa (Hokkaido Univ.) (16:45–17:45)								
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22nd (Fri)	Algebra 9:00–12:00 14:15–15:00	Topology 10:15–11:50 15:00–16:35	Geometry 9:30–11:30	Functional Equations 9:30–12:00 14:15–16:15	Functional Analysis 10:00–12:00 14:30–15:20	Applied Mathematics 9:00–11:45 14:15–16:30	Infinite Analysis 9:30–11:45 14:15–15:35	Complex Analysis 9:30–12:00 14:20–15:40	Statistics and Probability 9:30–12:00
	Featured Invited Talks					13:00–14:00			
	Invited Talks 15:30–16:30 16:45–17:45		Invited Talks 14:20–15:20 15:40–16:40	Invited Talk 16:30–17:30	Invited Talk 15:40–16:40	Invited Talk 16:45–17:45	Invited Talk 15:45–16:45	Invited Talk 16:00–17:00	Invited Talks 14:30–15:30 15:45–16:45
23rd (Sat)	Algebra 9:00–12:00 14:15–16:45			Functional Equations 9:30–11:45	Functional Analysis 10:30–12:00		Infinite Analysis 9:45–11:40	Complex Analysis 10:00–12:00	
	Featured Invited Talks					13:00–14:00			
				Invited Talk 14:15–15:15	Invited Talk 14:30–15:30		Invited Talk 14:30–15:30	Invited Talk 14:20–15:20	

Plenary Talks

March 21st (Thu) Clock Tower Centennial Hall, Centennial Hall (1F)

MSJ Autumn Prize Winner (15:30~16:30)

Yoshihiro Tonegawa (Hokkaido Univ.)[#] Regularity theories on generalized minimal surfaces and mean curvature flows (16:45~17:45)

Summary: A smooth k -dimensional surface in the n -dimensional Euclidean space, or more generally in a Riemannian manifold, is said to be minimal if its mean curvature vanishes identically. While it is a simple idealized model of soap films, insights gained from the studies on minimal surfaces have been surprisingly relevant to numerous physical and geometric problems, ranging from Navier-Stokes equation and free boundary problems to questions in general relativity. Among others, one extremely rich and powerful approach is to set up a generalized version of minimal surfaces and to analyze their regularity properties using the techniques from geometric measure theory and nonlinear PDE. It was initiated by Federer, Fleming, de Giorgi around 1950's and pursued by Almgren, Simon and many others since then. In this lecture I describe the notions of rectifiability of sets and generalized mean curvature vectors, and review some basic regularity results, mainly Allard regularity theorem, and mention results on area-minimizing case and stable hypersurface case. After that, I explain the much less studied parabolic version of minimal surfaces, namely, the mean curvature flow in the setting of geometric measure theory which is due to Brakke. Our recent regularity results, some relevant existence results and some future challenges are discussed.

Featured Invited Talks

March 20th (Wed)

Conference Room I

Yuzuru Inahama (Nagoya Univ.) Rough path theory —(stochastic) analysis of iterated integrals—
 (13:00~14:00)

Summary: In this talk we give a survey of rough path theory, from the definitions to the latest applications. This theory was invented by T. Lyons around 1998 and is based on two pillars, namely, (i) Itô's theory of stochastic differential equations and (ii) K. T. Chen's theory of iterated integrals of paths.

A rough path is a generalized path and is defined to be a couple of a path itself and its iterated integrals, whose Hölder regularity is rather bad. Probably hinted by K. T. Chen's theory, Lyons constructed line integrals along a rough path and ODEs driven by a rough path. These are continuous as functionals of a rough path. As a result, solutions of SDEs are obtained as continuous images of (the rough path lift of) Brownian motion, in particular, SDEs are made deterministic. This kind of result was inconceivable in the standard probability theory. Moreover, since this theory is basically deterministic, new kind of "SDEs" come into being even when the driving noise is not a semimartingale.

In the end of the talk, if time allows, we discuss recent applications of rough path theory to stochastic PDEs. Last year M. Hairer solved KPZ equation under the periodic condition for the first time. KPZ equation is something like Burgers equation with noise and is now a very important issue in statistical physics. In his theory rough path theory is used in an essential way that solutions of stochastic PDEs run in (a kind of) rough path space. We hope we could have at least a glimpse of this striking development.

Conference Room III

Toshiki Mabuchi (Osaka Univ.)[#] New developments in the Kobayashi–Hitchin correspondence
 for manifolds (13:00~14:00)

Summary: For irreducible holomorphic vector bundles over compact Kähler manifolds, the equivalence between the Takemoto–Mumford stability and the existence of Hermitian–Einstein metrics was proposed by S. Kobayashi in 1970s'. This conjecture was solved affirmatively by Donaldson and Uhlenbeck–Yau for algebraic case and general case, respectively.

An analogy of the correspondence for polarized algebraic manifolds is known as the Donaldson–Tian–Yau conjecture. It proposes the equivalence between the K-stability and the existence of constant scalar curvature Kähler metrics in the polarization class. Last October, G. Tian announced that he solved the conjecture affirmatively in the Kähler–Einstein case. Then soon afterwards, Chen–Donaldson–Song announced a similar result.

In this talk, I would like to discuss such new developments in the Kobayashi–Hitchin correspondence for manifolds by focussing on the announcements by Tian and Chen–Donaldson–Song. Finally, further developments for general polarization cases including the extremal Kähler case will also be discussed.

March 22nd (Fri)

Conference Room I

Guest Talk from the Japan Society for Industrial and Applied Mathematics

Shinichiro Nakamura (RIKEN)[#] In search for hidden mathematics in industrial basic problems (13:00~14:00)

Summary: The author has experienced computational science in Mitsubishi Chemical Research Center for more than 26 years. Subjects were the search for the design principles for catalysts, functional dyes, and many other industrial molecular products.

Examples include the design of photochromic molecular switches and the clarification of mechanism in natural photosynthesis.

The author will try to show the examples of hidden mathematical problems (to the eyes of the author who is not mathematician) in these industrial subjects, such as the relation of requested function and fractal structure of the surfaces, problem of the singularity point in potential energy surfaces, and molecular music.

Conference Room III

Hiroyuki Ochiai * A survey on a classification of unitary representations (13:00~14:00)
(Kyushu Univ./JST CREST)

Summary: This general talk is a coarse overview on a classification of irreducible unitary representations of a real simple Lie group, or almost equivalently, the real points of a reductive algebraic group.

March 23rd (Sat)

Conference Room I

Satoshi Yoshiara[#] Around nonlinear functions (13:00~14:00)
(Tokyo Woman's Christian Univ.)

Summary: I will discuss some topics in the research of nonlinear functions, namely, maps among finite vector spaces which are far from the linear maps. Starting with a review on several fundamental concepts, such as PN and APN functions, differentially uniformity, non-linearity, AB functions, algebraic degree, quadratic functions, CCZ and EA-equivalence, and (extended) discrete Fourier spectra (including the interrelation among PN functions, affine planes and semifields if time is allowed), I will state some of the main problems in this area. Then a brief description is given on the current list of infinite families of APN functions. In the latter part, I will discuss geometric approaches to the nonlinear functions, by means of semiplanes and dimensional dual hyperovals, which turns out to be useful to handle the equivalence problem. Several new results on the CCZ-equivalence among the known APN functions will be given, which are based on two theorems due to the speaker, and to Dempwolff and Edel.

Conference Room III

Junjiro Noguchi (Univ. of Tokyo) Value distribution and distribution of rational points II . . . (13:00~14:00)

Summary: I gave one lecture of this series in the fall of 1997. Since then some fifteen years has passed. I am going to talk about the developments of the value distribution theory for this period, and related topics in Diophantine approximation. The main topics will be such as Corvaja–Zannier–Ru Theorem for hypersurfaces of projective spaces, the second main theorem for entire curves in semi-abelian varieties, some Lang’s conjecture and Erdős–Yamanoi’s unicity Theorem. If time allows, I like to mention Yamanoi’s abc-theorem.

Conference Room IV

Tatsuo Nishitani (Osaka Univ.)[#] The Cauchy problem for partial differential equations with double characteristics (13:00~14:00)

Summary: In the first half of 70’s, Ivrii and Petkov introduced the notion of the fundamental matrix, which is the linearization of the Hamilton flow and now called the Hamilton map, and proved that if the Cauchy problem is C^∞ well-posed for any lower order term then the characteristics are at most double and at every double characteristic point the Hamilton map has non-zero real eigenvalues. If the Hamilton map has no non-zero real eigenvalues then in order that the Cauchy problem is C^∞ well-posed the subprincipal symbol must be real and bounded, in modulus, by the sum of the modulus of pure imaginary eigenvalues of the Hamilton map, which was proved partially by themselves and completed by Hörmander. This was a breakthrough in researches on the Cauchy problem for hyperbolic operators with double characteristics. Since then it has been recognized that what is crucial to the C^∞ well-posedness is not only the structure of the Hamilton map but also the behavior of the Hamilton flow near the double characteristic manifold and the Hamilton map itself is not enough to determine completely the behavior of the Hamilton flow. This lecture is intended to an introduction to the progress after Ivrii-Petkov’s work in characterizing those linear partial differential operators with double characteristics for which the Cauchy problem is C^∞ well-posed.

Foundation of Mathematics and History of Mathematics

March 20th (Wed) Conference Room VII

9:30–11:30

- 1 Teruaki Asai (Nara Univ. of Edu.)* On the table of Plimpton 322 15

Summary: Plimpton 322 is an Old-Babylonian tablet consisting of a table of Pythagorean triples. In this article, we want to show the way how the table was made and the possible purpose of the table. Roughly speaking, the Old-Babylonians had not selected the Pythagorean triples among many possibilities, but rather took all the possible triples. What is revealed in this article is that the most intriguing aspect of the table (the angles of 45° and 30°) turn out to be a mere coincidence.

- 2 Ken Saito (Osaka Pref. Univ.)[#] Diagrams in Euclid's *Elements* —Books 7–13 20

Summary: We have examined the diagrams in Books 7–13 of Euclid's *Elements* in the manuscripts used in the critical edition by Heiberg. The diagrams found in modern translations come from Heiberg's edition, and they have very little to do with manuscript diagrams. We discuss their features using faithful reproductions.

- 3 Shigeru Masuda (Kyoto Univ.)[#] The Fourier's motivations of works in the span of life 20

Summary: The first version of Fourier's Analytical Theory of Heat was forwarded to The institute of Science in 1807, entitled with *Theorie de la propagation de la chaleur dans les solides*, however, this version can be read only in the secondary source of Grattan-Guinness. Fourier reformed it to the prize paper in 1811 and won the prize, and finally he published the main work entitled: *Theorie analytique de la chaleur* in 1822. In 1888–90, G. Darboux edited *Oeuvres de Fourier*, 2nd Ed., however, he says the first version is unknown except for the four pages of extract in *Nouveau Bulletin des Sciences par la Societe Philomatique de Paris*. We would follow the Fourier's motivations of works in the span of life.

- 4 Shigeru Masuda (Kyoto Univ.)[#] The definite integral by Euler and Laplace from the viewpoint of Poisson 20

Summary: Why Poisson pays attention of careful handling to the transcendental function, criticizing the diversion from real to imaginary in definite integral? This is our motivation. Since 1811, Poisson issued many papers on the definite integral, containing transcendental, and remarked on the necessity of careful handling to the diversion from real to imaginary, especially, to Fourier explicitly. To Euler and Laplace, Poisson owes many knowledge, and builds up his principle of integral, consulting Lagrange, Lacroix, Legendre, etc. On the other hand, Poisson feels incompatibility with Laplace's 'passage', on which Laplace had issued a paper in 1809, entitled: *On the 'reciprocal' passage of results between real and imaginary*, after presenting the sequential papers on the occurring of 'one-way' passage in 1782–3. To these passages, Poisson proposes the direct, double integral in 1811, 13, 15 and 20.

- 5 Kenshi Miyabe (Kyoto Univ.)[#] The other history of probability theory 15

Summary: The axiomatic approach to probability theory was proposed by Hilbert 1900 and it made a success. The other approach traces back to the work by von Mises (1919). His theory can be summarized by his word “First the Collective — then the Probability”. In 1960s–70s, Solomonoff used complexity for prediction and called his theory “algorithmic probability”. Shafer and Vovk (2001) constructed probability theory based on unpredictability. All these theories suggest an idea that “the notion of probability is induced from the notion of randomness”.

- 6 Setsuo Takato (Toho Univ.)[#] Consideration of an interpretation of the Fangcheng procedure of *the Nine Chapters on the Mathematical Arts* 15

Summary: Many Chinese and Japanese historians have used Gauss–Jordan elimination to explain the fangcheng procedure of *the Nine Chapters*. To put it another way, they have insisted that back substitution was not used in the fangcheng procedure. Recently Roger Hart, the author of “The Chinese Roots of Linear Algebra”, pointed out that their interpretation was mistaken and it is significant that he did it by translating the original draft faithfully and analyzing the procedure mathematically. In this presentation, we introduce his interpretation and assertion, which seem more appropriate.

14:15–16:30

- 7 Hideyuki Majima (Ochanomizu Univ.)[#] Some remarks on the calculation of pi by Takebe Katahiro 20

Summary: We gave some remarks on the calculation by Takakazu Seki a few years. Seki found the so-called Aitken’s delta-sequenced process in his theory, but there were some errors in his calculation and he only claimed that his approximate number of pi was a bit less than 3.14159265359. Katahiro Takebe followed Seki’s method and discovered another method of calculation of pi. We will give some remarks on it.

- 8 Hikosaburo Komatsu (Univ. of Tokyo)^{*} On Mikami Yoshio’s study on the theory of determinants in Japan in the 17th century. Which are justified and which are not? 30

Summary: We give a critical survey of the work of Yoshio Mikami (1875–1950) on the elimination theory of Seki Takakazu (1640?–1708). It is true that Seki made a mistake in his expansion of determinants of order 5. But many proposals to correct the errors are also different errors. It is generally believed that Yoshio Mikami (1975–1950) clarified everything in his doctoral dissertation and others. However, his statements in those documents are often too ambiguous to distinguish their mathematical truth or lie. We correct many of his errors and give a rigorous proof of his statement that Seki’s elimination is attained by the classical method of elimination in the simultaneous linear equations in China two thousand years ago by Sylvester’s theorem which can be proved by the knowledge of Japanese mathematicians in the 17th century.

- 9 Shotaro Tanaka Representation of fractional function in power series —Expansion by Komatsu and by theorem by Wada, summary— 20

Summary: A. de Moivre made a recurring series using scale of relation. If scale of relation: $3x - 2x^2 + 5x^3$, $(1 + 2x + 3x^2)$ given, then $1 + 2x + 3x^2 + 10x^3 + 34x^4 + 97x^5 + \dots$.

L. Euler expanded a fractional function to the recurring series and found the general term. If $(1 - z)/(1 - z - 2z^2)$ given, then $a_n = (1/3)\{(-1)^n + 2^{n+1}\}$.

G. H. Hardy defined a recurring series by linear differential equations.

M. Fujiwara expanded a fractional function to the power series in $x^{-1} = 1/x$.

U. Komatsu showed Lauret's expansion of a fractional function. We will show that the expansion is easily done using Wada's Theorem. Summary of above all.

- 10 Takahiro Seki (Niigata Univ.)[‡] A Gentzen-style formulation for non-associative substructural logics I 15

Summary: Associativity (of fusion) is regarded as one of the important structural rules. Recently, some studies on non-associative substructural logics have been developed. In this talk, we consider a Gentzen-style formulation for some non-associative substructural logics, and prove the cut elimination theorem by a proof-theoretic method.

- 11 Keishi Okamoto [‡] On expressiveness of first-order temporal logics 15
(Sendai Nat. Coll. of Tech.)

Summary: Formal methods are methods for showing correctness of information systems. They depend on mathematical logics. For instance, in formal methods, modeling of a target system depends on syntax and semantics of a logic, and verification properties are described as formulas of the logic. Propositional temporal logics (e.g. LTL, CTL and CTL*) are often used for formal methods. And then their expressiveness results are known. On the other hand, it is also known that expressiveness of a propositional temporal logic is totally different from that of its first-order extension. In this talk we show expressiveness results on first-order temporal logics by extending proof of expressiveness results on propositional temporal logics.

- 12 Ryota Matsuo (Nagoya Univ.)[‡] Logics for strategies 15

Summary: In the article, we give repeated game language $\mathcal{R}_{G,n}$ to study G^n . A $\mathcal{R}_{G,n}$ -formula representing the unique strategy in G^n is called a strategic formula and a formula representing some strategies is called a pre-strategic formula. Firstly, we state some propositions. In particular, we give two computational problems as for the strategic and the pre-strategic formulas and these computational complexities are investigated. Next, we define natural strategies using the strategic formulas in order to apply our theory to bounded rationality. As a result of our theory, we show that one direction of the famous Kuhn's theorem is still true but the other direction of this theorem is not true in the natural cases. Finally, we investigate so called the perfect folk theorem using the strategic formulas.

March 21st (Thu) Conference Room VII

9:30–11:40

- 13 Kohtaro Tadaki (Chuo Univ.)[#] The generic group model and algorithmic randomness 20

Summary: In modern cryptography, the generic group model is used as an imaginary framework in which the security of a cryptographic scheme is discussed. In particular, the generic group model is often used to discuss the computational hardness of problems, such as the discrete logarithm problem, which is used as a computational hardness assumption to prove the security of a cryptographic scheme. In this talk, we apply the concepts and methods of algorithmic randomness to the generic group model, and consider the secure instantiation of the generic group, i.e., a random encoding of the group elements. We show that the generic group can be instantiated by a specific computable function while keeping the computational hardness originally proved in the generic group model.

- 14 Kenshi Miyabe (Kyoto Univ.)[#] Van Lambalgen’s Theorem for uniform Kurtz randomness 15

Summary: The theory of algorithmic randomness defines some randomness notions such as Martin–Löf randomness, Schnorr randomness, Kurtz randomness, Demuth randomness and so forth. Van Lambalgen’s theorem is one of the most important theorems in the theory of algorithmic randomness and talks about relative Martin–Löf randomness. The usual relativization works well for Martin–Löf randomness (thus, van Lambalgen’s theorem holds), but it does not work well for other randomness notions. In my previous work, I proposed uniform relativization and proved van Lambalgen’s theorem for uniform Schnorr randomness. In this talk, I will talk about van Lambalgen’s theorem for uniform Kurtz randomness.

- 15 Akitoshi Kawamura (Univ. of Tokyo)[#] On representations of analytic functions and polynomial-time com-
 Norbert Müller (Univ. Trier) putability of operators 15
 Carsten Rösnick (TU Darmstadt)
 Martin Ziegler (TU Darmstadt)

Summary: We study the computational complexity of operators on analytic functions. We work in the framework of Recursive Analysis, the theory of real computation by approximation up to guaranteed error bounds. We introduce and compare several representations of analytic functions. We then study the polynomial-time computability of basic operators on analytic functions, and discuss extensions to larger classes of smooth functions.

- 16 Takayuki Kihara (JAIST)[#] An application of Kumabe–Slaman forcing to the ω -decomposability
 problem on Borel functions 20

Summary: We show some variants of the Jayne–Rogers Theorem at finite and transfinite levels of the hierarchy of Borel functions, by using the Shore–Slaman Join Theorem on the Turing degrees. This can be viewed as a partial solution to Andretta’s conjecture and Motto Ros’ conjecture on the strong generalizations of the Jayne–Rogers Theorem.

- 17 Tatsuya Miyazaki (Nagoya Univ.)[#] On rigid Souslin trees and their preservation 15

Summary: The author investigated the rigid structure of Souslin trees. A rigidity notion “free”, for Souslin trees, is known to be preserved under forcings with the property (K). This can be used to obtain the consistency result that there is a rigid Souslin tree and simultaneously the CH fails. The author introduces a new rigidity notion for ω_1 -trees and proves an analogous preservation result. The investigation includes a few structural analysis for various rigid Souslin trees.

- 18 Teruyuki Yorioka (Shizuoka Univ.)[#] Some statements which can be forced with a coherent Suslin tree 15

Summary: I will discuss some statements which can be forced with a coherent Suslin tree which is a witness of PFA(S), under PFA(S).

- 19 Toshimichi Usuba (Nagoya Univ.)[#] Large cardinals and indestructibly countably tight spaces 15

Summary: A countably tight topological space is indestructible if every σ -closed forcing notion preserves the countable tightness of the space. We showed that the statement “every indestructibly countably tight space of size ω_1 has character $\leq \omega_1$ ” is equiconsistent with the existence of an inaccessible cardinal.

13:10–14:10 Talk invited by Section on Foundation and History of Mathematics

Hiroshi Sakai (Kobe Univ.)[#] stationary and semi-stationary reflection principles

Summary: The stationary and semi-stationary reflection principles are important consequences of Martin’s Maximum, and they themselves have many interesting consequences. In this talk I will introduce recent results on these reflection principles. In particular, I will show that most of consequences of the stationary reflection principle can be deduced from the semi-stationary reflection principle. Also I will present some results indicating that the stationary reflection principle and the semi-stationary reflection principle are closely related to super compact cardinals and strongly compact cardinals, respectively.

Algebra

March 20th (Wed) Conference Room I

9:00–12:00

- 1 Tomohiro Iwami * On certain criterion (weak form) for semistability of 3-fold log flips
(Kyushu Sangyo Univ.) 10

Summary: We will try to give certain criterion, but which is still a weak form, for semistability of 3-fold log flips appearing in the reduction steps in the proof of 3-fold log flips given by V. V. Shokurov, under some kinds of characterizations of modified division algorithm by S. Mori for such types of 3-fold log flips.

- 2 Ryo Akiyama (Shizuoka Univ.)[#] Classification of quantum affine planes 10

Summary: Let A be a 3-dimensional quadratic AS-regular algebra with a normal element $u \in A_1$. In this talk, we define a quantum affine plane by a noncommutative affine scheme associated to $A[u^{-1}]_0$, and classify certain quantum affine planes.

- 3 Yoshifumi Tsuchimoto (Kochi Univ.)[#] Auslander regularity of non commutative projective space 15

Summary: We discuss the Auslander regularity of non commutative projective space over a field of positive characteristic.

- 4 Shinya Kitagawa * On certain pencils of plane curves of degree thirteen with a quintuple
(Gifu Nat. Coll. of Tech.) point and nine quadruple points 15

Summary: Any genus two fibration on rational surface with Picard number eleven can be considered as a pencil of plane curves of degree thirteen with a quintuple point and nine quadruple points through a birational morphism. We consider the case where the fibrations have three singular fibres of types (V) in the sense of Horikawa, and write down the defining equations of the pencils with three parameters.

- 5 Sachiko Saito (Hokkaido Univ. of Edu.)[#] Real 2-elementary K3 surfaces of type (3,1,1) and degenerations 10

Summary: We consider real 2-elementary K3 surfaces (X, τ, φ) of type $((3, 1, 1), -1)$. The fixed point (anti-bi-canonical) curve A of τ is the disjoint union of a nonsingular rational curve A_0 and a nonsingular curve A_1 of genus 9. X has an elliptic fibration with its section A_0 and a unique reducible fiber $E + F$, where F might be reducible. Contracting the curve F on the quotient surface X/τ , we get the real 4-th Hirzebruch surface F_4 . The image A'_1 of A_1 on F_4 has one real double point. We try to classify the isotopy types of the real parts RA'_1 of A'_1 on RF_4 . We enumerate up all the isometry classes of involutions of the K3 lattices of type $((3, 1, 1), -1)$, and consider their correspondences to the “non-increasing simplest degenerations” of real nonsingular anti-bi-canonical curves on RF_4 .

- 6 Takeshi Usa (Univ. of Hyogo) Homological shells of a canonical curve $g = 5, 6$ 15

Summary: We continue to classify the homological shells of a canonical curve with genus $g = 5$ or $g = 6$. In the case $g = 5$, we solve affirmatively the remaining problem on the existence of a homological shell surface with degree 5 for any trigonal canonical curve and finish our classification in this case. For the case $g = 6$, assuming that the curve is generic (i.e. non-trigonal and non-plane-quintic), we investigate mainly good homological shells of dimension 3. We also show the inequality on Δ -genera of homological shells coming from good homological shells of a canonical curve with $g = 6$, which is predicted by our Δ -genus inequality conjecture.

- 7 Shigeru Iitaka (Gakushuin Univ.)[‡] Hartshorne identities and their application 15

Summary: Hartshorne identities are presented and as their applications, several kinds of inequalities between genera and mixed plurigenera of pairs of algebraic curves and rational surfaces are given.

- 8 Yoshiaki Fukuma (Kochi Univ.)[‡] Effective non-vanishing of global sections of multiple adjoint bundles for quasi-polarized n -folds 15

Summary: In this talk, we study a natural number m with $h^0(m(K_X + L)) > 0$ for any quasi-polarized manifolds (X, L) defined over the field of complex numbers such that $K_X + L$ is nef.

- 9 Ryo Okawa (Kyoto Univ.)[‡] Frobenius morphisms and derived categories on two dimensional toric
Hokuto Uehara (Tokyo Metro. Univ.) Deligne–Mumford stacks 15

Summary: For a toric Deligne–Mumford (DM) stack over the complex number field, we can consider a certain generalization of the Frobenius endomorphism. For such an endomorphism of a two-dimensional toric DM stack, we show that the push-forward of the structure sheaf generates the bounded derived category of coherent sheaves on the stack.

- 10 Kotaro Kawatani (Nagoya Univ./Osaka Univ.)[‡] FM groupoid on K3 surfaces and Atkin–Lehner involutions 15

Summary: We show that there is a surjection from the Fourier–Mukai transformations on projective K3 surfaces with the Picard number $\rho(X) = 1$ to so called to the group of Atkin–Lehner involutions. This was expected in Hosono–Lian–Oguiso–Yau’s paper.

- 11 Kotaro Kawatani (Nagoya Univ./Osaka Univ.)[‡] Stability conditions on K3 surfaces and hyperbolic plane 15

Summary: We introduce a hyperbolic metric on the (normalized) space of stability conditions on projective K3 surfaces X with Picard rank $\rho(X) = 1$. And we show that all walls are geodesic in the normalized space with respect to the hyperbolic metric. Furthermore we demonstrate how the hyperbolic metric is helpful for us by discussing mainly two topics. We first make a study of so called Bridgeland’s conjecture. In the second topic we prove a famous Orlov’s theorem without the global Torelli theorem.

14:15–16:45

- 12 Kazunori Yasutake (Kyushu Univ.)^{*} On Fano fourfolds with nef vector bundle $\Lambda^2 T_X$ 10

Summary: Fano variety is a variety with ample anti-canonical line bundle. In 1992, Campana and Peternell classified threefolds with nef vector bundle $\Lambda^2 T_X$. I will talk about a classification of Fano fourfolds whose Picard number is at least two with this property.

- 13 Kiwamu Watanabe (Saitama Univ.)^{*} Fano 5-folds with nef tangent bundles 15

Summary: We prove that smooth Fano 5-folds with nef tangent bundles and Picard numbers greater than one are rational homogeneous manifolds.

- 14 Ken-ichi Yoshida (Nihon Univ.)[#] Ulrich ideals and modules on 2-dimensional rational singularities 15
 Shiro Goto (Meiji Univ.)
 Kazuho Ozeki (Yamaguchi Univ.)
 Ryo Takahashi (Nagoya Univ.)
 Kei-ichi Watanabe (Nihon Univ.)

Summary: We classify all Ulrich ideals and modules on 2-dimensional rational double points.

- 15 Takayuki Hibi[#] Normality of dilated polytopes 15
 (Osaka Univ./JST CREST)
 Akihiro Higashitani (Osaka Univ.)

Summary: For an integral convex polytope \mathcal{P} of dimension d , let $\mu(\mathcal{P})$ denote the maximal degree of the Hilbert basis of the polyhedral cone arising from \mathcal{P} . In this talk, it is proved that given an integer $d \geq 4$, there exists an integral convex polytope \mathcal{P} of dimension d with $\mu(\mathcal{P}) = d - 1$ such that $(d - 2)\mathcal{P}$ is normal. Moreover, given integers $d \geq 3$ and $2 \leq j \leq d - 1$, we show the existence of an empty simplex of \mathcal{P} of dimension d with $j = \mu(\mathcal{P})$ such that $q\mathcal{P}$ cannot be normal for any $1 \leq q < j$.

- 16 Akihiro Higashitani (Osaka Univ.)[#] Non-normal very ample toric rings 15

Summary: In this talk, it is proved that for given integers h and d with $h \geq 1$ and $d \geq 3$, there exists a non-normal very ample integral convex polytope of dimension d which has exactly h holes.

- 17 Kazunori Matsuda (Nagoya Univ.)^{*} Regularity bounds for binomial edge ideals 10
 Satoshi Murai (Yamaguchi Univ.)

Summary: We show that the Castelnuovo–Mumford regularity of the binomial edge ideal of a graph is bounded below by the length of its longest induced path and bounded above by the number of its vertices.

- 18 Hidefumi Osugi [#] Toric ideals and their circuits 15
 (Rikkyo Univ./JST CREST)
 Takayuki Hibi
 (Osaka Univ./JST CREST)

Summary: In this talk, we study toric ideals generated by circuits. For toric ideals which have squarefree quadratic initial ideals, a sufficient condition to be generated by circuits is given. In particular, squarefree Veronese subrings, the second Veronese subrings and configurations arising from root systems satisfy the condition. In addition, we study toric ideals of finite graphs and characterize the graphs whose toric ideals are generated by circuits $u - v$ such that either u or v is squarefree. There exists several classes of graphs whose toric ideals satisfy this condition and whose toric rings are nonnormal.

- 19 Akiyoshi Sannai (Nagoya Univ.)[#] Numerical characterizations of F -singularities 10

Summary: We define a new invariant, the dual F -signature of modules over the rings of positive characteristic. By using this invariant, we give characterizations of regular, F -regular, F -rational, and Gorenstein singularities. We also discuss about the relation with minimal log discrepancy. Especially, in some cases, there is a module of which the dual F -signature coincide with the minimal log discrepancy of the ring.

- 20 Yusuke Nakajima (Nagoya Univ.)[#] Generalized F -signature of invariant subrings 15
 Mitsuyasu Hashimoto (Nagoya Univ.)

Summary: It is known that a certain invariant subring R has finite F -representation type. Thus, we can write Frobenius push-forward eR as a finite direct sum of finitely generated R -modules. For the multiplicity of free direct summand, there is the notion of F -signature defined by C. Huneke and G. Leuschke. In this talk, we extend this notion to non-free direct summands.

16:45–17:45 Talk invited by Algebra Section

- Takayuki Hayakawa (Kanazawa Univ.)[#] Birational morphisms of 3-dimensional algebraic varieties

Summary: We study birational morphisms of 3-dimensional algebraic varieties which appear as contractions of extremal rays. Among these contractions, we focus on divisorial contractions which contracts an irreducible divisor to a singular point. The aim is to construct all such divisorial contractions explicitly by using equations of singularities and weighted blowing ups. This task is completed when the index of the singularity is greater than or equal to two, and almost all is known when the index of the singularity is one. As an application of these constructions, we give another proof of the existence of 3-dimensional flips.

March 21st (Thu) Conference Room I

9:00–12:00

- 21 Noriko Zaitse (Eigakuin) The field higher dimension over \mathbb{R} than the sedenions does not exist 10

Summary: The field in which the solution of $x^2 = -1$ is added to a real number field is a complex number field. It is two dimensional expansion. Similarly if one origin which fills $x^2 = -1$ which is not $\pm i$ is attached to a complex number, in addition this is set to j , it means that it was added automatically $ij = k$ will also be two-dimensional expansion and will be the number of Hamiltonians. Why its number of Hamiltonians is non-commutative field is shown by a diagram. (figure.1k) Similarly, the number of Cayley can also be defined and it becomes a nonassociative field. If the definition is given similarly, since the origin in which the direction of the sedenions does not become settled, addition cannot be defined, it is not the field. (figure.2k)

- 22 Shinichi Tajima (Univ. of Tsukuba)[#] Efficient symbolic computation of matrix polynomials with an extended Horner’s rule 10
 Katsuyoshi Ohara (Kanazawa Univ.)
 Akira Terui (Univ. of Tsukuba)

Summary: The Horner’s Rule is well-known method for evaluating univariate polynomials efficiently. For calculating “matrix polynomials” by evaluating the polynomial with matrices, we propose an efficient method by extending naive Horner’s rule. Our key idea is dividing computation of the Horner’s rule into parts to reduce the number of matrix multiplications which dominates the computing time of matrix polynomials with naive Horner’s rule. We have implemented our new algorithm into computer algebra system Risa/Asir, and show that, with proper settings on the degree of division of the Horner’s rule, not only the computing time but also the amount of memory used for the computation have been decreased, compared to the calculation with naive Horner’s rule. We also show an attempt for even more efficient computation of our new algorithm with distributed/parallel computing facility of Risa/Asir.

- 23 Shinichi Tajima (Univ. of Tsukuba)[#] On structure of invariant subspaces for square matrix 10
 Katsuyoshi Ohara (Kanazawa Univ.)

Summary: We discuss structure of invariant subspaces of square matrix. It is an application of minimal annihilating polynomials of matrix.

- 24 Katsuyoshi Ohara (Kanazawa Univ.)[#] A randomized algorithm for computing minimal annihilating polynomials of square matrix 10
 Shinichi Tajima (Univ. of Tsukuba)

Summary: A fast method for computing minimal annihilating polynomials of square matrix is developed. The method uses a randomized algorithm.

- 25 Shuzo Izumi (Kinki Univ.)[#] A family of Artinian rings associated to a finite-dimensional vector space of holomorphic functions 10

Summary: Let $Z \subset \mathcal{O}(U)$ be a finite-dimensional vector space of holomorphic functions on an open subset $\Omega \subset \mathbb{C}^n$. Let $f_b \downarrow$ denote the homogeneous term of the minimal degree of the Taylor expansion of $f \in Z$ centred at $b \in \Omega$ and put $Z_b \downarrow = \text{Span}_{\mathbb{C}}\{f_b \downarrow : f \in Z\}$. Then the natural sesquilinear form on $Z_b \downarrow \times Z$ is a non-degenerate one (de Boor–Ron). It is also known that Z_b is D -invariant i.e. closed with respect to partial differentiation on a non-empty analytically open subset $U \subset \Omega$. These imply that Z_b has a natural structure of a ring such that $\pi : \mathcal{O}_b \rightarrow Z_b$ is a retraction homomorphism. Thus we have associated a deformation of graded Artinian local rings $\{Z_b : b \in U\}$ to Z . We make a remark on the types of such rings.

- 26 Shuzo Izumi (Kinki Univ.)[#] Taylor expansion and transcendency on an analytic manifold embedded in an affine space 15

Summary: Let $\iota : X \rightarrow \mathbb{C}^m$ be an embedding of a connected analytic manifold and $\Phi : (\mathbb{C}^m, b) \rightarrow (X, a)$ a parametrisation of X around a . Then, using the dual space in the previous report, we can construct the Bos–Calvi tangent space $D_{X,a}^{\Phi,d}$ of “dual order d ”. This space is D -closed on an analytically open subset $U \subset X$. At a point of U , we define “Taylor expansion” $T_{X,a}^d : \mathcal{O}_{X,a} \rightarrow P^d(X, a)$, where $P^d(X, a)$ denotes the space of polynomial functions of degree $\leq d$ on (X, a) . If $\dim(X, a) = 1$, $T_{X,a}^d$ is independent of Φ (a generalisation of a theorem of Bos–Calvi). Using the maximum of the degree of the elements of $D_{X,a}^{\Phi,d}$, we see that transcendency of the embedding ι is not very high at a general point.

- 27 Kazuma Shimomoto (Meiji Univ.)^{*} F-injective and F-split rings and deformation problems 10
 Jun Horiuchi (Nippon Inst. of Tech.)
 Lance Edward Miller (Univ. of Utah)

Summary: It is a long-standing open problem whether F-injective (resp. F-split) local rings deform. These rings correspond to singularities in positive characteristic defined by the Frobenius map. We give some positive answers to this problem.

- 28 Takahiko Furuya (Tokyo Univ. of Sci.)[#] Hochschild cohomology for a class of some self-injective special biserial algebras of rank four 10

Summary: The purpose of this talk is to study the Hochschild cohomology of some self-injective special biserial algebra A_T . We determine the dimensions of the Hochschild cohomology groups of A_T , and show that the Hochschild cohomology ring modulo nilpotence of A_T is finitely generated as an algebra.

- 29 Hiroaki Komatsu^{*} Adjoint pair associated to generalized derivations of bimodules 10
 (Okayama Pref. Univ.)

Summary: Let A and B be algebras over a commutative ring R , and let \mathfrak{M} denote the category of (A, B) -bimodules in which left and right actions of R coincides. Let $K \rightarrow A$ and $L \rightarrow B$ be R -algebra homomorphisms. For $M, N \in \mathfrak{M}$, a (K, L) -homomorphism $f : M \rightarrow N$ is called a *generalized derivation* if $f(amb) = f(am)b + af(mb) - af(m)b$ holds for every $a \in A, m \in M, b \in B$. The set of all generalized derivations from M to N is denoted by $\text{GDer}(M, N)$. We construct an adjoint pair $(\mathcal{U}, \mathcal{V})$ of functors from \mathfrak{M} to \mathfrak{M} such that $\mathcal{U}(M)$ represents the functor $\text{GDer}(M, -)$ and $\mathcal{V}(M)$ represents the functor $\text{GDer}(-, M)$. We show that if A is a separable K -ring and B is a separable L -ring, then \mathcal{U} and \mathcal{V} are separable functors.

- 30 Yasuhiko Takehana[#] A generalization of costable torsion theory 10
 (Hakodate Nat. Coll. of Tech.)

Summary: E. P. Armendariz characterised a stable torsion theory. R. L. Bernherdt dualised a stable torsion theory, call it costable torsion theory and characterised costable torsion theory. In this talk we generalize this by using a torsion theory.

- 31 Takuma Aihara (Bielefeld Univ.) Dimensions of triangulated categories with respect to subcategories 2
 Tokuji Araya (Tokuyama Coll. of Tech.) 15
 Osamu Iyama (Nagoya Univ.)
 Ryo Takahashi (Nagoya Univ.)
 Michio Yoshiwaki (Osaka City Univ.)

Summary: This talk introduces the concept of the dimension of a triangulated category with respect to a fixed full subcategory. For the bounded derived category of an abelian category, upper bounds of the dimension with respect to a contravariantly finite subcategory and a resolving subcategory are given. Our methods not only recover some known results on the dimensions of derived categories in the sense of Rouquier, but also apply to various commutative and non-commutative noetherian rings.

- 32 Ryo Kanda (Nagoya Univ.) Classifying Serre subcategories via atom spectrum 10

Summary: We introduce a spectrum of an abelian category, which we call the atom spectrum. It is a topological space consisting of all the equivalence classes of monoform objects. In terms of the atom spectrum, we give a classification of Serre subcategories of an arbitrary noetherian abelian category. In the case of the module category over a commutative ring, we show that the atom spectrum coincides with the prime spectrum of the commutative ring. As a special case of our theorem, we recover Gabriel's classification theorem of subcategories.

- 33 Hirotaka Koga (Univ. of Tsukuba)[#] Derived equivalences and Gorenstein dimension 20

Summary: For derived equivalent left and right coherent rings we will show that the triangulated categories of complexes of finite Gorenstein dimension are equivalent.

13:15–14:15 Talk invited by Algebra Section

Naoki Terai (Saga Univ.) Classification of licci edge ideals

Summary: This report is based on a joint work with K. Kimura and K. Koshida.

Let $S = K[x_1, x_2, \dots, x_n]$ be a polynomial ring over a field K and set $\mathfrak{m} = (x_1, \dots, x_n)$ and $R = S_{\mathfrak{m}}$, which is a regular local ring. Let I, I' be proper ideals of R . Then I and I' are said to be direct linked, denoted by $I \sim I'$, if there exists a regular sequence $\underline{z} = z_1, \dots, z_g$ in $I \cap I'$ such that $I' = (\underline{z}) : I$ and $I = (\underline{z}) : I'$. Moreover, I is said to be linked to I' if there exists a sequence of direct links

$$I = I_0 \sim I_1 \sim I_2 \sim \dots \sim I_m = I'.$$

Then I is in the linkage class of I' . In particular, if one can choose I' as a complete intersection ideal (i.e., an ideal generated by a regular sequence), then I is called *licci*.

When is an ideal licci? This is a classical question in commutative algebra. It is known that Cohen-Macaulay ideals with height two and Gorenstein ideals with height three are licci. Here we consider it in the case of squarefree monomial ideals generated in degree two. Such an ideal is described as an edge ideal of a graph. Let $G = (V(G), E(G))$ be a graph. Then

$$I(G) = (x_i x_j \mid \{i, j\} \in E(G)) \subseteq S = k[x_v \mid v \in V(G)]$$

is said to be the edge ideal of G . Then we have:

Theorem (Classification of licci edge ideals).

Set $g = \text{height } I(G)$. Then $I(G)_{\mathfrak{m}}$ is licci if and only if G is isomorphic to either G_a, G_b, G_{c1} , or G_{c2} such that

$$\begin{aligned} I(G_a) &= (x_i y_i)_{1 \leq i \leq g}, \\ I(G_b) &= (x_i y_i)_{1 \leq i \leq g}, (x_j y_1)_{2 \leq j \leq h}, \\ I(G_{c1}) &= (x_i y_i)_{1 \leq i \leq g-2}, (x_j z_1)_{1 \leq j \leq h}, z_1 z_2, z_2 z_3, z_3 z_1, \\ I(G_{c2}) &= (x_i y_i)_{1 \leq i \leq g-3}, z_1 z_2, z_2 z_3, z_3 z_4, z_4 z_5, z_5 z_1. \end{aligned}$$

after a suitable change of the variables.

March 22nd (Fri) Conference Room I

9:00–12:00

- 34 Satoshi Yamanaka (Okayama Univ.)[‡] On Galois polynomials of degree p in skew polynomial rings of derivation
 Shûichi Ikehata (Okayama Univ.) type II 10

Summary: Let B be a ring of prime characteristic p , and D a derivation of B . Let $B[X; D]$ be the skew polynomial ring in which the multiplication is given by $\alpha X = X\alpha + D(\alpha)$ ($\alpha \in B$). Let $f = X^p - Xa - b$ be a polynomial in $B[X; D]$ such that $fB[X; D] = B[X; D]f$. We shall determine the automorphism group $\text{Aut}_A(B[X; D]/fB[X; D])$ under some assumptions, and we shall give a condition f to be a Galois polynomial.

- 35 Mitsuhiro Miyazaki ^{*} Tensor of indeterminates and invariant theory 10
(Kyoto Univ. of Edu.)

Summary: High-dimensional array data analysis is now rapidly developing and being successfully applied in various fields. A high-dimensional array datum is called a tensor in those communities. To be precise, a d -dimensional array datum $(a_{i_1 i_2 \dots i_d})_{1 \leq i_j \leq m_j}$ is called a d -tensor or an $m_1 \times \dots \times m_d$ -tensor.

A 2-tensor is no other than a matrix. For a matrix of indeterminates, that is, a matrix whose entries are independent indeterminates, there are many results about the action of classical groups and the ring of invariants under these actions. In this talk, we consider an $m \times n \times 2$ -tensor of indeterminates and the action of the product of special linear groups on the polynomial ring generated by the entries of the tensor.

- 36 Kyouko Kimura (Shizuoka Univ.) ^{*} Non-vanishingness of Betti numbers of edge ideals and complete bipartite graphs 10

Summary: We study the non-vanishingness of Betti numbers of edge ideals. Let G be a finite simple graph. Then we can associate an ideal $I(G)$ with G , which is called the edge ideal of G . We show that the Betti number of $I(G)$ does not vanish if G contains a set of complete bipartite subgraphs with some properties, one of which is related to the 3-disjointness of edges of G .

- 37 Takao Hayami (Hokkai-Gakuen Univ.) ^{*} Hochschild cohomology ring of quaternion algebras 10

Summary: We give an efficient bimodule projective resolution of the generalized quaternion \mathbb{Z} algebra Γ . As a main result, we determine the ring structure of the Hochschild cohomology $HH^*(\Gamma)$ by calculating the Yoneda products using this resolution.

- 38 Kenichi Shimizu (Nagoya Univ.) ^{\#} On indicators of Hopf algebras 15

Summary: Kashina, Montgomery and Ng introduced the n -th indicator $\nu_n(H)$ of a finite-dimensional Hopf algebra H and showed that the indicators have some interesting properties such as the gauge invariance. I will talk about recent progress on the study of the properties of the indicators, including (1) the cyclotomic integrality, (2) a formula for the opposite Hopf algebra, (3) a formula for the Drinfeld double, and (4) a relation to the quasi-exponent.

- 39 Hiroki Sasaki (Shinshu Univ.) ^{\#} Cohomology rings of tame blocks 15

Summary: We give a theorem concerning direct summands of source algebras of block ideals. We also show that the cohomology rings of tame blocks are the images of transfer maps from the cohomology rings of their defect groups induced by direct summands of source algebras.

- 40 Tsuyoshi Miezaki (Yamagata Univ.) ^{\#} The McKay–Thompson series of Mathieu Moonshine modulo two 10
Thomas Creutzig (TU Darmstadt)
Gerald Höhn (Kansas State Univ.)

Summary: In this note, we describe the parity of the coefficients of the McKay–Thompson series of Mathieu moonshine. As an application, we prove a conjecture of Cheng, Duncan and Harvey stated in connection with umbral moonshine for the case of Mathieu moonshine.

- 41 Yuya Mizuno (Nagoya Univ.)[‡] τ -tilting modules over preprojective algebras of Dynkin type 15

Summary: The notion of preprojective algebras is one of the important subjects in the representation theory of algebras. On the other hand, the notion of τ -tilting modules was recently introduced by Adachi–Iyama–Reiten. In this talk, we discuss τ -tilting modules over preprojective algebras. We show that all support τ -tilting modules are given by maximal ideals. We also discuss the bijection between the Coxeter group and support τ -tilting modules and their partial orders.

- 42 Akihiko Hida (Saitama Univ.)[‡] The action of the double Burnside algebra on the cohomology of the extraspecial p -group 10

Summary: Let E be the extraspecial p -group of order p^3 and exponent p where p is an odd prime. We determine the mod p cohomology of summands in the stable splitting of p -completed classifying space BE modulo nilpotence.

- 43 Yutaka Yoshii (Nara Nat. Coll. of Tech.)^{*} The Loewy series of PIMs for $2(h-1)$ -deep weights for a finite Chevalley group 10

Summary: Pillen proved that the Loewy series of PIMs for $3(h-1)$ -deep weights for a finite Chevalley group coincide with the Loewy series of the modules for the algebraic group extended from the corresponding PIMs for a Frobenius kernel. Here we claim that this fact already holds for $2(h-1)$ -deep weights.

- 44 Tomohiro Kamiyoshi[‡] Counting subspaces generated by subsets of a root system 10
(Matsue Coll. of Tech.)

Makoto Nagura

(Nara Nat. Coll. of Tech.)

Shinichi Otani (Kanto Gakuin Univ.)

Summary: Let Φ be an irreducible (and reduced) root system of a finite-dimensional Euclidean space V . In this talk, we will give a complete classification of the subspaces of V generated by a subset of Φ . Our classification of such subspaces was motivated by a classification theory of semisimple “finite-prehomogeneous” vector spaces. We have counted such subspaces as distinct sets.

- 45 Tsunekazu Nishinaka[‡] Primitivity of group rings of locally freely productable groups 10
(Okayama Shoka Univ.)

Summary: Let R be a ring with the identity element. Then R is right primitive if and only if there exists a faithful irreducible right R -module M_R . If a group is finite or abelian, then the group ring of such groups can never be primitive. In this talk, we first define a group with a certain local property which is a generalization of a locally free group, and we next introduce primitivity of group rings of their groups. Our main result is as follows: Let G be an infinite group which has a free subgroup with the same cardinality as G itself. If for each finitely generated proper subgroup H of G , there exists $x \in G$ such that $\langle H, x \rangle$ is the free product $H * \langle x \rangle$ of H and $\langle x \rangle$ in G , then the group ring KG is primitive for any field K .

- 46 Shuhei Tsujie (Hokkaido Univ.)[#] A canonical system of basic invariants of a finite reflection group ····· 10
Norihito Nakashima (Hokkaido Univ.)

Summary: A canonical system of basic invariants of a finite reflection group is a system of basic invariants satisfying certain differential equations. The system relates to mean value problems for polytopes. An algorithm to compute the system was known but is not effective for finite reflection groups of high-rank. Some researchers construct canonical systems for finite irreducible reflection groups except type E. We give a canonical system explicitly for any finite irreducible reflection group.

14:15–15:00

- 47 Toshiyuki Kikuta (Osaka Inst. of Tech.)[#] A congruence property of Igusa's cuspform of weight 35 ····· 15
Hirotaka Kodama (Kinki Univ.)
Shoyu Nagaoka (Kinki Univ.)

Summary: Igusa gave a set of generators of the graded ring of degree two Siegel modular forms. In these generators, there are four even weight forms $\varphi_4, \varphi_6, \chi_{10}, \chi_{12}$, and only one odd weight form χ_{35} . Here φ_k is the normalized Eisenstein series of weight k and χ_k is a cusp form of weight k . A purpose of this talk is to introduce a strange congruence relation of odd weight cusp form X_{35} , which is a suitable normalization of χ_{35} . As a tool to confirm the congruence relation, a Sturm type theorem for the odd weight case is also given.

- 48 Shingo Sugiyama (Osaka Univ.)[#] Asymptotic behaviors of means of central values of automorphic L -functions for $GL(2)$ ····· 10

Summary: Ramakrishnan and Rogawski gave an asymptotic formula for a mean of central L -values attached to elliptic holomorphic cusp forms with prime level as the level tends to infinity. Tsuzuki proved a result similar to that of Ramakrishnan and Rogawski for Hilbert cuspidal waveforms with square free level. In this talk, we generalize Tsuzuki's asymptotic formula to Hilbert cuspidal waveforms with arbitrary level.

- 49 Yasuko Hasegawa (Keio Univ.)[#] Central values of standard L -functions for $Sp(2)$ ····· 10

Summary: We show that the central values of standard L -functions for $Sp(2)$ to compute the $SL(2) \times SL(2)$ -period of the residue of minimal parabolic Eisenstein series. First, we want to prove some analytic properties of minimal parabolic Eisenstein series of weight k and degree 2 and clearly express the residue of it. Next, we compute the period the residue to give the central values of standard L -functions.

15:30–16:30 Award Lecture for 2012 Algebra Prize

- Tomoyuki Arakawa (Kyoto Univ.)[#] Representation theory of W-algebras

Summary: In this talk we will review the recent development in the representation theory of W-algebras.

16:45–17:45 Award Lecture for 2012 Algebra PrizeAtsushi Ichino (Kyoto Univ.)[#] Automorphic representations and periods

Summary: A period is a complex number which can be expressed as an integral of an algebraic function over an algebraic domain. This notion has a counterpart in the theory of automorphic forms, which is defined by a certain integral of an automorphic form and also related to branching rules in representation theory. In this talk, we discuss a relation of a period of an automorphic form to a certain arithmetic invariant, a special value of an automorphic L-function, in the so-called Gross–Prasad case. This talk is based on a joint work with Tamotsu Ikeda and that with Shunsuke Yamana.

March 23rd (Sat) Conference Room I

9:00–12:00

- 50 Yoshio Tanigawa (Nagoya Univ.)^{*} On the means of number-theoretic error terms with shifted arguments
 Jun Furuya 10
 (Okinawa Nat. Coll. of Tech.)

Summary: Let $E(x)$ be a number-theoretic error term. In this talk, we shall consider the properties of the function $\sum_{n \leq x} E(n + \alpha)^k - \int_1^x E(t)^k dt$, where k is a positive integer and α is a positive number with $0 < \alpha < 1$.

- 51 Yusuke Fujisawa (Nagoya Univ.)^{*} On estimates of partial sums of the Möbius and Liouville functions for
 Makoto Minamide number fields 15
 (Kyoto Sangyo Univ.)

Summary: In a number field degree n , Landau examined partial sums of the Möbius and Liouville functions. We will reconsider them.

- 52 Takahiro Wakasa (Nagoya Univ.)^{*} Supremum of the function $S_1(t)$ on short intervals 10

Summary: We prove supremum of the function $S_1(T)$, defined by the integration of the argument of the Riemann zeta-function. The supremum of $S(T)$ have already been obtained by Karatsuba and Korolev. Our result is based on that Karatsuba and Korolev result.

- 53 Kaneaki Matsuoka (Nagoya Univ.) The behavior of the higher derivatives of Hardy’s function under the
 Riemann hypothesis 10

Summary: We shall show a new formula for the higher derivatives of Hardy’s function, and discuss the zeros of their functions under the Riemann hypothesis.

- 54 Masanori Katsurada (Keio Univ.)[#] Complete asymptotic expansions for generalized Epstein zeta-functions
 10

Summary: Complete asymptotic expansions associated with the generalized Epstein zeta-function $\psi_{\mathbb{Z}^2}(s; a, b; \mu, \nu; z)$ when the parameter $y = \Im z$ tends to $+\infty$ are presented. Our main formulae yield various consequences, for e.g., i) its proof clarifies the key ingredients by which the functional equation of $\psi_{\mathbb{Z}^2}(s; a, b; \mu, \nu; z)$ is to be valid; ii) the limiting case $s \rightarrow 1$ of our main formulae allows us to unify the (classical) first and second limit formulae of Kronecker, while other specific cases naturally reduce to several of their variants which assert the closed form evaluations of $\psi_{\mathbb{Z}^2}(s; 0, 0; \mu, \nu; z)$ at $s = m$ ($m = 2, 3, \dots$) and of $(\partial/\partial s)\psi_{\mathbb{Z}^2}(s; a, b; 0, 0; z)$ at $s = -n$ ($n = 0, 1, \dots$).

- 55 Soichi Ikeda (Nagoya Univ.)* On an alternating series representation of real numbers 10

Summary: We introduce an algorithm which represent any real number as an alternating series of rational numbers. That algorithm is a generalization of the alternating-Sylvester series and has the same properties as that. In addition, we construct the real numbers by our alternating series representation. Our method is similar to that of Arnold Knopfmacher and John Knopfmacher. However, our proofs of the algebraic properties of the real numbers are achieved by a general lemma.

- 56 Soichi Ikeda (Nagoya Univ.) Kaneaki Matsuoka (Nagoya Univ.) Yoshikazu Nagata (Nagoya Univ.) The mean values of Euler–Zagier double zeta function 10

Summary: Let $s_1 = \sigma_1 + it$ and $s_2 = \sigma_2 + it$ with $\sigma_1, \sigma_2, t \in \mathbb{R}$. For certain σ_1 and σ_2 , we prove the mean value theorems for Euler double zeta-function $\zeta_2(s_1, s_2)$. Our results suggest the existence of an analogue of the critical line for $\zeta_2(s_1, s_2)$.

- 57 Tomoya Machide (Kinki Univ.)# Restricted sum formulas for double zeta values of even weight and Ramanujan’s identity for Bernoulli numbers 10

Summary: We give some restricted sum formulas for double zeta values of even weight. We also prove that an obtained restricted sum formula yields Ramanujan’s identity for sums of products of Bernoulli numbers with a gap of 6, and vice versa.

- 58 Yasuo Ohno (Kinki Univ.)# Mika Sakata (Kinki Univ.) On 2 and 3-orders of di-Bernoulli numbers 10

Summary: Poly-Bernoulli numbers were introduced and studied by M. Kaneko as a generalization of classical Bernoulli numbers. He clarified the p -divisibility of denominators of di-Bernoulli numbers. We plan to talk about 2 and 3-orders of di-Bernoulli numbers.

- 59 Tomoya Machide (Kinki Univ.)# On a parameterized sum formula for quadruple zeta values 10

Summary: We give a parameterized generalization of the sum formula for quadruple zeta values. The generalized formula has four parameters, and is invariant under a cyclic group of order four. As applications, we also obtain weighted sum formulas for quadruple zeta values, which contain some known and new results.

- 60 Takao Komatsu (Hirosaki Univ.)# Ken Kamano (Osaka Inst. of Tech.) Poly-Cauchy polynomials 15

Summary: We introduce the poly-Cauchy polynomials which generalize the classical Cauchy polynomials and numbers, and investigate their arithmetical properties. These polynomials are considered as an analogue of poly-Bernoulli polynomials that generalize classical Bernoulli polynomials and numbers. Moreover, we consider the zeta functions which interpolate the poly-Cauchy polynomials. The values of these functions at positive integers can be expressed by using the polylogarithm function or the truncated multiple zeta star values.

- 61 Shingo Saito (Kyushu Univ.)* The Bowman–Bradley theorem for mod p multiple zeta values 10
 Noriko Wakabayashi
 (Kyushu Sangyo Univ.)

Summary: The Bowman–Bradley theorem asserts that the multiple zeta values at the sequences obtained by inserting a fixed number of twos between $3, 1, \dots, 3, 1$ add up to a rational multiple of a power of π ; its counterpart for multiple zeta-star values has been proved by Kondo, Tanaka, and the speaker. We show that a similar result holds for mod p multiple zeta(-star) values defined by Zagier.

- 62 Kazuhito Kozuka * Knopp type identities for p -adic multiple Dedekind sums 10
 (Miyakonojo Nat. Coll. of Tech.)

Summary: We consider multiple Dedekind sums from p -adic point of view. We define p -adic multiple Dedekind sums by means of Bernoulli functions and construct p -adic interpolating functions for the sums. Then we deduce Knopp type identities for the sums and for the interpolating functions, which are generalizations of Knopp’s formula for the classical Dedekind sums. We also show generalizations of Subrahmanyam’s formula, which is known to be equivalent to Knopp’s one.

14:15–16:45

- 63 Masatoshi Nakano * Some conjecture on Fibonacci number 10
 (Kesenuma High School)

Summary: We propose some conjecture on the number of Fibonacci primes less than or equal to n -th Fibonacci number.

- 64 Hajime Kaneko (Nihon Univ.)[#] Transcendence of real numbers related to the β -expansions by Pisot and Salem numbers 15

Summary: In this talk we consider arithmetical properties of real numbers of the form $f(s_n; \beta) = \sum_{n=0}^{\infty} s_n \beta^{-n}$, where s_n ($n = 0, 1, \dots$) is a bounded sequence of nonnegative integers and β is a Pisot or Salem number. In particular, we give new criteria for the transcendence of such values. We also investigate the digits of β -expansions of algebraic numbers in the case where β is a Pisot or Salem number.

- 65 Yohei Tachiya (Hiroshima Univ.)[#] Linear independence of certain Lambert series 10

Summary: We generalize the original result of Erdős by proving the linear independence over \mathbb{Q} of a set of certain Lambert series containing Erdős–Borwein constant.

- 66 Masatoshi Suzuki (Tokyo Tech)[#] On self-reciprocal polynomials having only zeros on the unit circle ... 15

Summary: We establish a necessary and sufficient condition for all zeros of a self-reciprocal polynomial to lie on the unit circle.

- 67 Masakazu Yamagishi (Nagoya Inst. of Tech.) * Chebyshev polynomials, cyclotomic polynomials and twin primes 10

Summary: In a series of papers, Stephen P. Humphries defined and investigated certain operators to determine the geometric and algebraic intersection number functions associated to a simple closed curve on a surface. A prominent role was played by Chebyshev polynomials. We are particularly interested in number theoretical aspects of his results. Specifically, he indicated some connections between Chebyshev polynomials and twin primes. We give short proofs of some key results of Humphries' by using Chebyshev polynomials of the third and fourth kinds and cyclotomic polynomials. We also give counterexamples to a conjecture of his.

- 68 Hajime Kuroiwa (Kochi Univ.)* An application of a remainder represented by a splitting behavior 15

Summary: We may discuss a splitting behavior of polynomials at primes. We defined a remainder of $x^p - x$ divided by $u(x)$. We used this, we obtained an answer of question. And we may discuss an application of a remainder.

- 69 Yuuki Takai (Univ. of Tokyo/Keio Univ.) * Indivisibility of relative class numbers of totally imaginary quadratic extensions of totally real number fields 10

Summary: In this talk, we consider indivisibility of relative class numbers of CM quadratic extensions. For a fixed totally real number field F which is a Galois extension over \mathbb{Q} and a sufficiently large prime number p , we show that there are infinitely CM quadratic extensions over F whose relative class numbers are not divided by p . To obtain the result, we use Hilbert modular forms of half-integral weight, these diagonal restrictions and Sturm's theorem. Our method is a generalization of Kohlen-Ono's method.

- 70 Tsuyoshi Itoh (Chiba Inst. of Tech.)* On the μ -invariant of tamely ramified Iwasawa modules 15
Yu Takakura (Kyushu Univ.)

Summary: We consider the μ -invariant of the "tamely ramified Iwasawa module" for \mathbb{Z}_p -extensions of imaginary quadratic fields.

- 71 Nao Takeshi (Tsuda Coll.)[#] Elliptic curves with good reduction everywhere over cubic fields 10

Summary: It is known that there is no elliptic curve over \mathbb{Q} having good reduction everywhere by J. Tate. Concerning the existence or nonexistence of elliptic curves having good reduction everywhere, we have many results for quadratic fields. In this talk, I will concentrate on the case of cubic fields and report on the following results: (1) nonexistence of such elliptic curves over certain cubic fields, which extends a result due to Bertolini-Canuto, and (2) the construction of certain infinite families of cubic fields over which such elliptic curves exist.

- 72 Akinari Hoshi (Rikkyo Univ.)[#] Krull-Schmidt theorem fails for dimension 5 10
Aiichi Yamasaki (Kyoto Univ.)

Summary: Let G be a finite subgroup of $GL(n, \mathbb{Z})$ and M_G be the corresponding G -lattices, i.e. finitely generated \mathbb{Z} -free $\mathbb{Z}[G]$ -module, of rank n . Theorem. (i) When $n \leq 4$, the Krull-Schmidt theorem holds for M_G . (ii) When $n = 5$, the Krull-Schmidt theorem fails for M_G if and only if G is one of the 11 groups as in [HY, Theorem 4.6]. (iii) When $n = 6$, the Krull-Schmidt theorem fails for M_G if and only if G is one of the 149 groups as in [HY, Theorem 4.6]. See [HY, Section 4], A. Hoshi, A. Yamasaki, Rationality problem for algebraic tori, arXiv:1210.4525v3.

73	Aiichi Yamasaki (Kyoto Univ.) [#] Isoclinism families of the groups of order 256	10
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Summary: We found that 56092 isomorphy classes of the groups of order 256 are divided into 714 isoclinism families. Three invariants, used for the separation of isoclinism families for the groups of order 128, are not sufficient for the groups of order 256, and we found the fourth invariant to complete the separation of 714 isoclinism families.

Geometry

March 20th (Wed) Conference Room III

9:20–12:00

- 1 Hirotaka Ebisui (Oval Research Center)[#] Saround theorem of famous theorem in history 5

Summary: We know there are many theorem in history. For example, there are Papus, Meneraus, Pascal, Simson, Napoleon, Morley, Fractal, etc. We show attached theorem of them as researching saround them. These theorem is somehow similar researches as adding new conditions to famous theorem-composition.

- 2 Hirotaka Ebisui (Oval Research Center)[#] On some square infinty-chain expansion-compositions of Phytagoras 2 area theorem and 6 perpendiculars-concurrence theorem, which show the existance of infinity parallel space 5

Summary: We show the title context using CAD figures and one proof of area theorem by some output results of Maple soft Promram Code.

- 3 Noriko Zaitsu (Eigakuin) About rigidity and infinitesimal rigidity of Polyhedron 10

Summary: Square pyramid is rigid, but the polyhedron excluding the bottom there is flexible. This paper is consider about rigidity and infinitesiml rigidity of Polyhedron. December, 1992 “the polyhedron which infinitesimal flexible however has rigidity exists” I discovered the theorem under a captain Mr. Osamu Kobayasi. (figure 1) Then, while it was careless, the point was exceeded to Mr. Kuan of China, but since the example was different, it carried out by noticing that there is another meaning later. First, “does an infinitesimal flexible polyhedron exist at 2 or n points in one motion?” The conjecture was considered. (figure 2) Behind, the polyhedoron foldable at both ends which moves very truly and near flexible polyhedron were discovered from the little cause in 2005 or 2006. (figure 3)

- 4 Kiyohisa Tokunaga (Fukuoka Inst. of Tech.)[#] The divergence theorem of a triangular integral 10

Summary: This divergence theorem of a triangular integral demands the antisymmetric symbol to derive the inner product of the nabla and a vector. Replacing a cuboid (a rectangular solid) by a tetrahedron (a triangular pyramid) as the finite volume element, a single limit is only demanded for triple sums in our theory of a triple integral. The divergence theorem of a triangular integral is derived by substituting the total differentials into our new method of a triangular integral. We thus infer that our new method of a triangular integral must be the inverse operation of the total differential.

- 5 Sadahiro Maeda (Saga Univ.)[#] Characterizations of the homogeneous real hypersurface of type (B) Katsufumi Yamashita (Saga Univ.) having two constant principal curvatures in a complex hyperbolic space 10

Summary: We characterize the homogeneous real hypersurface M of type (B) having two constant principal curvatures in a complex hyperbolic space $\mathbb{C}H^n(c)$ by investigating its contact form η , its shape operator A and the extrinsic shape of some geodesics on M in the ambient space $\mathbb{C}H^n(c)$.

- 6 Sadahiro Maeda (Saga Univ.)[#] A characterization of minimal real hypersurfaces of type (A_2) in a
Yuichiro Taniguchi (Saga Univ.) complex projective space 10

Summary: We characterize minimal real hypersurfaces of type $(|r mA_2)$ in the class of all minimal real hypersurfaces in a complex projective space by investigating extrinsic shapes of their geodesics.

- 7 Naoya Ando (Kumamoto Univ.)^{*} Over-determined systems on surfaces in 3-dimensional space forms ... 15

Summary: From the equations of Gauss and Codazzi–Mainardi, we can obtain an over-determined system on a surface with nowhere zero principal curvatures in a 3-dimensional space form. The set of solutions of this system is determined by the first fundamental form and principal distributions. Referring to results which were already obtained in the case where the ambient space is Euclidean, the speaker has obtained results with respect to over-determined systems on surfaces in other 3-dimensional space forms.

- 8 Kouhei Miura (Tokyo Univ. of Sci.)^{*} The global lightlike transversal bundles of lightlike paracomplex submanifolds in parahermitian manifolds 10

Summary: We study lightlike paracomplex submanifolds of parahermitian manifolds and their lightlike transversal bundles. In particular, we prove that if the paracomplex structure of the ambient space induces the identity endomorphism of the radical distribution, then there exists the global lightlike transversal bundle, which is uniquely determined with respect to a screen distribution and a screen transversal bundle of the lightlike submanifold.

- 9 Naoyuki Koike (Tokyo Univ. of Sci.)^{*} The classification of certain kind of isoparametric hypersurfaces in symmetric spaces of non-compact type 15

Summary: Recently we obtained a Cartan type identity for certain kind of curvature-adapted isoparametric hypersurfaces in symmetric spaces of non-compact type. This identity is a generalization of Cartan–D’Atri’s identity for curvature-adapted (=amenable) isoparametric hypersurfaces in rank one symmetric spaces. The proof is performed by showing the minimality of a focal submanifold of the complexification of the hypersurface. Furthermore, by using this identity, we showed that such curvature-adapted isoparametric hypersurfaces are principal orbits of Hermann actions.

- 10 Atsufumi Honda (Tokyo Tech)^{*} Weakly complete wave fronts one of whose principal curvatures is constant 10

Summary: Shiohama and Takagi proved that a complete surface one of whose principal curvatures is a non-zero constant in the Euclidean 3-space is either totally umbilical or umbilic-free. In this talk, we introduce a generalization to a class of surfaces with admissible singularities, so-called wave fronts. More precisely, we show that a weakly complete wave front one of whose principal curvatures is a non-zero constant in the Euclidean 3-space is either totally umbilical or umbilic-free. Moreover, as a corollary, we prove the orientability of such wave fronts.

- 11 Shyuichi Izumiya (Hokkaido Univ.)[#] Singularities of lightlike hypersurfaces along spacelike submanifolds in
Takami Sato (Hokkaido Univ.) anti-de Sitter space 15

Summary: Anti-de Sitter space is the Lorentzian space form with the negative curvature. In this talk we consider lightlike hypersurfaces along spacelike submanifolds in anti-de Sitter space with general codimension. Especially, we investigate the singularities of lightlike hypersurfaces as an application of the theory of Legendrian singularities.

- 12 Takami Sato (Hokkaido Univ.)[#] Evolutes of spacelike hypersurfaces in anti-de Sitter space 15

Summary: In this talk, we consider spacelike hypersurfaces in anti-de Sitter space. Especially, we investigate the geometric meaning of the singularities of both the anti-de Sitter Gauss image and the anti-de Sitter evolute from the view point of the Lagrangian/Legendrian singularity theory.

14:20–15:20

- 13 Hirotake Kurihara (Kyoto Univ.)[#] A characterization of great antipodal sets by design theory on complex Grassmannian spaces 15

Summary: A great antipodal set is a generalization of antipodal pair on a sphere. In this talk, we give a new characterization of a great antipodal set on a complex Grassmannian space by design theory.

- 14 Jun Nonaka (Keio Univ.)^{*} Coxeter polyhedra in hyperbolic spaces 15

Summary: A right-angled polyhedron is a kind of Coxeter Polyhedron. Vinberg showed that there are no compact right-angled polyhedra in the hyperbolic n -space \mathbb{H}^n for $n \geq 5$. This means that any right-angled polyhedron of finite volume in \mathbb{H}^n for $n \geq 5$ must have at least one cusp. I provide lower bounds on the number of cusps of right-angled polyhedra of finite volume in \mathbb{H}^n with $n = 6, \dots, 12$.

- 15 Soji Kaneyuki (上智大^{*}) On the group of holomorphic and anti-holomorphic transformations of a compact Hermitian symmetric space and the G -structure 15

Summary: Let M be a compact irreducible Hermitian symmetric space. We determine the full group of holomorphic and anti-holomorphic transformations of M . Also we characterize it as the automorphism group of a G -structure on M , called a generalized conformal structure.

15:45–16:45 Talk invited by Geometry Section

- Wayne Rossman (Kobe Univ.)[#] Construction of discrete surfaces in terms of discrete flat connections

Summary: We will talk about a method for discretization of surfaces that preserves certain differential geometric structures of the surfaces, with relations to preservation of properties of the underlying integrable systems. The method is based on: 1) restricting to types of smooth surfaces that have underlying integrable systems structures 2) noting that such surfaces have associated families of flat connections 3) then discretizing those connections 4) then using the discretized connections to determine the resulting discrete surfaces. The final conclusion will be a theory for general discrete linear Weingarten surfaces in 3-dimensional spaceforms. This is joint work with F. Burstall and U. Hertrich-Jeromin.

March 21st (Thu) Conference Room III

9:20–11:50

- 16 Takayuki Moriyama (Kyoto Univ.)[#] Deformations of special Legendrian submanifolds on Sasaki–Einstein manifolds 15

Summary: A Sasaki–Einstein manifold is a Riemannian manifold M whose cone $C(M)$ is a Calabi–Yau manifold. A submanifold X in a Sasaki–Einstein manifold M is a special Legendrian submanifold if the cone $C(X)$ is a special Lagrangian submanifold in $C(M)$. In this talk, we will see some results of deformations of a special Legendrian submanifold.

- 17 Kotaro Kawai (Tohoku Univ.)* Construction of coassociative submanifolds 10

Summary: The notion of coassociative submanifolds is defined as the special class of the minimal submanifolds in G_2 manifolds. We construct coassociative submanifolds in \mathbb{R}^7 and the anti-self-dual bundle over the 4-sphere by using the symmetry of the Lie group action.

- 18 Kota Hattori (Univ. of Tokyo)* Generalizations of Taub-NUT deformations 15

Summary: We introduce a generalizations of Taub-NUT deformations for large families of hyperkähler quotients, which is already known to be defined for toric hyperkähler manifolds and ALE spaces of type D_k .

- 19 Tomoyuki Hisamoto (Univ. of Tokyo)[#] Geometry of the space of Kähler metrics, the relation between Calabi-type functionals and the Donaldson–Futaki invariant. 15

Summary: Given a polarized Kähler manifold, we show that the algebraic norm of a test configuration equals to the norm of tangent vectors of associated weak geodesic ray in the space of Kähler metrics. Using this result, We may give a natural energy theoretic explanation for the lower bound estimate on the Calabi functional by Donaldson and prove the analogous result for the Kähler–Einstein metric.

- 20 Nobuhiko Otoba (Keio Univ.)[#] New examples of Riemannian metrics with constant scalar curvature 15

Summary: We constructed a one-parameter family of Riemannian metrics on the non-trivial S^2 -bundle over S^2 . In a certain sense, these metrics are the counterpart of the one-parameter family of natural product metrics on the trivial S^2 -bundle over S^2 . Every metric in the family has the following properties: (i) its isometry group contains the special unitary group $SU(2)$, (ii) the projection as fiber bundle is a Riemannian submersion with totally geodesic fibers onto the round 2-sphere of some radius, and (iii) it has constant scalar curvature. We observe some of these metrics are unique constant scalar curvature metrics in their respective conformal classes up to constant multiplication.

- 21 Hajime Fujita (Japan Women’s Univ.)[#] On an S^1 -equivariant index for symplectic manifold 15

Summary: Using a technique developed in a joint work with M. Furuta and T. Yoshida we give a formulation of S^1 -equivariant index theory for a prequantized symplectic manifold with a Hamiltonian S^1 -action. We explain the difference between our index and the index defined by M. Braverman.

- 22 Masao Jinzenji (Hokkaido Univ.)[#] Multi-point virtual structure constants and mirror computation of CP^2 -Masahide Shimizu (Hokkaido Univ.) model 10

Summary: In this talk, we introduce multi-point virtual structure constants for the mirror computation of Gromov–Witten invariants of CP^2 . These constants are defined as the intersection numbers of the compactified moduli space of quasi maps from CP^1 to CP^2 with $2 + n$ marked points. Some of the generating functions of these invariants correspond to the mirror maps and the other generating functions are translated into the generating functions of genus 0 Gromov–Witten invariants of CP^2 . We also discuss the mirror computation of the open Gromov–Witten invariants of CP^2 .

- 23 Tsukasa Takeuchi (Tokyo Univ. of Sci.)[#] About the configuration and characteristic of concrete recursion operator 10
 Kiyonori Hosokawa
 (Tokyo Univ. of Sci.)

Summary: It is known that a vector field X is separable, integrable and Hamiltonian for certain symplectic structure when X admits an invariant, mixed, diagonalizable tensor field T with vanishing Nijenhuis torsion and doubly degenerate eigenvalues without stationary points. Then, the vector field is a separable and completely integrable Hamiltonian system. The operator T is called a recursion operator. Now, we consider geodesic flow on n -dimensional sphere S^n and pseudo-Riemann metric as a concrete example, and we construct another recursion operator T_1 from T .

- 24 Peng Fei Bai (Nagoya Inst. of Tech.)^{*} Areas of trajectory-spheres 10
 Toshiaki Adachi (Nagoya Inst. of Tech.)

Summary: On a Kähler manifold we consider trajectory-spheres which are formed by trajectory-segments of arclength r under influence of Kähler magnetic fields. We show comparison theorems on norms of hole components of magnetic Jacobi fields, and give estimates of area elements of trajectory-spheres under some assumption on sectional curvatures.

13:00–14:00 Talk invited by Geometry Section

- Makiko Tanaka (Tokyo Univ. of Sci.)[#] Antipodal sets of compact symmetric spaces and the intersection of totally geodesic submanifolds

Summary: In my recent joint work with Hiroyuki Tasaki we proved that the intersection of two real forms in a Hermitian symmetric space of compact type is an antipodal set, in which the geodesic symmetry at each point is the identity. We also determined the intersection numbers of two real forms. One of our main ideas is making use of induction on polars, which are connected components of the fixed point set of a geodesic symmetry. Induction on polars is effective in both general arguments and case-by-case arguments. An antipodal set and a polar were first introduced by B.-Y. Chen–T. Nagano. In this talk I will give a brief survey of Chen–Nagano’s theory on compact symmetric spaces and then I will explain our results.

March 22nd (Fri) Conference Room III

9:30–11:30

- 25 Shun Maeta (Tohoku Univ.)[#] Biharmonic submanifolds and generalized Chen’s conjecture 10

Summary: We consider a biharmonic properly immersed submanifold M in a complete Riemannian manifold N with non-positive sectional curvature. Assume that the sectional curvature K^N of N satisfies $K^N \geq -L(1 + \text{dist}_N(\cdot, q_0)^2)^{\frac{\alpha}{2}}$ for some $L > 0$, $2 > \alpha \geq 0$ and $q_0 \in N$. Then, we prove that M is minimal. As a corollary, we give that any biharmonic properly immersed submanifold in a hyperbolic space is minimal. These results give affirmative partial answers to the global version of generalized Chen’s conjecture.

- 26 Shun Maeta (Tohoku Univ.)[#] Biharmonic Lagrangian submanifolds in complex space forms 10
Hajime Urakawa (Tohoku Univ.)

Summary: We give the necessary and sufficient conditions for Lagrangian submanifolds in Kähler manifolds to be biharmonic. We classify biharmonic PNMC Lagrangian H-umbilical submanifolds in the complex space forms. Furthermore, we classify biharmonic PNMC Lagrangian surfaces in the 2-dimensional complex space forms.

- 27 Yoshio Matsuyama (Chuo Univ.)[#] Curvature pinching for complete submanifolds 10

Summary: Complete classifications for a complete Kaehler submanifold M_n with the scalar curvature $\rho \geq n^2$ in a complex projective space and for a complete totally real minimal submanifold with nonnegative sectional curvature in a complex projective space are given, so that a conjecture of K. Ogiue are resolved.

- 28 Hiroki Sako (Kyoto Univ.)^{*} Generalizations of expander graphs and Property A for discrete metric spaces 15

Summary: I will introduce a generalization of expander sequences. An expander sequence is finite graphs which are highly connected in some sence. A sequence of weighted weak expander spaces will be defined. I will also review several notions related to amenability for discrete groups and metric spaces. Property A can be regarded as amenability for discrete metric spaces. It is proved that for a metric space X the following are equivalent: (i) there exists a sequence of weighted weak expander spaces inside X , (ii) X does not have property A.

- 29 Shouhei Honda (Kyushu Univ.)^{*} A Bochner type inequality on limit spaces. 20

Summary: We give the definition of L^p -convergence of tensor fields with respect to the Gromov–Hausdorff topology and several fundamental properties of the convergence. We apply this to establish a Bochner-type inequality which keeps the term of Hessian on the Gromov–Hausdorff limit space of a sequence of Riemannian manifolds with a lower Ricci curvature bound and to give a geometric explicit formula for the Dirichlet Laplacian on a limit space defined by Cheeger–Colding.

- 30 Kei Kondo (Tokai Univ.)[#] Toponogov’s comparison theorem in Finsler geometry 20
Shin-ichi Ohta (Kyoto Univ.)
Minoru Tanaka (Tokai Univ.)

Summary: We recently established a Toponogov comparison theorem for Finsler manifolds, in the manner of radial curvature geometry. Here, we consider the situation that the radial flag curvature is bounded below by the radial curvature function of a non-compact surface of revolution, the edge opposite to the base point is contained in a Berwald-like region, and that the Finsler metric is convex enough in the radial directions in that region.

14:20–15:20 Talk invited by Geometry Section

Jeff Viaclovsky [#] Critical metrics on connected sums of Einstein four-manifolds
(Univ. of Wisconsin, Madison)

Summary: I will discuss a gluing procedure designed to obtain critical metrics of quadratic Riemannian functionals on connected sums of certain Einstein four-manifolds. Briefly, start with two Einstein four-manifolds of positive scalar curvature which are "rigid". Using the Green's function for the conformal Laplacian, convert one of these into an asymptotically flat (AF) scalar-flat metric. A "naive" approximate critical metric is obtained by scaling down this AF metric, and attaching it to the other compact Einstein metric minus a small ball using cutoff functions to obtain a smooth metric on the connected sum. It turns out that this naive approximate metric is too rough, and must be refined in order to compute the leading term of the Kuranishi map. A zero of the Kuranishi map is then found for a specific quadratic Riemannian functional, which depends on the geometry of the factors, and also on the mass of the AF metric. This is joint work with Matt Gursky.

15:40–16:40 Talk invited by Geometry Section

Hiroshi Matsuzoe [#] Statistical manifolds and geometry of estimating functions
(Nagoya Inst. of Tech.)

Summary: The notion of statistical manifold was introduced by statistician Lauritzen. Later, an equivalent definition was given by Kurose in terms of a Riemannian metric and an affine connection. It is known that, under suitable conditions, a statistical model has a statistical manifold structure. Such a manifold structure is closely related to geometry of estimating functions. In this talk, I will give a short summary of geometry of statistical manifolds and estimating functions. Then I will talk non-integrable generalization of statistical manifolds.

Complex Analysis

March 22nd (Fri) Conference Room VIII

9:30–12:00

- 1 Katsuyuki Nishimoto * N-fractional calculus of the function $f(z) = ((z-b)^2-c)^{-3}$ and identities
 (Descartes Press Co.) 15

Summary: In this article the N-fractional calculus of the function in title is discussed by the calculation in the manners $((z-b)^2-c)^{-4} \cdot (z-b)^2-c)_r$ and $((z-b)^2-c)^{-3})_{r-1}$. Moreover some identities derived from them are presented.

One of them is shown as follows for example, $\sum_{k=0}^{\infty} \frac{[3]_k \Gamma(2k+6+\gamma)}{k! \Gamma(2k+6)} S^k = (1-S)G(k, \gamma, 0) - 2\gamma G(k, \gamma, 1) + \gamma(\gamma-1)G(k, \gamma, 2)$ where $G(k, \gamma, m) = \sum_{k=0}^{\infty} \frac{[4]_k \Gamma(2k+8+\gamma-m)}{k! \Gamma(2k+8)} S^k$, $(|\Gamma(2k+8+\gamma-m)| < \infty) S = \frac{c}{(z-b)^2}, |S| < 1, \Gamma(\dots)$; Gamma function and $[\lambda]_k = \lambda(\lambda+1) \cdots (\lambda+k-1) = \Gamma(\lambda+k)/\Gamma(\lambda)$ with $[\lambda_0] = 1$. (Notation of Pochhammer)

- 2 Mitsuru Uchiyama (Shimane Univ.)[#] Principal inverses of orthogonal polynomials 15

Summary: Let $\{p_n(t)\}$ be orthogonal polynomials with positive leading coefficients and d_n the maximal zero of $p'_n(t)$. The inverse of the restriction of $p_n(t)$ to $[d_n, \infty)$ is called the principal inverse of p_n and denoted by p_n^{-1} . We show it has an analytic continuation to the upper half plane that is a Pick (or Nevanlinna) function.

- 3 Hitoshi Shiraishi (Kinki Univ.)[#] Coefficient estimates for Schwarz functions 15
 Toshio Hayami (Kinki Univ.)

Summary: Let \mathcal{B} be the class of functions $w(z)$ of the form $w(z) = \sum_{k=1}^{\infty} b_k z^k$ which are analytic and $|w(z)| < 1$ in the open unit disk $\mathbb{U} = \{z \in \mathbb{C} : |z| < 1\}$. Then we call $w(z) \in \mathcal{B}$ the Schwarz function. Also, let \mathcal{P} denote the class of functions $p(z)$ of the form $p(z) = 1 + \sum_{k=1}^{\infty} c_k z^k$ which are analytic and $\text{Re}(p(z)) > 0$ in \mathbb{U} . In the present talk, we discuss new coefficient estimates for Schwarz functions.

- 4 Toshio Hayami (Kinki Univ.)[#] Coefficient estimates for a certain class concerned with arguments of
 Shigeyoshi Owa (Kinki Univ.) $f'(z)$ 15

Summary: Let \mathcal{A} denote the class of functions $f(z)$ of the form $f(z) = z + \sum_{n=2}^{\infty} a_n z^n$ which are analytic in the open unit disk $\mathbb{U} = \{z \in \mathbb{C} : |z| < 1\}$, and let \mathcal{P} be the class of functions $p(z)$ of the form $p(z) = 1 + \sum_{k=1}^{\infty} c_k z^k$ which are analytic in \mathbb{U} and satisfy the condition $\text{Re}(p(z)) > 0$ ($z \in \mathbb{U}$). In the present talk, we discuss the coefficient estimates of functions $f(z) \in \mathcal{A}$ satisfying $f'(z_0) = 0$ for some $z_0 \in \mathbb{U}$.

- 5 Junichi Nishiwaki (Setsunan Univ.)[#] Notes on a certain class of analytic functions 15
 Shigeyoshi Owa (Kinki Univ.)

Summary: Let \mathcal{A} be the class of analytic functions $f(z)$ in the open unit disk \mathbb{U} . Furthermore, the subclass \mathcal{B} of \mathcal{A} concerned with the class of uniformly convex functions or the class \mathcal{S}_p is defined. By virtue of some properties of uniformly convex functions and the class \mathcal{S}_p , some properties of the class \mathcal{B} are considered.

- 6 Kazuo Kuroki (Kinki Univ.)[#] Starlikeness of order α for certain class of analytic functions 15
 Shigeyoshi Owa (Kinki Univ.)

Summary: Let \mathcal{A} denote the class of functions $f(z)$ of the form $f(z) = z + \sum_{k=2}^{\infty} a_k z^k$ which are analytic in the open unit disk $\mathbb{U} = \{z \in \mathbb{C} : |z| < 1\}$. Also, let \mathcal{T}_λ be the class of functions $f(z) \in \mathcal{A}$ which satisfy the inequality $\left| \frac{z}{f(z)} - \lambda z \left(\frac{z}{f(z)} \right)' - 1 \right| < 1$ ($z \in \mathbb{U}$) for some complex number λ with $\lambda \neq 0$.

In the present talk, we discuss starlikeness of order α for $f(z) \in \mathcal{T}_\lambda$.

- 7 Naohiro Yaginuma (Nippon RAD, Inc.)[#] On the first boundary value problem of the biharmonic equation for the
 Minoru Yanagishita (Chiba Univ.) half-space 15

Summary: In this talk, we shall solve the first boundary value problem of the biharmonic equation for the half-space with respect to slowly growing and regular boundary functions. The relation between a particular solution and certain general solutions of this problem will be discussed. A solution of this boundary value problem for any regular boundary functions will also be given.

- 8 Hiroaki Masaoka (Kyoto Sangyo Univ.)[#] On harmonic Hardy–Orlicz spaces 15
 Tero Kilpeläinen (Univ. of Jyvaskyla)
 Pekka Koskela (Univ. of Jyvaskyla)

Summary: Given a \mathcal{P} -Brelot harmonic space, we show that various vector spaces of harmonic functions coincide if and only if they are finite dimensional.

- 9 Rikio Yoneda * Toeplitz operators and Hankel operators on the Bergman spaces with
 (Otaru Univ. of Commerce) closed range 10

Summary: In this research, we study the Hankel operators on the Bergman spaces with the closed range. And we will talk about Toeplitz operators on the Bergman spaces with closed range.

14:20–15:40

- 10 Masashi Kisaka (Kyoto Univ.)[#] On the transcendental entire functions with the property that $J(f) \cup$
 $\{\infty\} \subset \widehat{\mathbb{C}}$ is a Sierpiński carpet 15

Summary: Let f be a transcendental entire function and $J(f)$ its Julia set. Under some conditions, we show that $J(f) \cup \{\infty\} \subset \widehat{\mathbb{C}}$ is a Sierpiński carpet. Also we show that there exist transcendental entire functions with arbitrarily small growth which satisfy the above conditions.

- 11 Masahiro Yanagishita (Waseda Univ.)[#] On a relation between the universal Teichmüller space and the Grunsky
 operator 20

Summary: Being a Strebel point gives a sufficient condition for that the extremal Beltrami coefficient is uniquely determined in a Teichmüller equivalence class. We consider how Strebel points are characterized. In this talk, we will give a new characterization of Strebel points in a certain subset of the universal Teichmüller space by a property of the Grunsky operator.

- 12 Yoshihiko Shinomiya (Tokyo Tech)[‡] On holomorphic sections of Veech holomorphic families of Riemann surfaces 15

Summary: We give upper bounds of the numbers of holomorphic sections of Veech holomorphic families of Riemann surfaces. The numbers depend only on the topological types of base Riemann surfaces and fibers. We also give a relation between types of Veech groups and moduli of cylinder decompositions of flat surfaces.

- 13 Yohei Komori (Waseda Univ.)^{*} On a degenerate family of Riemann surfaces of genus two over an elliptic curve 15

Summary: We construct a degenerate family of Riemann surfaces of genus two constructed as double branched covering surfaces of a fixed torus. We determine its singular fibers and holomorphic sections.

16:00–17:00 Talk invited by Complex Analysis Section

- Tomoki Kawahira (Nagoya Univ.)[‡] Zalcman’s lemma and complex dynamics

Summary: For a given family of holomorphic maps on a plane domain, Zalcman’s lemma gives an if and only if condition for its non-normality. In this talk we apply this lemma to one-dimensional complex dynamics to characterize its chaotic locus (the Julia set), and explain its applications.

March 23rd (Sat) Conference Room VIII

10:00–12:00

- 14 Kohei Ueno ^{*} Böttcher coordinates for polynomial skew products 15
(Toba Nat. Coll. of Maritime Tech.)

Summary: We generalize the Böttcher’s theorem to polynomial skew products: under one condition a polynomial skew product is analytically conjugate to the associated monomial map on some region near infinity.

- 15 Tomoko Shinohara [‡] A construction of an invariant surface for an indeterminate point of rational mappings 15
(Tokyo Metro. Coll. of Ind. Tech.)

Summary: In this talk, consider a local dynamical structure of a rational mapping F of \mathbf{P}^n near the set I of indeterminate points of F . In general, after we blow up \mathbf{P}^n a finite number of times, we arrive at a variety X and a birational isomorphism of X with \mathbf{P}^n such that the induced rational map $\tilde{F} : X \rightarrow \mathbf{P}^n$ is regular.

Assume that the dimension of I is $n - 2$. Under certain condition, by using a sequence of blow ups, we can construct a surface V which contains I and is invariant by F . Moreover, we consider a specific rational mapping F and give the Taylor expansion of a defining function of V .

- 16 Tatsuhiro Honda [#] Distortion theorems for linearly invariant families 15
 (Hiroshima Inst. of Tech.)
 Hidetaka Hamada
 (Kyushu Sangyo Univ.)
 Gabriela Kohr (Babeş-Bolyai Univ.)

Summary: We give a distortion theorem for linearly invariant families on a homogeneous unit ball B of a finite dimensional complex Banach space X . The exponents in the distortion bounds depend on the Bergman metric at 0. Further, we introduce a new definition for the trace-order of a linearly invariant family on B , based on a Jacobian argument. We also construct an example of a linearly invariant family on B which has minimum trace-order and is not a subset of the normalized convex mappings of B for $\dim X \geq 2$. Finally, we prove a regularity theorem for linearly invariant families on B .

- 17 Tomohiro Okuma (Yamagata Univ.)* The maximal ideal cycles over complete intersection surface singularities
 Fan-Ning Meng (Yamagata Univ.) of Brieskorn type 15

Summary: For a complete intersection surface singularity of Brieskorn type, we give concrete descriptions of the maximal ideal cycle and the fundamental cycle on the minimal good resolution space. Then we provide a condition for these cycles to coincide.

- 18 Atsuhira Nagano (Waseda Univ.)[#] Double integrals on chambers of the Kummer surface and the Hilbert
 modular function 15

Summary: In this talk, we shall give a simple defining equation of a Kummer surfaces on the Humbert surface of invariant 5 with 2 complex parameter. The period mapping for this family has an expression of double integrals of an algebraic function on chambers in \mathbb{R}^2 .

- 19 Takayuki Koike (Univ. of Tokyo)* Minimal singular metrics of a line bundle admitting no Zariski-decomposition
 10

Summary: We give a concrete expression of a minimal singular metric of a big line bundle on a compact Kähler manifold which is the total space of a toric bundle over a complex torus. In this class of manifolds, Prof. Nakayama constructed examples which have line bundles admitting no Zariski-decomposition even after any proper modifications. As an application, we discuss the Zariski-closedness of non-nef loci and the openness conjecture of Demailly and Kollár in this class.

- 20 Masanori Adachi (Nagoya Univ.)[#] On the ampleness of positive CR line bundles over 3-manifolds foliated
 by Riemann surfaces 15

Summary: We give an example of a compact Levi-flat CR 3-manifold with a positive-along-leaves CR line bundle which is not ample with respect to transversely infinitely differentiable CR sections. This example shows that we cannot improve the regularity of Kodaira type embedding theorem for compact Levi-flat CR manifolds obtained by Ohsawa and Sibony.

14:20–15:20 Talk invited by Complex Analysis Section

Hidetaka Hamada [#] Loewner chains on complete hyperbolic complex manifolds
(Kyushu Sangyo Univ.)

Summary: We present a new geometric construction of Loewner chains in one and several complex variables which holds on complete hyperbolic complex manifolds and show that there is essentially a one-to-one correspondence between evolution families of order d and Loewner chains of the same order. As a consequence, we obtain a univalent solution $(f_t: M \rightarrow N)$ for any Loewner–Kufarev PDE. We also show that a modified Roper–Suffridge extension operator preserves Loewner chains of order d .

Functional Equations

March 20th (Wed) Conference Room IV

9:30–12:00

- 1 Tomoyuki Tanigawa (Kumamoto Univ.)* Regularly varying solutions of half-linear differential equations with retarded and advanced arguments 15

Summary: Sharp conditions are established for the existence of slowly varying solution and regularly varying solution of index 1 of the half-linear differential equation with both retarded and advanced arguments.

- 2 Toshiharu Kawasaki (Nihon Univ.)[#] On the Cauchy problem for an ordinary differential equation by using Masashi Toyoda (Tamagawa Univ.) a fixed point theorem 15

Summary: Kawasaki and Toyoda considered the second order Cauchy problem $u''(t) = f(t, u(t))$, for almost every $t \in [0, 1]$, $u(0) = 0$, $u'(0) = \lambda$, where f is a mapping from $[0, 1] \times (0, \infty)$ into \mathbb{R} and $\lambda \in \mathbb{R}$ with $\lambda > 0$. In this talk we consider more general Cauchy problem $u''(t) = f(t, u(t), u'(t))$, for almost every $t \in [0, 1]$, $u(0) = 0$, $u'(0) = \lambda$, where f is a mapping from $[0, 1] \times (0, \infty) \times \mathbb{R}$ into \mathbb{R} and $\lambda \in \mathbb{R}$ with $\lambda > 0$.

- 3 Ichiro Tsukamoto (Toyo Univ.)* On asymptotic behaviour of positive solutions of $x'' = t^{\alpha\lambda-2}x^{1+\alpha}$ ($\alpha = \lambda_0$, $\lambda > 0$) 12

Summary: We consider the differential equation denoted in the title, and claim that for all positive solutions, we get the domains of these and the analytical expressions of these valid in the neighbourhoods of the ends of the domains. In particular, we state the analytical expressions with new form.

- 4 Seiji Saito (Doshisha Univ.)[#] Globally uniformly asymptotic stability of solutions for difference equations 15

Summary: In this talk we discuss the globally uniformly asymptotic stability of solutions for difference equations and ordinary differential equations by applying converse theorems of solutions.

- 5 Katsuyuki Nishimoto * Solutions to the homogeneous Bessel equation by means of N-fractional calculus operator 15
 (Descartes Press Co.)

Summary: In this article, the solutions to the homogeneous Bessel equation are discussed by means of the N-fractional calculus operator (NFCO). That is, we have the particular solutions as follows, for example.

$$\begin{aligned} \varphi_{[1]} &= z^\nu e^{iz} (e^{-i2z} \cdot z^{-(\nu+1/2)})_{\nu-1/2} \text{ (fractional differintegrated form)} \\ &= (-i2)^{\nu-1/2} z^{-1/2} e^{-iz} {}_2F_0\left(\frac{1}{2} - \nu, \frac{1}{2} + \nu; \frac{i}{2z}\right) \\ &\left(\left|\frac{i}{2z}\right| < 1\right) \\ &= A \cdot H_\nu^{(2)}(z), \quad (A = \sqrt{\pi} 2^{\nu-1} e^{-i\pi\nu}) \end{aligned}$$

and

$$\begin{aligned} \varphi_{[6]} &= z^{-\nu} e^{iz} (z^{\nu-1/2} \cdot e^{-i2z})_{-(\nu+1/2)} \text{ (fractional differintegrated form)} \\ &= e^{i\pi(\nu+1/2)} \Gamma(-2\nu) z^\nu e^{-iz} {}_1F_1\left(\frac{1}{2} + \nu; 1 + 2\nu; 2iz\right) \quad (|2iz| < 1) \\ &\left(\left|\frac{\Gamma(-2\nu-k)}{\Gamma(-\nu+1/2)}\right| < \infty\right) \\ &= B^* \cdot J_\nu^{(2)}(z), \quad (B^* = 2^\nu \Gamma(-2\nu) \Gamma(1 + \nu) e^{i\pi(\nu+1/2)}) \end{aligned}$$

where ${}_pF_q(\dots)$ is the generalized Gauss hypergeometric function, $H_\nu^{(2)}(z)$ is the Hankel function, and

$$J_\nu^{(2)}(z) = e^{-iz} \frac{(z/2)^\nu}{\Gamma(1+\nu)} {}_1F_1\left(\frac{1}{2} + \nu; 1 + 2\nu; 2iz\right) = J_\nu(z) \quad (|2iz| < 1)$$

is the first kind Bessel Function.

- 6 Katsuyuki Nishimoto * The solutions to the radial Schrödinger equation of the hydrogen atom by means of N-fractional calculus operator 15
 (Descartes Press Co.)

Summary: In this article, the solutions to the radial Schrödinger equation of the Hydrogen atom (in the Coulomb field)

$$\varphi_2 \cdot x^2 + \varphi_1 \cdot 2x + \varphi \cdot \{-(1/4)x^2 + \nu x + l(l+1)\} = 0$$

are discussed by means of N-fractional calculus operator.

A particular solution to the equation above is shown as follows for example.

$$\begin{aligned} \varphi &= \varphi_{[1]} = x^l e^{x/2} (e^{-x} \cdot x^{\nu-(l+1)})_{l+\nu} \text{ (fractional differintegrated form)} \\ &= (e^{i\pi})^{l+\nu} e^{-x/2} x^{\nu-1} {}_2F_0(-l - \nu, l + 1 - \nu; -1/x) \\ &\left(|-1/x| < 1\right) \end{aligned}$$

where ${}_pF_q(\dots)$; Generalized Gauss hypergeometric functions.

- 7 Ryu Sasaki (Kyoto Univ.)# Global solutions of certain second order differential equations with a high degree of apparent singularity 10
 Kouichi Takemura (Chuo Univ.)

Summary: Infinitely many explicit solutions of certain second order differential equations with an apparent singularity of characteristic exponent -2 are constructed by adjusting the parameter of the multi-indexed Laguerre polynomials.

- 8 Nobuki Takayama # Pfaffian systems of A-hypergeometric systems 15
 (Kobe Univ./JST CREST)

Takayuki Hibi

(Osaka Univ./JST CREST)

Kenta Nishiyama

(Osaka Univ./JST CREST)

Summary: We are interested in bases of $R_n/(R_n H_A[s])$ as the vector space over the field $\mathbf{C}(s, x)$ where $H_A[s]$ is an A-hypergeometric ideal. Any basis of the vector space yields an associated Pfaffian system or an integrable connection associated to $H_A[s]$. Bases can be described by those of simpler quotients $R_n/(in_w(I_A) + \sum R_n(E_i - s_i))$.

- 9 Hiromasa Nakayama (Kobe Univ./JST CREST) [#] Gröbner basis for differential equations of the Lauricella hypergeometric functions 15

Summary: We find Gröbner basis for differential equations of the Lauricella hypergeometric function F_A, F_B, F_C, F_D . By using the Gröbner basis, we determine the characteristic variety and the singular locus of F_B .

14:15–16:30

- 10 Hidekazu Ito (Kanazawa Univ.) [#] Superintegrability of vector fields and their normal forms near equilibrium points 15

Summary: The notion of Liouville integrability for Hamiltonian systems can be generalized to (non-Hamiltonian) vector fields by assuming the existence of symmetry (commuting vector fields) as well as integrals. Using this notion, Zung studied the problem of existence of a convergent normalization of a vector field near an equilibrium point. In this talk, we consider the same problem under the assumption of non-commutative (super) integrability. We present a result establishing the existence of coordinates in which the system can be solved explicitly under some non-resonance condition.

- 11 Chihiro Matsuoka (Ehime Univ.) [#] Global solutions created by Borel–Laplace transform of difference equations associated with Hénon maps 15

Summary: In this study, we propose new analytic functions that can describe the stable and unstable manifolds of saddle fixed points of the Hénon maps. An algorithm to construct these functions and concrete forms of them are given by using the Borel–Laplace transform. We prove that the obtained functions differ from the functions, linearizing analytic maps, proposed by Poincaré. Using the asymptotic expansion of one of these functions, we show that it is possible to depict the detailed structure of the stable and unstable manifolds of the Hénon map.

- 12 Masaki Hibino (Meijo Univ.) ^{*} On the summability of divergent power series solutions for certain 1st order linear PDEs 15

Summary: We study the Borel summability of divergent power series solutions for certain singular first-order linear partial differential equations of nilpotent type. Despite the fact that the domain of the Borel sum is local, there is a close affinity between the Borel summability of divergent solutions and global analytic continuation properties for coefficients of equations.

- 13 Yasuaki Nijjima (Chiba Univ.) [#] On the prolongation of 2-bounded holomorphic solutions to the first order involutive system 10

Summary: The prolongation problem of the partial differential equation has a very important position in the theory of partial differential equations. In 1975, the prolongation of holomorphic solutions of determined nonlinear partial differential equations was studied by Tsuno. In this talk, we study the prolongation of holomorphic solutions of the first order involutive system by using the method of Tsuno.

- 14 Hideshi Yamane (Kwansei Gakuin Univ.) [#] Long-time asymptotics for the defocusing integrable discrete nonlinear Schrödinger equation 15

Summary: We investigate the long-time asymptotics for the defocusing integrable discrete nonlinear Schrödinger equation of Ablowitz–Ladik by means of the inverse scattering transform and the Deift–Zhou nonlinear steepest descent method. The leading term is a sum of two terms with decaying oscillation.

- 15 Haruya Mizutani (Gakushuin Univ.)[‡] Remarks on Strichartz estimates for Schrödinger equations with potentials superquadratic at infinity 15

Summary: We study local-in-time Strichartz estimates with loss of derivatives for Schrödinger equations with variable coefficients and electromagnetic potentials, under the conditions that the geodesic flow is nontrapping and convex and that potentials grow supercritically at infinity.

- 16 Tetsutaro Shibata (Hiroshima Univ.)^{*} Inverse bifurcation problems for diffusive logistic equation of population dynamics 15

Summary: We consider the nonlinear eigenvalue problem arising in population dynamics with unknown nonlinear term $f(u)$. Our focus is inverse bifurcation problem in L^1 -framework. Precisely, we prove that the asymptotic behavior of L^1 -bifurcation curve $\lambda(\alpha)$ as $\alpha \rightarrow \infty$ determines $f(u)$ uniquely, where $\alpha := \|u_\lambda\|_1$.

- 17 Yutaka Kamimura (Tokyo Univ. of Marine Sci. and Tech.)[‡] An inverse analysis of advection-diffusion 15

Summary: We consider an ocean circulation inverse problem to determine unknown velocity field and diffusivities of the time-independent advection-diffusion equation from data of a tracer. A reconstruction formula is shown in terms of a solution to Marchenko-type integral equation. Moreover a necessary and sufficient condition for an analytic function in the right half-plane to be a tracer data is shown. A uniqueness result for the velocity field and diffusivities is also shown

16:45–17:45 Talk invited by Functional Equations Section

- Naoto Yamaoka (Osaka Pref. Univ.)[‡] An oscillation constant for half-linear differential equations and its application

Summary: This talk is concerned with the oscillation problem for the half-linear differential equations $(a(t)|x'|^{p-2}x')' + b(t)|x|^{p-2}x = 0$, where $p > 1$, and $a(t)$, $b(t)$ are positive and continuous on $(0, \infty)$. A typical example of the equation is the generalized Euler differential equation $(|x'|^{p-2}x')' + \delta|x|^{p-2}x/t^p = 0$, where $\delta > 0$. It is known that the condition $\delta > ((p-1)/p)^p$ is necessary and sufficient for all nontrivial solutions of the generalized Euler differential equation to be oscillatory. Some results for half-linear or more general nonlinear differential equations are obtained by the condition. Moreover, elliptic equations with p -Laplacian operator are discussed as an application to the results.

March 21st (Thu) Conference Room IV

9:30–12:00

- 18 Satoshi Tanaka (Okayama Univ. of Sci.)[‡] Exact multiplicity of positive solutions for a class of two-point boundary value problems with one-dimensional p -Laplacian 15

Summary: Employing Kolodner–Coffman method, we show the exact multiplicity of positive solutions for one-dimensional p -Laplacian which is subject to Dirichlet boundary condition with a positive convex nonlinearity and an indefinite weight function. Moreover, the results obtained here are applied to the study of radially symmetric solutions of the Dirichlet problem for elliptic equations in annular domains.

- 19 Naoki Sioji (Yokohama Nat. Univ.)[#] Uniqueness of a positive radial solution for an elliptic equation $\Delta u + g(r)u + h(r)u^p = 0$ and its applications 15
 Kohtaro Watanabe
 (Nat. Defense Acad. of Japan)

Summary: We study the uniqueness of a positive radial solution for an elliptic equation $\Delta u + g(r)u + h(r)u^p = 0$ under Dirichlet boundary condition and we apply it to an Brezis–Nirenberg problem on a spherical cap.

- 20 Ryuji Kajikiya (Saga Univ.)^{*} Asymmetry of positive solutions of the Emden–Fowler equation in hollow symmetric domains 15

Summary: In this lecture, we study the Emden–Fowler equation in a hollow domain which is invariant under the action of a closed subgroup of the orthogonal group. Then we prove that if the domain is thin enough, a least energy solution is not group invariant.

- 21 Ryuji Kajikiya (Saga Univ.)^{*} Multiple positive solutions of the Emden–Fowler equation in hollow symmetric domains 15

Summary: In this lecture, we study the Emden–Fowler equation in a hollow symmetric domain. Then we prove that if the domain is thin enough, there exist multiple positive solutions.

- 22 Yasuhito Miyamoto (Keio Univ.)[#] Structure of the positive solutions for supercritical elliptic equations in a ball 10

Summary: We study the global branch consisting of the positive solutions for supercritical elliptic equations in a ball. We show that if the nonlinear term satisfies certain conditions, then the branch has infinitely many turning points.

- 23 Yasuhito Miyamoto (Keio Univ.)[#] Symmetry breaking bifurcation from solutions concentrating on the equator of \mathbb{S}^N 10

Summary: We construct a smooth branch consisting of the positive radial solutions concentrating on the equator on \mathbb{S}^N . We show that this branch has infinitely many symmetry breaking bifurcation points.

- 24 Yasuhito Miyamoto (Keio Univ.)[#] Monotonicity of the first eigenvalue and the global bifurcation diagram
 Kazuyuki Yagasaki (Hiroshima Univ.) for the branch of interior peak solutions 10

Summary: We are interested in the structure of solutions for an elliptic Neumann problem in a ball. We study the global bifurcation diagram of the branch of interior peak solutions. In particular the monotonicity of a certain time-map is shown when the domain is an interval. We also study the monotonicity of the first eigenvalue.

- 25 Daisuke Naimen (Osaka City Univ.)[#] Existence of infinitely many solutions for nonlinear Neumann problems with indefinite coefficients 15

Summary: We investigate the nonlinear Neumann boundary value problem: $-\Delta u + u = a(x)|u|^{p-2}u$ in Ω , $\frac{\partial u}{\partial \nu} = \lambda b(x)|u|^{q-2}u$ on $\partial\Omega$, where Ω is a smooth bounded domain in \mathbb{R}^N with $N \geq 3$ and $\frac{\partial}{\partial \nu}$ denotes the outer normal derivative. We suppose $1 < q < 2 < p \leq 2^* = 2N/(N-2)$ and a and b are sign-changing continuous functions in $\overline{\Omega}$. Under the suitable conditions on a and b , we prove the existence of infinitely many solutions of the problem for sufficiently small $\lambda > 0$. We ensure the existence by min-max theorem described by the Krasnoselski genus. In addition, we apply the concentration compactness lemma by Lions when $p = 2^*$.

- 26 Yusuke Kotera (Osaka Univ.)[#] Hadamard variational formula for general domain perturbation 10
 Takashi Suzuki (Osaka Univ.)
 Takuya Tsuchiya (Ehime Univ.)

Summary: We study the Hadamard variational formula for general domain perturbation, especially second variational formula for Dirichlet problem and mixed problem.

- 27 Yoichi Miyazaki (Nihon Univ.)[#] L_p regularity theorem for elliptic equations and smoothness of the domain 12

Summary: We derive the L_p regularity theorem for elliptic equations under restricted smoothness assumptions on the boundary of the domain. If the elliptic operator is of order $2m$, we can lessen the smoothness assumption by $m - 1$ in both cases of non-divergent operators and divergent operators.

13:30–14:30 Award Lecture for 2012 Analysis Prize

- Shigeru Sakaguchi (Tohoku Univ.)[#] Stationary isothermic surfaces and geometry of domain

Summary: This talk is based on the results obtained by collaborating with Rolando Magnanini (Università di Firenze). Let Ω be a domain in $\mathbb{R}^N (N \geq 2)$ with $\partial\Omega = \partial(\mathbb{R}^N \setminus \overline{\Omega})$. We consider the solution u of either the initial-boundary value problem, where the initial value equals zero and the boundary value equals 1, or the Cauchy problem where the initial data is the characteristic function of the set $\mathbb{R}^N \setminus \Omega$. A hypersurface Γ in \mathbb{R}^N is said to be a *stationary isothermic surface* of u if at each time the solution u remains constant on Γ . The problem we consider is the classification of all the domains Ω having a stationary isothermic surface. We review the previous results and report some new results. Among these, in particular, a new result concerning the characterization of the circular cylinder in \mathbb{R}^3 is reported.

March 22nd (Fri) Conference Room IV

9:30–12:00

- 28 Chihiro Aida (Meiji Univ.)[#] Diffusion-induced bifurcation from infinity 15
 Chao-Nien Chen
 (Nat. Changhua Univ. of Edu.)
 Hirokazu Ninomiya (Meiji Univ.)

Summary: Diffusion term has an influence on global existence of solution in reaction diffusion system. It is known that there is this phenomenon in some specific nonlinearity, however, how do we understand this phenomenon in the case of general nonlinear term? In this presentation I will explain diffusion-induced bifurcation from infinity as one of answer to this question.

- 29 Yuki Kaneko (Waseda Univ.)[#] Spreading and vanishing for free boundary problems in an ecological
 Yoshio Yamada (Waseda Univ.) model 15
 Kazuhiro Oeda (Waseda Univ.)

Summary: We consider free boundary problems for reaction-diffusion equations modeling the spreading of species, where unknown functions are population density and spreading front of species. Moreover, the dynamical behavior of the free boundary is determined by Stefan-like condition. The purpose of this talk is to show the asymptotic behavior of solutions which is understood as dichotomy theorem of spreading or vanishing of species. We also give some sufficient conditions for spreading or vanishing.

- 30 Hiroko Okochi (Tokyo Univ. of Pharmacy and Life Sci.)[#] Conditions for Turing’s instability concerning reaction-diffusion equations 8

Summary: Motivated to research behaviors of solutions to reaction-diffusion equations, we consider simplified differential equations of the form $du/dt \in -\partial\varphi(u(t)) + g$. Here, $\partial\varphi$ denotes a subdifferential operator defined in H and $g \in H$. We show that the relation $g \notin R(\partial\varphi)$ is necessary and sufficient for Turing’s instability, and that the relation $g \in \overline{R(\partial\varphi)}$ is necessary for pattern transitions.

- 31 Hiroko Okochi (Tokyo Univ. of Pharmacy and Life Sci.)[#] Pattern transitions of solutions concerning reaction-diffusion equations 8

Summary: Considering differential equations of the form $du/dt \in -\partial\varphi(u(t)) + g$, where $\partial\varphi$ denotes a subdifferential operator defined in H and $g \in H$, we show that if $g \in \overline{R(\partial\varphi)} \setminus R(\partial\varphi)$ and if $\varphi(rx) = |r|^p\varphi(x)$ holds for some $p > 1$, then every solution satisfies pattern transition which does not converge as $t \rightarrow \infty$. Moreover, under the same conditions, each solution u satisfies that for sufficiently large t , $u(t)$ is almost orthogonal to g . Clearly, this behavior is enough different from no diffusion cases $\partial\varphi = 0$.

- 32 Yoshifumi Mimura (Tokyo Univ. of Sci.)[#] The variational formulation of the fully parabolic Keller–Segel system with degenerate diffusion 15

Summary: We prove the time global existence of solutions of the degenerate Keller–Segel system, under the assumption that the mass of the first component is below a certain critical value. What we deal with is the full parabolic-parabolic system rather than the simplified parabolic-elliptic system. Our approach is to formulate the problem as a gradient flow on the product space of the Wasserstein space and L^2 -space.

- 33 Sachiko Ishida (Tokyo Univ. of Sci.)[#] Local-in-time existence and blow-up of solutions to quasilinear degenerate parabolic-parabolic Keller–Segel systems 15
Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This talk gives a blow-up result for the quasilinear degenerate Keller–Segel systems of parabolic-parabolic type. It is known that the system has a global solvability in the case where $q < m + \frac{2}{N}$ (m denotes the intensity of diffusion and q denotes the nonlinearity) without any restriction on the size of initial data, and where $q \geq m + \frac{2}{N}$ and the initial data are “small”. However, there is no result when $q \geq m + \frac{2}{N}$ and the initial data are “large”. This talk discusses such case and show that there exist blow-up energy solutions from initial data having large negative energy.

- 34 Noriko Mizoguchi (Tokyo Gakugei Univ./JST PRESTO)^{*} Finite-time blowup in the two-dimensional parabolic Keller–Segel system 15
Michael Winkler (Univ. Paderborn)

Summary: There are a lot of solutions to simplified Keller–Segel system blowing up in finite time. However it has been open for over forty years whether finite-time blow-up is a generic feature in the original Keller–Segel system. In this talk, we give a positive answer to the question.

- 35 Takashi Suzuki (Osaka Univ.)[#] Global-in-time behavior of Lotka–Volterra systems 10
Yoshio Yamada (Waseda Univ.)

Summary: We study the Lotka–Volterra system provided with the diffusion. We extend our previous work to the case of more than three components and clarify the dynamics, particularly the role of its spatially homogeneous part.

- 36 Norisuke Ioku (Ehime Univ.)[‡] On the best constant for the Hardy inequality in the limiting case with scale invariance 12

Summary: We are concerned with Hardy type inequalities in limiting cases with scale invariance. Using the oscillation of rearranged function which is defined by Bennett–Devore–Sharpley, we show Hardy type inequalities in limiting cases with scale invariance. We also show that the Hardy inequality with logarithmic term can be proved as corollary of the result.

- 37 Hiroya Ito (Univ. of Electro-Comm.)[‡] A generalization of the Korn inequality 15

Summary: We consider a generalization of Korn’s inequality, which is essential in mathematical elasticity, from the viewpoint of the coercivity for first order elliptic systems with constant coefficients. Some necessary and sufficient conditions for such coercivity to hold are known from Nečas’s work. The main purpose of this talk is to present a new necessary and sufficient condition, which is in general easier to check than the known conditions. Although the establishment of the new condition is not so easy in the sense that it relies on a certain tool in algebraic geometry, the condition provides some useful information about what are vague in Nečas’s argument. Moreover, an inequality stronger than the usual Korn inequality is presented.

14:15–16:15

- 38 Naoyuki Ichihara (Hiroshima Univ.)^{*} On the criticality of viscous Hamilton–Jacobi equations 15

Summary: We deal with a nonlinear additive eigenvalue problem for viscous Hamilton–Jacobi equations. Qualitative properties of the principal eigenvalue and associated eigenfunction are studied. Such analysis plays a key role in studying the corresponding stochastic optimal control problem. Our results can be regarded as a nonlinear extension of the criticality theory for Schrödinger operators with decaying potentials.

- 39 Tomoyuki Niizato (Osaka Univ.)^{*} Almost global existence of solutions to the short-pulse equation 10

Summary: We consider the Cauchy problem for the short-pulse equation: $\partial_t u - \partial_x^{-1} u = \partial_x (u^3)$. We prove an almost global existence of solutions to the short-pulse equation. More precisely, we have a lower bound of maximal existence time T as follows: $T \geq \exp\left(\frac{B}{\varepsilon^2}\right)$, where ε is the size of initial data.

- 40 Takamori Kato (Kyoto Univ.)[‡] Unconditional well-posedness of the fifth order KdV equation with Kotaro Tsugawa (Nagoya Univ.) periodic boundary condition 15

Summary: We consider the well-posedness of the Cauchy problem for the fifth order KdV equation in the periodic setting when initial data is given in the Sobolev space H^s . This equation is one of the KdV hierarchies. The direct iteration method does not work for any $s \in \mathbb{R}$ because three derivatives are included in the resonant parts. To overcome this difficulty, we use the algebraic structure of the nonlinear terms. Strong nonlinear interactions are canceled by symmetry of the nonlinear terms and we obtain the unconditional well-posedness for $s \geq 1$. This result is optimal in some sense.

- 41 Nakao Hayashi (Osaka Univ.)^{*} Logarithmic time decay and cubic nonlinear Schrödinger equations ... 10

Summary: We consider the Cauchy problem for cubic nonlinear Schrödinger equations. Our purpose is to study the influence of the resonance cubic term to another type of cubic nonlinearity. Under some conditions, we prove time decay of small solutions with a logarithmic correction.

- 42 Masahiro Ikeda (Osaka Univ.)[#] Lifespan of solutions for the nonlinear Schrödinger equation without gauge invariance 10

Summary: We study the lifespan of solutions for the nonlinear Schrödinger equation with a subcritical non-gauge invariant power nonlinearity. Our main aim in this talk is to prove an upper bound of the lifespan in the subcritical case.

- 43 Toshiyuki Suzuki (Tokyo Univ. of Sci.)[#] The limiting case of nonlinear Schrödinger equations with inverse-square potentials 15

Summary: We consider the Cauchy problem for nonlinear Schrödinger equations with with inverse-square potentials $(\mathbf{NLS})_a$. Here $P_a := -\Delta + a|x|^{-2}$ is nonnegative and selfadjoint in $L^2(\mathbb{R}^N)$ if $a \geq -(N-2)^2/4$ (in the sense of form-sum). Okazawa–S.–Yokota (2012) showed the wellposedness of $(\mathbf{NLS})_a$ for $a > -(N-2)^2/4$. Thus the wellposedness of $(\mathbf{NLS})_a$ for $a = -(N-2)^2/4$ is open.

- 44 Hayato Miyazaki (Hiroshima Univ.)[#] The derivation of the conservation law for nonlinear Schrödinger equations of Gross–Pitaevskii type 10

Summary: We consider the derivation of the conservation law for nonlinear Schrödinger equations of Gross–Pitaevskii type. It proceeds in two steps to construct a time global solution for nonlinear Schrödinger equations with nonlinearities of gauge invariance. The first step is to construct a time local solution to Duhamel’s integral equations by using a contraction argument. The next step is to extend the solution to a time global solution by using conservation laws. Thus, it is important to obtain conservation laws. In this talk, using Ozawa’s idea, we show that the conservation law is derived in a way independent of approximating procedure. By using the method, we may remove a technical assumption for the nonlinearity necessary to construct the time global solution.

- 45 Nobu Kishimoto (Kyoto Univ.)[#] Well-posedness for the cubic nonlinear Schrödinger equation on two-dimensional torus 15

Summary: We consider the initial value problem for the cubic nonlinear Schrödinger equation on two-dimensional torus with general period and related Strichartz-type estimates. Under some condition on the period, we show that the L^4 Strichartz estimate with no derivative loss fails, and that the data-to-solution map associated with the initial value problem also fails to be smooth in the L^2 topology, which implies that the standard iteration argument does not work to prove the well-posedness in L^2 . The condition on the period is related to how close the ratio of two periods for different directions can be approximated by rational numbers, and almost all periods satisfy that condition.

16:30–17:30 Award Lecture for 2012 Analysis Prize

- Yoshiyuki Kagei (Kyushu Univ.)[#] Asymptotic behavior of solutions of the compressible Navier-Stokes equation around a parallel flow

Summary: We consider the initial boundary value problem for the compressible Navier-Stokes equation in an n -dimensional infinite layer ($n \geq 2$). Our main interest is in stability properties of parallel flows. We show that if the Reynolds and Mach numbers are sufficiently small, then strong solutions to the compressible Navier-Stokes equation around the stationary parallel flow exist globally in time for sufficiently small initial perturbations. The asymptotic behavior of the solution in large time is described by a solution of an $n - 1$ dimensional linear heat equation when $n \geq 3$ and by a solution of a 1-dimensional viscous Burgers equation when $n = 2$.

March 23rd (Sat) Conference Room IV

9:30–11:45

- 46 Hiroyuki Takamura * An example of dissipative structure of nonlinear wave equations with
(Future Univ.-Hakodate) quadratic terms in four space dimensions 10
Kyouhei Wakasa
(Future Univ.-Hakodate)

Summary: One of the final problems which was open more than 20 years on the optimality for the general theory of the fully nonlinear wave equations was solved by our previous work (J. Differential Equations, 2011). Such a result is achieved by so-called almost global solution of a semilinear equation with a single and positive quadratic term in four space dimensions. In this talk, I would like to show you another equation with a special quadratic term of non-single and indefinite sign which admits a global in time solution.

- 47 Kazuyuki Doi (Toyama Pref. Univ.) * On the weighted pointwise estimates for derivatives of solutions to the
Hideo Kubo (Hokkaido Univ.) wave equation 10

Summary: In this talk we would like to present a simplified approach to the weighted pointwise estimate for the solution to the inhomogeneous wave equation in three space dimensions obtained by the work of Yokoyama (2000). Actually, we are able to avoid several complicated integrals appeared in the course of the proof, by using a known estimate for the homogeneous wave equation due to Klainerman (1984). We also modify the weight in such a way that the argument in the application to the nonlinear problem becomes rather simple.

- 48 Tomonari Watanabe (Hiroshima Univ.)[#] Global existence and decay estimates for quasilinear wave equations
with nonuniform dissipative term 10

Summary: We study global existence and decay estimates for quasilinear wave equations with nonuniform dissipative term. In the case of the nondissipative case, it is well known that no matter how small the initial data, there do not exist time globally defined smooth solutions in general. But we can prove the small data global existence by assuming the dissipation effective near the infinity, even if equations behave the quasilinear wave equations on the bounded domain. Furthermore we get the decay estimates with additional assumptions on initial data.

- 49 Itsuko Hashimoto * Initial boundary value problem for scalar conservation law 10
(Kanazawa Univ./Osaka City Univ.)
Heinrich Freistühler (Konstanz Univ.)

Summary: We consider the initial boundary value problem with wide class of flux functions.

- 50 Naoki Tsuge (Gifu Univ.)[#] The motion of the gas in a nozzle —Time global existence and invariant
regions— 15

Summary: We study the motion of isentropic gas in a nozzle. In the present talk, we consider unsteady flow, which is governed by the compressible Euler equation, and prove the existence of global solutions for the Cauchy problem. Although the flow is recently studied in some papers, the monotonicity of the cross section area of the nozzle is assumed in these papers. Therefore, we consider the general cross section area. When we prove the global existence, the most difficult point is to obtain the bounded estimate for solutions. To overcome this, we employ a new invariant region.

- 51 Jan Prüss (Univ. Halle)* On a stability of incompressible two-phase flows with phase transitions
 Senjo Shimizu (Shizuoka Univ.) in a bounded domain: The case of non-equal densities 15
 Mathias Wilke (Univ. Halle)

Summary: In this talk, we discuss about the model for incompressible two-phase flows with phase transitions consistent with thermodynamics in the case of constant but non-equal densities of the phases. We extend our well-posedness result to general geometries, study the stability of the equilibria of the problem.

- 52 Tetu Makino (Yamaguchi Univ.)* Spherically symmetric motions of a gaseous star 15

Summary: Spherically symmetric motions of a gaseous star governed by the Euler–Poisson equations are analyzed by the Nash–Moser theory. Smooth solutions for which time-periodic linearized approximations plus equilibrium governed by the Lane–Emden equation are the first approximations are constructed under some assumptions on the adiabatic exponent.

- 53 Teppei Kobayasi (Meiji Univ.)* Jeffery–Hamel’s flows in the plane III 10

Summary: Jeffery–Hamel’s flow is treated by the various physical method and situations. L. Rosenhead [6] investigates the behavior of a solution of Jeffery–Hamel’s flow. L. D. Landau and E. M. Lifshitz [5] obtains the results similar to [6]. L. E. Fraenkel [1] investigates Jeffery–Hamel’s flow in the slightly curved V-shaped domain. But Jeffery–Hamel’s flow have seldom been treated by the mathematical method. It is known that in the half space G. P. Galdi, M. Padula, V. A. Solonnikov [2] obtain a solution of Jeffery–Hamel’s flow. In this talk we succeed in proving the existence of a solution of Jeffery–Hamel’s flow for a given flux in the V-shaped domain between two inclined plane walls interacting with the smaller angle than the acute angle using the similar method to [2].

- 54 Teppei Kobayasi (Meiji Univ.)* Steady Navier–Stokes equations with Poiseuille’s flow and Jeffery–Hamel’s flow 15

Summary: Let us consider a steady flow of an incompressible viscos fluid in a two dimensional unbounded domain with unbounded boundaries. The domain has two outlets. The upstream part of the domain is a cylinder and the downstream part of the domain is a V-shaped domain between two inclined plane walls. In the upstream part the velocity is required to approach the Poiseuille flow and in the downstream part the velocity is required to approach Jeffery–Hamel’s flow. We succeed in proving the existence of such a steady flow under the restricted flux condition which depends only on the upstream and downstream part.

14:15–15:15 Talk invited by Functional Equations Section

- Hiroyuki Takamura [#] General theory of initial value problems for nonlinear wave equations
 (Future Univ.-Hakodate) and its optimality.

Summary: The optimality of the general theory of nonlinear wave equations has been recently completed by two works on the blowing-up solutions for model equations. One of them, our theorem on the last problem, is focused on quadratic terms in four space dimensions. In this talk, I would like to outline the general theory, and to introduce the difficulty in such a situation and our success to overcome it including our try to find a criterion to get the global existence of classical solutions.

Real Analysis

March 20th (Wed) Conference Room VIII

9:00–12:10

- 1 Shota Kojima (Rikkyo Univ.)[#] A generalization of e 10

Summary: We will consider a generalization of an expression which defines e .

- 2 Yukino Tomizawa (Chuo Univ.)[#] Lipschitz evolution operators in Banach spaces 15
 Yoshikazu Kobayashi (Chuo Univ.)
 Naoki Tanaka (Shizuoka Univ.)

Summary: The purpose of study is to obtain a new natural characterization of the continuous infinitesimal generators of Lipschitz evolution operators in a general class. We study the existence and uniqueness of solutions to the initial-value problem for nonautonomous differential equations in Banach spaces. We introduce a dissipativity condition with respect to a family of metric-like functionals, which is a relaxation of dissipativity conditions employed in prior researches and guarantees the existence and uniqueness of solutions to the initial-value problem. Moreover, we introduce a class of Lipschitz evolution operators. We can characterize the infinitesimal generators of Lipschitz evolution operators by conditions which obtain the existence and uniqueness of solutions to the initial-value problem.

- 3 Takesi Fukao (Kyoto Univ. of Edu.)[#] Characterization of the solution for evolution equations with time-
 Nobuyuki Kenmochi (Bukkyo Univ.) dependent constraints 15

Summary: In this talk, the existence and uniqueness questions of abstract parabolic variational inequalities are considered in connection with Lagrange multipliers. The focus of authors attention is the characterization of parabolic variational inequalities by means of Lagrange multipliers. It is well-known that various kinds of parabolic differential equations under convex constraints are represented by variational inequalities with time-dependent constraints, and the usage of Lagrange multipliers associated with constraints enables to reformulate the variational inequalities as equations. As a typical case, a parabolic problem with nonlocal time-dependent obstacle is treated in the framework of abstract evolution equations governed by time-dependent subdifferentials.

- 4 Toyohiko Aiki (Japan Women's Univ.)[#] On large time behavior of a solution to the concrete corrosion problem
 Adrian Muntean (TU Eindhoven) in a sewer pipe 15

Summary: In this talk we show a two-scale model for concrete corrosion in a sewer pipe. The model is obtained in order to describe the process of the product of gypsum in water region of the concrete. The existence and the uniqueness of a solution to the model were already studied by Fatim–Muntean–Aiki. The main result of the talk is to establish a large time behavior of solution. More precisely, the solution converges to a stationary solution strongly in L^2 space in case we assume that the function describing the rate of product of gypsum is strictly increasing.

- 5 Ken Shirakawa (Chiba Univ.) Existence theorem for solutions to multidimensional phase-field models
 Salvador Moll (Univ. Valencia) of grain boundaries 15

Summary: In this talk, a phase-field model of the grain boundary, known as Kobayashi–Warren–Carter model, will be considered in a general multidimensional setting. Kobayashi–Warren–Carter model is described as a coupled system of two parabolic PDEs, and this system includes some non-standard situations brought down a total variation energy with unknown-dependent weight. The main focus in this talk will be on the existence theorem of Kobayashi–Warren–Carter model, including the mathematical treatments of the non-standard situations. The proof of the existence theorem will be based on the time-discretization method. Furthermore, it will be mentioned that the time-discretization approach will be to provide a uniform solution method for various systems associated with Kobayashi–Warren–Carter model.

- 6 Noriaki Yamazaki (Kanagawa Univ.)[#] Necessary conditions for optimal control of positive solutions to second
 Lingling Zhang (Taiyuan Univ. of Tech.) order impulsive differential equations 15
 Chengbo Zhai (Shanxi Univ.)

Summary: The second order differential equation with impulsive effects is considered. Recently, we investigated an optimal control problem of positive solutions to impulsive differential equations, and we proved the existence of an optimal control that minimizes the nonlinear cost function. In this talk we show the necessary condition for the optimal control problem of positive solutions to second order differential equation with impulsive effects. Moreover, we prove the time-local uniqueness of optimal control to our problem.

- 7 Hiroki Ohwa (Niigata Univ.)* On the wave-front tracking method for 2×2 hyperbolic systems of
 conservation laws 15

Summary: This talk is concerned with the global existence of solutions to the Cauchy problem for 2×2 hyperbolic systems of conservation laws with initial data having sufficiently small total variation. We show the global existence of solutions by improving the wave-front tracking algorithm.

- 8 Naoki Sato[#] On global solution of a one dimensional free boundary problem for
 (Nagaoka Nat. Coll. of Tech.) adsorption phenomena 15
 Toyohiko Aiki (Japan Women's Univ.)
 Yusuke Murase (Meijo Univ.)
 Ken Shirakawa (Chiba Univ.)

Summary: We study one dimensional free-boundary problem for adsorption phenomena in wetting-drying process on the surface of porous medium like paper and bamboo charcoal. We consider a pore in the porous medium. Since water-drop will be generated in the pore when humidity becomes high, the region occupied by water-drop is described with a free boundary. In our previous talk we have already proposed a mathematical model for this phenomenon as one dimensional free boundary problem and showed the local existence and the uniqueness of a solution. In this talk, we establish a new result concerned with the existence of global solution in time for our problem. More precisely, it holds that the free boundary touches the fixed boundary or the solution exists globally in time.

- 9 Motohiro Sobajima[#] On analytic C_0 -semigroups generated by generalized Ornstein–Uhlenbeck
 (Tokyo Univ. of Sci.) operators in weighted L^p -spaces 15
 Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: Generation of analytic semigroups by generalized Ornstein–Uhlenbeck operators in weighted L^p -spaces is shown. The results improve the recent results established by Metafun–Prüss–Rhandi–Schnaubelt ('05) and Kojima–Yokota ('10).

- 10 Yutaka Tsuzuki (Tokyo Univ. of Sci.)[#] Solvability of nonlinear heat equations with unbounded obstacles coupled with Navier–Stokes equations 15
 Motohiro Sobajima (Tokyo Univ. of Sci.)
 Tomomi Yokota (Tokyo Univ. of Sci.)

Summary: This paper is considered with the system of nonlinear heat equations with constraints coupled with Navier–Stokes equations in two-dimensional domains. In Fukao–Kubo (2008), they proved the existence and uniqueness of solutions to the system with linear heat equations when obstacle functions are bounded. This paper gives the existence result even if obstacle functions are unbounded and nonlinear terms are added to heat equations. The key to the improvement is another estimate as an application of the Gagliardo–Nirenberg inequality.

- 11 Akio Ito (Kinki Univ.)[#] Existence and uniqueness of non-negative time-global solutions to ODE
 Kazuhiko Yamamoto (Kinki Univ.) system describing cardiomegaly 15

Summary: The first purpose of the present paper is to propose a new mathematical model which describes the mechanism of cardiomegaly for spontaneously hypertensive rats. Our model is expressed by a nonlinear system of ODEs based on the kinetics of biochemical reactions among proteins concerned with cardiomegaly. Their network is too complex and huge for most of the biologists to analyze it exhaustively and theoretically. Hence, the second one is to analyze our model from the mathematical point of view. Actually, we show the existence and uniqueness of time-global non-negative solutions as all initial data are non-negative.

- 12 Risei Kano (Kochi Univ.)[#] The existence of weak solutions for tumor invasion models 15
 Akio Ito (Kinki Univ.)

Summary: In this talk, we discuss the solvability for weak solutions in the tumor invasion models. We have already showed the existence of solutions using the method of quasi-variational inequalities. But we do not show some propositions of solutions (for example, uniqueness), since its method has great nonlinearity. Then we show the existence of weak solutions for solutions for tumor invasion models.

14:15–16:30

- 13 Kota Kumazaki[#] Large time behavior of a solution for carbon dioxide transport model
 (Tomakomai Nat. Coll. of Tech.) in concrete carbonation process 15

Summary: In this talk, we consider a mathematical model of carbon dioxide transport in concrete carbonation process in three dimensional case. This model is a parabolic type equation such that a coefficient of the time derivative contains a non-local term depending on the unknown function itself. For this model, we have already proved the existence and uniqueness of a solution of an initial boundary value problem of this model. In this talk, we discuss the large time behavior of the solution of this problem.

- 14 Hiroshi Watanabe (Salasian Polytecnic)[#] A kinetic approach to strongly degenerate parabolic equations 15

Summary: We consider the initial value problem (CP) for strongly degenerate parabolic equations. Strongly degenerate parabolic equations are regarded as a linear combination of the time-dependent conservation laws (quasilinear hyperbolic equations) and the porous medium type equations (non-linear degenerate parabolic equations). Thus, this equations has both properties of hyperbolic equation and those of parabolic equations and describes various nonlinear convective diffusion phenomena such as filtration problems, Stefan problems and so on.

In this talk, we use a kinetic approximation introduced by Giga–Miyakawa to construct entropy solutions to (CP).

- 15 Akio Ito (Kinki Univ.)[#] Solvability of mathematical modeling for Sake whose finish time depends
Nobuyuki Kenmochi (Bukkyo Univ.) on the solutions 15
Yusuke Murase (Meijo Univ.)

Summary: In this talk, we discuss solvability of mathematical modeling for Japanese Sake in the first fermenting stage with certain time interval $[0, T_1]$. Especially, we consider the case that T_1 depends upon the solution of the modeling.

Japanese Sake are brewed with 5 fermenting stages, and the first stage is established for culturing Koji (some kind of bacteria). In phenomena, breweries finish 1st stage if the temperature reaches to some threshold value.

We examine the solvability when we define that T_1 be a infimum time of the integral of solutions becomes larger than the decided value.

- 16 Takeshi Iida (Fukushima Nati. Coll. of Tech.)[#] The inequalities on weighted Morrey spaces for Hardy–Littlewood maximal function and singular integrals 15

Summary: The aim in this talk is to consider the boundedness of the Hardy–Littlewood maximal function and singular integral operators on weighted Morrey spaces. In particular, we consider the case of the plural weights. Main results which were generalized the our results in 2011 recover the result due to Komori and Shirai.

- 17 Gaku Sadasue (Osaka Kyoiku Univ.)[#] Generalized Morrey–Campanato spaces of martingales 15
Yoshihiro Sawano (Tokyo Metro. Univ.)
Eiichi Nakai (Ibaraki Univ.)

Summary: We introduce generalized Morrey–Campanato spaces of martingales and show some their relations. We give Burkholder’s type inequalities on these spaces. We also give a result on the equivalence between Morrey spaces and Campanato spaces of martingales.

- 18 Takahiro Noi (Chuo Univ.)[#] Trace operators for Besov spaces with variable exponents 15

Summary: Diening et el (2009, JFA) has proved the boundedness of trace operator from Triebel–Lizorkin spaces with variable exponents $F_{p(\cdot),q(\cdot)}^{s(\cdot)}(\mathbb{R}^n)$ to $F_{p(\cdot),p(\cdot)}^{s(\cdot)-\frac{1}{p(\cdot)}}(\mathbb{R}^{n-1})$ by using atomic decompositions.

In this talk, we consider quasi norm estimates about atomic decompositions for Besov spaces with variable exponents $B_{p(\cdot),q(\cdot)}^{s(\cdot)}(\mathbb{R}^n)$.

- 19 Katsuo Matsuoka (Nihon Univ.)[#] On the boundedness for singular integrals in central Morrey spaces and λ -CMO spaces 15

Summary: In this talk, we will extend the known results of boundedness for singular integrals in L^p spaces, BMO space and Lipschitz spaces to the central Morrey spaces and the λ -CMO spaces. In order to do this, we use the results of B_σ -function spaces estimates.

- 20 Shinya Moritoh (Nara Women's Univ.)^{*} Anisotropic versions of some analogues of Besov–Triebel–Lizorkin spaces 15

Summary: We consider anisotropic versions of some analogues of Besov–Triebel–Lizorkin spaces. These analogues are defined by Triebel in his book published in 2006.

16:45–17:45 Talk invited by Real Analysis Section

- Giorgio Metafuno (Salento Univ.)[#] Spectral properties of second order operators with unbounded coefficients in \mathbb{R}^d

Summary: In this talk we present some spectral properties of second order operators of the form $L = \sum_{i,j} a_{ij} D_{ij} + b \cdot \nabla$ in \mathbb{R}^d . The matrix (a_{ij}) is supposed to be locally uniformly elliptic but the ellipticity constant may go to 0 or to ∞ as $|x| \rightarrow \infty$. Moreover, the vector field b is not assumed to be bounded. The operator will be considered in L^p both with respect to the Lebesgue measure and with respect to the invariant measure of the underlying stochastic process, when it exists.

The following problems will be considered:

- (i) solvability of the equation $\lambda u - Lu = f$ and generation of an analytic semigroup;
- (ii) regularity of the above solutions and domain characterization;
- (iii) location of the spectrum of L in L^p .

Many results are known when b is unbounded or singular but the diffusion matrix (a_{ij}) is (globally) uniformly elliptic (this is the case of the Ornstein Uhlenbeck operator, where $a_{ij} = \delta_{ij}$ and b is linear). The case of unbounded diffusion will be examined only under the assumption $a_{ij}(x) = (a + |x|^\alpha)c_{ij}(x)$ where $a = 0, 1$, $\alpha \in \mathbb{R}$ and the matrix (c_{ij}) is globally uniformly elliptic.

March 21st (Thu) Conference Room VIII

9:00–11:55

- 21 Enji Sato (Yamagata Univ.)[#] Fourier multipliers from L^p spaces to Morrey spaces on the unit circle
Takashi Izumi (Yamagata Univ.) 15

Summary: We show the relation of Fourier multipliers which is the set of all translation invariant bounded linear operators from L^p spaces to Morrey spaces on the unit circle.

- 22 Nobusumi Sagara (Hosei Univ.)[#] Maharam-types and Lyapunov's theorem for vector measures on Banach spaces 15
Mohammed Ali Khan (Johns Hopkins Univ.)

Summary: This paper offers a sufficient condition, based on Maharam (1942) and re-emphasized by Hoover and Keisler (1984), for the validity of Lyapunov's theorem on the range of an atomless vector measure taking values in an infinite-dimensional Banach space that is not necessarily separable nor has the RNP property. In particular, we obtain an extension of a corresponding result due to Uhl (1969). The proposed condition is also shown to be necessary in the sense formalized in Keisler and Sun (2009), and thereby closes a question of long-standing as regards an infinite-dimensional generalization of the theorem.

- 23 Toshiharu Kawasaki (Nihon Univ.)[#] Approximately derivative in a vector lattice 15

Summary: In previous paper we defined the derivative of mappings from a vector lattice to a complete vector lattice. In another paper we defined the approximately derivative in the case where the domain is finite dimension. This derivative seemed to be a subset generally however in it was proved that the subset consisted of a single point. In this talk we define an approximately derivative of mappings from a vector lattice to a complete vector lattice again.

- 24 Toshikazu Watanabe (Nihon Univ.)[#] On Riesz space-valued non-additive measures 15
Tamaki Tanaka (Niigata Univ.)

Summary: In this talk, we assume that V is a Riesz space and we show that Lusin's theorem remains valid for V -valued non-additive Borel measures that have pseudometric generating property and satisfy the Egoroff condition on a metric space and assume that V is order separable.

- 25 Fumiaki Kohsaka (Oita Univ.)[#] Nonexistence of fixed points and unbounded sets 15

Summary: In this talk, we study the relation between the fixed point property for firmly nonexpansive-type mappings and the boundedness of a nonempty closed convex subset of a Banach space.

- 26 Kichi-Suke Saito (Niigata Univ.)[#] Beckner's inequality and its application to Banach spaces 10
Ryotaro Tanaka (Niigata Univ.)
Naoto Komuro
(Hokkaido Univ. of Edu.)

Summary: A classical inequality which was proved by Beckner is an important tool for the study of Banach space geometry. In this talk, we present another proof of that inequality.

- 27 Ryotaro Tanaka (Niigata Univ.)[#] A structure of finite dimensional normed linear spaces 15
Kichi-Suke Saito (Niigata Univ.)

Summary: Recently, Alonso showed that every two-dimensional normed space is isometrically isomorphic to a generalized Day–James space introduced by Nilsrakoo and Saejung. In this talk, we consider the result of Alonso for n -dimensional normed spaces.

- 28 Hiroyasu Mizuguchi (Niigata Univ.)[#] On the calculation method of the Dunkl–Williams constant of normed
Kichi-Suke Saito (Niigata Univ.) spaces 15
Ryotaro Tanaka (Niigata Univ.)

Summary: The Dunkl–Willimas constant of a normed space was defined by A. Jimenez-Melado et al. In general, it is very difficult to calculate the constant. To compute the Dunkl–Williams constant, we introduce some notations related to Birkhoff orthogonality and characterize the constant.

- 29 Koji Aoyama (Chiba Univ.)[#] Existence of fixed points of firmly nonexpansive-like mappings in Banach
spaces 15

Summary: The aim of this talk is to investigate a hybrid projection method and a hybrid shrinking projection method for a single mapping of type (P) in a Banach space. We show that the sequences generated by these methods are well-defined without assuming the existence of fixed points, and that the boundedness of the generated sequences is equivalent to the existence of fixed points of mappings of type (P).

- 30 Aoi Honda (Kyushu Inst. of Tech.)[#] Inner and outer approximation spaces of $\Lambda_2(f)$ and ℓ_p 15
 Yoshiaki Okazaki
 (Kyushu Inst. of Tech.)
 Hiroshi Sato (Kyushu Univ.)^{*}

Summary: Let $f(\neq 0) \in L_2(\mathbb{R}, dx)$. An inner (resp. outer) approximation space Λ_2^0 (resp. $\Lambda_2^\varphi(f)$) of the sequence space $\Lambda_2(f)$ is introduced. Analyzing the properties of $\Lambda_2^0(f), \Lambda_2^\varphi(f)$, we discuss the conditions on f which imply $\ell_p \subset \Lambda_2(f)$ or $\ell_{p-} \subset \Lambda_2(f)$.

12:55–13:25

- 31 Takayuki Tamura (Chiba Univ.)[#] On direct sums of Banach spaces with a strictly monotone norm 15
 Mikio Kato (Shinshu Univ.)

Summary: We shall discuss the strict monotonicity and uniform non-squareness of ψ -direct sums $(X_1 \oplus \cdots \oplus X_N)_\psi$ of Banach spaces X_1, \dots, X_N .

- 32 Yasuji Takahashi (Okayama Pref. Univ.)^{*} Some results on von Neumann–Jordan type constants of a Banach space
 Mikio Kato (Shinshu Univ.) 15

Summary: We shall introduce a new von Neumann–Jordan type constant $C''_{NJ}(X)$ for a Banach space X , and discuss the relation between this constant and some other geometric constants such as the modified von Neumann–Jordan constant $C'_{NJ}(X)$ and the James constant $J(X)$, etc.

13:40–14:40 Talk invited by Real Analysis Section

- Tsuyoshi Yoneda (Hokkaido Univ.)[#] Fourier analysis and rotating Navier–Stokes equations

Summary: In this talk we consider an incompressible two-dimensional flow on a beta plane by using Fourier series. Rossby waves are generally expected to dominate the beta plane dynamics. We prove a mathematically rigorous theorem: that at a high beta, the flow dynamics is governed exclusively by the resonant interactions of Rossby waves.

Functional Analysis

March 21st (Thu) Conference Room V

9:30–12:15

- 1 Tatsuya Tsurii (Osaka Pref. Univ.)[#] Deformations of finite hypergroups 10
Satoshi Kawakami (Nara Univ. of Edu.)

Summary: We introduce deformations of finite groups and finite hypergroups of low order for example cyclic groups, symmetric groups, dihedral groups, the quaternion group, hypergroup join, conjugacy class hypergroups and character hypergroups of finite groups, orbital hypergroups, semi-direct product hypergroups, in the category of hypergroups. Moreover we discuss the relationship among them and the dual structure of these deformations of groups and hypergroups.

- 2 Masafumi Sakao (Chiba Univ.)[#] Duality problem of extension hypergroups 10
Tatsuya Tsurii (Osaka Pref. Univ.)
Satoe Yamanaka (Osaka Pref. Univ.)
Satoshi Kawakami (Nara Univ. of Edu.)

Summary: In the category of commutative signed hypergroups, the duality $\hat{K} \cong K$ holds. Let H and L be commutative hypergroups and $K(H, L, \sigma)$ ($\sigma \in \Sigma$) a commutative hypergroup which is an extension of L by H . Under this situation we also have a commutative signed hypergroup $K(\hat{L}, \hat{H}, \gamma)$ ($\gamma \in \Gamma$) which is an extension of \hat{H} by \hat{L} . Duality problem of extension hypergroups is to make clear the relationship between $\sigma \in \Sigma$ and $\gamma \in \Gamma$ when $\hat{K}(H, L, \sigma) \cong K(\hat{L}, \hat{H}, \gamma)$ holds as extensions. We report some results for certain models of the cases that $L = \mathbb{Z}_q(2)$ and $H = \mathbb{T}, \mathbb{Z}_2$.

- 3 Itsumi Mikami[#] A hypergroup coming from infinite dimensional representations of a
Tatsuya Tsurii (Osaka Pref. Univ.) motion group 10
Satoe Yamanaka (Osaka Pref. Univ.)
Satoshi Kawakami (Nara Univ. of Edu.)

Summary: We introduce a commutative hypergroup arising from infinite dimensional irreducible representations π of a semi-direct product hypergroup $K = H \rtimes_{\alpha} G$, which is realized as functions on K by taking a canonical spherical functions of representations π of K .

- 4 Satoe Yamanaka (Osaka Pref. Univ.)[#] Induced states of a hypergroup 10
Herbert Heyer (Tübingen Univ.)
Satoshi Kawakami (Nara Univ. of Edu.)

Summary: Let $H = (H, M^b(H), \circ, *)$ be a closed subhypergroup of a hypergroup $K = (K, M^b(K), \circ, *)$. For a state φ of the Banach $*$ -algebra $M^b(H)$, we introduce a notion of an induced state $\text{ind}_H^K \varphi$ which is compatible with an induced representation $\text{ind}_H^K \pi$ for a representation π of H . We show certain models that the formula $Ch(\text{ind}_H^K \pi) = \text{ind}_H^K Ch(\pi)$ holds for $\pi \in \text{Rep}(H)$ where Ch is a mapping from $\text{Rep}(K)$ to $M^b(\hat{K})$ or from $\text{Rep}(H)$ to $M^b(\hat{H})$ when \hat{K} and \hat{H} have hypergroup structures.

- 5 Satoshi Kawakami (Nara Univ. of Edu.)[#] When does the dual have a hypergroup structure? 10
Herbert Heyer (Tübingen Univ.)

Summary: We introduce some models of hypergroups coming from certain dual objects of the following cases. (1) Finite semi-direct product hypergroups. (2) Semi-direct product groups of type I (a motion group). (3) Semi-direct product groups of non-type I (the discrete Mautner group, the Mautner group). (4) Quantum group ($SU_q(2)$).

- 6 Satoshi Kawakami (Nara Univ. of Edu.)[#] Imprimitivity theorem for representations of a hypergroup 10
Herbert Heyer (Tübingen Univ.)

Summary: We introduce an imprimitivity theorem for representations of certain hypergroups. This imprimitivity theorem is formulated rather differently from the case for representations of a locally compact group but applicable to the group case.

- 7 Takaaki Nomura (Kyushu Univ.)* Inductive structure and the determinant of the right multiplication operators in the clan structure of a Euclidean Jordan algebra 15

Summary: Inductive structure of the right multiplication operators in the clan structure of a Euclidean Jordan algebra is presented through a Jordan frame. Their determinant is expressed explicitly as a product of powers of the Jordan algebra principal minors associated to the Jordan frame.

- 8 Hideto Nakashima (Kyushu Univ.)[#] Clans defined by representations of Hermitian Jordan algebras 15

Summary: Starting with a representation φ of a Euclidean Jordan algebra V by selfadjoint operators on a real Euclidean vector space E , we introduce a clan structure in $V_E := E \oplus V$. By the adjunction of a unit element to V_E , we obtain a clan V_E^0 with unit. In this lecture, we deal with Hermitian Jordan algebras and present an explicit expression of the basic relative invariants of V_E^0 . If φ is regular, the expression is in terms of the Jordan algebra principal minors of V and the quadratic map associated to φ . If φ is not regular, we need an embedding of V_E^0 into some Hermitian space to obtain precise expressions of the basic relative invariants which are irreducible polynomials.

- 9 Hideto Nakashima (Kyushu Univ.)[#] Clans defined by representations of Lorentzian Jordan algebras 15
Takaaki Nomura (Kyushu Univ.)

Summary: We keep to the notation of the previous lecture and treat Lorentzian Jordan algebras here. In this case also, we present an explicit expression of the basic relative invariants. Like the Hermitian case, the expression depends on whether φ is regular or not.

- 10 Hideto Nakashima (Kyushu Univ.)[#] Dual clans of clans defined by representations of Euclidean Jordan algebras 15
Takaaki Nomura (Kyushu Univ.)

Summary: We describe the dual clans of V_E^0 and determine the basic relative invariants. In this case we do not need the classification of Euclidean Jordan algebras. Moreover the expression is uniform and independent of the regularity condition of φ .

- 11 Atsumu Sasaki (Tokai Univ.)[#] Compatible automorphisms for visible linear actions ····· 15

Summary: Let V be a multiplicity-free space of a connected complex reductive Lie group $G_{\mathbb{C}}$. Then, the action of a compact real form G_u on V is strongly visible in the sense of T. Kobayashi. By definition, there exist a slice S and an anti-holomorphic diffeomorphism σ for the G_u -action on V . In this talk, we can find an anti-holomorphic involution σ_{\sharp} such that $\sigma_{\sharp}(g) \cdot v = \sigma(g \cdot \sigma(v))$ ($g \in G_{\mathbb{C}}, v \in V$). This property plays a crucial role to the study of visible actions on nilpotent orbits in complex semisimple Lie algebra.

- 12 Takashi Hashimoto (Tottori Univ.)[#] Embedding of real coadjoint orbits in the twisted cotangent bundle of the complex flag variety ····· 15

Summary: For a linear connected complex reductive Lie group G , one can construct a G -equivariant symplectomorphism in terms of local coordinates from a holomorphic twisted cotangent bundle of the generalized flag variety of G onto the semisimple coadjoint orbit of G . As an application, one can obtain an explicit embedding of a noncompact real coadjoint orbit into the twisted cotangent bundle.

13:30–14:30 Talk invited by Functional Analysis Section

- Hisayosi Matumoto (Univ. of Tokyo)[#] On the homomorphisms between scalar generalized Verma modules

Summary: In this talk, we discuss the homomorphisms between generalized Verma modules, which are induced from one dimensional representations (such generalized Verma modules are called scalar. Classification of the homomorphisms between scalar generalized Verma modules is equivalent to that of equivariant differential operators between the spaces of sections of homogeneous line bundles on generalized flag manifolds. Verma constructed homomorphisms between Verma modules associated with root reflections. Bernstein, I. M. Gelfand, and S. I. Gelfand proved that all the nontrivial homomorphisms between Verma modules are compositions of homomorphisms constructed by Verma. We introduce elementary homomorphisms between scalar generalized Verma modules, which can be regarded as a generalization of Verma's homomorphisms. We conjecture that any homomorphism between scalar generalized Verma modules is composition of elementary homomorphisms. The conjecture is affirmative for many parabolic subalgebras under the assumption that the infinitesimal characters are regular. The material of the lecture taken from arXiv:1205.6748 [math.RT].

March 22nd (Fri) Conference Room V

10:00–12:00

- 13 Yuki Seo (Osaka Kyoiku Univ.)[#] The Arithmetic-Geometric mean inequality in an external formula ··· 10

Summary: The classical Jensen inequality and its reverse are discussed by means of internally dividing points. J. I. Fujii pointed out that the concavity is also expressed by externally dividing points. In this paper, we shall discuss an external version of the arithmetic-geometric mean inequality.

- 14 Kei Ji Izuchi (Niigata Univ.)* Composition operators induced by analytic maps to the polydisk 15
 Quang Dieu Nguyen
 (Hanoi Univ. of Education, Vietnam)
 Shūichi Ohno (Nippon Inst. of Tech.)

Summary: We study properties of composition operators induced by symbols acting from the unit disk to the polydisk. This result will be involved in the investigation of weighted composition operators on the Hardy space on the unit disk and moreover be concerned with composition operators acting from the Bergman space to the Hardy space on the unit disk.

- 15 Wolfgang Krieger (Univ. of Heidelberg)* A class of subshifts with property (A) 15
 Toshihiro Hamachi (Kyushu Univ.*)

Summary: We give a necessary and sufficient condition for a Markov–Dyck shift, that is constructed from a strongly connected finite directed graph, to have property (A). More generally, this criterion applies to a class of subshifts, that are constructed from labelled finite directed strongly connected graphs with labels taken from a semigroup, that is constructed from a partitioned directed graph with a relation (\mathcal{R} -graph).

- 16 Tsuyoshi Kajiwara (Okayama Univ.)[#] Trace on cores of C^* -algebras associated with rational functions 15
 Yasuo Watatani (Kyushu Univ.)

Summary: We present result about traces on cores of C^* -algebras associated with dynamical systems generated by rational functions on Riemannian sphere. We present only partial results because branched points may appear in the inverse images of branched points, there may exist no section for the original rational functions and rational functions may not satisfy hyperbolicity assumption.

- 17 Kengo Matsumoto * C^* -algebras associated with Hilbert C^* -quad modules of finite type
 (Joetsu Univ. of Edu.) 15

Summary: Let $\mathcal{A}, \mathcal{B}_1, \mathcal{B}_2$ be C^* -algebras such that $\mathcal{A} \subset \mathcal{B}_1$ and $\mathcal{A} \subset \mathcal{B}_2$. A Hilbert C^* -quad module \mathcal{H} over $(\mathcal{A}, \mathcal{B}_1, \mathcal{B}_2)$ is a Hilbert C^* -bimodule over \mathcal{A} with multi structure of Hilbert C^* -bimodules over \mathcal{B}_1 and \mathcal{B}_2 satisfying some conditions. We will construct a C^* -algebra $\mathcal{O}_{\mathcal{H}}$ from a Hilbert C^* -quad module \mathcal{H} by creation operators on 2-dimensional Fock–Hilbert module and show its universality subject to certain operator relations among generators.

- 18 Yasuhiko Sato (Kyoto Univ.)[#] Decomposition rank of UHF absorbing C^* -algebras 15

Summary: We mainly consider the number of commutators and its relations with Murray von-Neumann equivalence. By this observation, we can prove that the decomposition rank of UHF absorbing C^* -algebra is less than two, for any unital separable simple nuclear infinite-dimensional C^* -algebras with a unique tracial state.

- 19 Hiroyuki Osaka (Ritsumeikan Univ.)[#] Nuclear dimension for an inclusion of unital C^* -algebras 10
 Tamotsu Teruya (Gunma Univ.)

Summary: We prove that if a C^* -algebra A is a local \mathcal{C}_n (resp. \mathcal{C}_{nuc_n}) in the sense of Osaka and Phillips, then $A \in \mathcal{C}_n$ (resp. \mathcal{C}_{nuc_n}). As applications, if A is separable unital C^* -algebra with $\text{dr}(A) \leq n$ and $\alpha : G \rightarrow \text{Aut}(A)$ is an action of finite group G with the Rohlin property, then $\text{dr}(A^\alpha) \leq n$ and $\text{dr}(A \rtimes_\alpha G) \leq n$.

- 20 Hiroyuki Osaka (Ritsumeikan Univ.)[#] On generalized Powers–Størmer’s inequality 15
 Dinh Trung Hoa (Duy Tan Univ.)
 Ho Minh Toan
 (Math. Inst., Vietnam Acad. of Sci. and Tech.)

Summary: A generalization of Powers–Størmer’s inequality for operator monotone functions on $[0, +\infty)$ and for positive linear functional on general C^* -algebras will be proved. It also will be shown that the generalized Powers–Størmer inequality characterizes the tracial functionals on C^* -algebras.

14:30–15:20

- 21 Hiroshi Ando (IHÉS)[#] Ultraproducts of von Neumann algebras 20
 Uffe Haagerup (Univ. of Copenhagen)

Summary: We study three different notions of ultraproducts of von Neumann algebras (Golodets, Ocneanu, and Groh–Raynaud) from a unified viewpoint. In particular, we show that the Golodets’ and Ocneanu’s constructions are equivalent, and the Ocneanu ultraproduct can be realized as a corner of the Groh–Raynaud ultraproduct. Based on this connection, we show that the modular automorphism group of the ultraproduct state is the ultraproduct of the modular automorphism groups of the corresponding sequence of normal faithful states.

- 22 Satoshi Goto (Sophia Univ.)[#] On classification of connections between Dynkin diagrams and ADE fusion bimodules 10

Summary: We discuss Ocneanu’s classification of all biunitary connections between ADE Dynkin diagrams and (fusion) bimodule categories of those connection systems.

- 23 Satoshi Goto (Sophia Univ.)[#] On generalized Goodman–de la Harpe–Jones subfactors of type $D-E$ 10

Summary: We consider subfactors generated by irreducible $D-E$ connections and compute their (dual) principal graphs. We also discuss some subequivalence among ADE paragroups.

- 24 Satoshi Goto (Sophia Univ.)[#] On flat and non-flat connection systems of the 3311 spoke subfactor 5

Summary: We consider 5 kinds of (non-)flat connection systems which generate the 3311 spoke subfactor and show some computations of the flat parts of non-flat connections.

15:40–16:40 Talk invited by Functional Analysis Section

- Reiji Tomatsu (Hokkaido Univ.)[#] Classification problem of group or quantum group actions on von Neumann algebras

Summary: I will survey the history and recent progress of classification of group or quantum group actions on von Neumann algebras.

March 23rd (Sat) Conference Room V

10:30–12:00

- 25 Hiromichi Miyake \sharp On the existence of the mean values for commutative semigroups of Dunford–Schwartz operators on L^1 15

Summary: Recently, we studied a notion of the mean value for vector-valued bounded functions defined on an amenable semigroup with values in a locally convex space to prove mean ergodic theorems for semigroups of linear and non-linear mappings in Banach spaces (or locally convex spaces). In this talk, we discuss weak compactness of a separated locally convex topology on L^1 whose weak topology is coarser than the weak topology on L^1 generated by L^∞ , and show the existence of the mean values for commutative semigroups of Dunford–Schwartz operators on L^1 in the case when the reference measure is σ -finite.

- 26 Yoshinori Kametaka (Osaka Univ.*) \sharp The best constant of discrete Sobolev inequality on chiral type Carbon nano tube 10

Summary: The best constant of discrete Sobolev inequality on chiral type Carbon nano tube is obtained. We consider a classical mechanical model, each Carbon atom are connected by a linear spring with uniform spring constant. The best constant of discrete Sobolev inequality is the rigidity or hardness of our mechanical model.

- 27 Hiroyuki Yamagishi \sharp Complete low-cut filter and the best constant of Sobolev inequality
(Tokyo Metro. Coll. of Ind. Tech.) 10
Yoshinori Kametaka (Osaka Univ.)
Atsushi Nagai (Nihon Univ.)
Kohtaro Watanabe
(Nat. Defense Acad. of Japan)
Kazuo Takemura (Nihon Univ.)

Summary: We obtained the best constants of Sobolev inequalities corresponding to complete low-cut filter. In the background, we have an n -dimensional boundary value problem and a one-dimensional periodic boundary value problem. The best constants of the corresponding Sobolev inequalities are equal to diagonal values of Green's functions for these boundary value problems.

- 28 Hiroyuki Yamagishi \sharp The best constant of discrete Sobolev inequality on complete graph
(Tokyo Metro. Coll. of Ind. Tech.) 10
Kohtaro Watanabe
(Nat. Defense Acad. of Japan)
Yoshinori Kametaka (Osaka Univ.)

Summary: We obtained the best constants of three kinds of discrete Sobolev inequalities corresponding to a graph Laplacian on complete graph. Discrete heat kernel, Green matrix and pseudo Green matrix play an important role.

- 29 Shin-ichi Nakagiri (Kobe Univ.) \sharp Structural properties of solution semigroups associated with hyperbolic Volterra integro-differential systems 15

Summary: In this paper we study the structural properties of solution semigroups, especially the structure of spectrum, for a hyperbolic system of first-order Volterra integro-differential equations. The keys of analysis are the use of deformation formula and the exponential analysis for entire functions. For the purpose we introduce the concept of small solutions and establish necessary and sufficient conditions for the completeness of generalized eigenspaces.

- 30 Kohei Umeta (Hokkaido Univ.)[#] The edge of the wedge theorem for holomorphic functions with growth conditions of exponential type and Laplace hyperfunctions ······ 15
 Naofumi Honda (Hokkaido Univ.)

Summary: H. Komatsu established the theory of Laplace hyperfunctions of one variable, which plays an important role in solving both linear ordinary differential equations with variable coefficients and partial differential equations. In this talk we give the edge of the wedge theorem for holomorphic functions with growth conditions of exponential type and construct the sheaf of Laplace hyperfunctions of several variables. We also give Laplace transformations for Laplace hyperfunctions.

14:30–15:30 Talk invited by Functional Analysis Section

- Akzunori Ando (Univ. of Tsukuba)[#] Inverse scattering problem for discrete Schrödinger operators on the hexagonal lattice

Summary: We consider the spectral theory and inverse scattering problem for the discrete Schrödinger operator on the hexagonal lattice, which is a sort of two dimensional lattice and covers the plane by equilateral hexagons with honeycomb structure.

First of all, we review spectral properties of discrete Laplacian on the hexagonal lattice. By using Mourre estimates, we can show the absolute continuity of the discrete Schrödinger operator.

Next, we construct a spectral representation and obtain a representation of the scattering matrix by using the abstract stationary scattering theory.

Finally, we show a reconstruction procedure for the potential and the key lemmas for it, that is, analytic continuation and estimates of the resolvent. Using those lemmas, we can recover the potential by investigating the asymptotic behaviors of the analytic continuation of the scattering matrix by using inductive argument.

Statistics and Probability

March 20th (Wed) Conference Room IX

9:30–12:00

- 1 Yukiko Iwata (Univ. of Tokyo)[#] Stochastic perturbations of one-dimensional maps 15

Summary: We consider random perturbations of some one-dimensional map, which become a Markov process. The Markov processes are small with respect to the noise level and give a class of one-dimensional maps for which there always exists a smooth invariant probability measure.

- 2 Yu Ito (Kyoto Univ.)[#] Integrals along rough paths via fractional calculus 15

Summary: In this talk, we will provide the definition of the integral along β -Hölder rough paths for any $\beta \in (0, 1]$, which is based on the integration by parts formulas in the context of the fractional derivatives. It is a generalization of the preceding study of Hu and Nualart, who considered the case of $\beta \in (1/3, 1/2)$. It follows from the main theorems in this talk that our integral coincides with the first level path of the rough integral along geometric β -Hölder rough paths.

- 3 Makoto Nakashima (Univ. of Tsukuba)[#] Super-Brownian motion in random environment 15

Summary: We know that super-Brownian motion give a solution of an SPDE, heat equation with noise, when spatial dimension is one. Also, solutions of a certain type of heat equations with noise are represented as superprocesses. In this talk, we will construct a solution as the scaling limit point of branching random walks in random environment.

- 4 Yuki Suzuki (Keio Univ.)^{*} A diffusion process with a Brownian potential including a zero potential part 15

Summary: A one-dimensional diffusion process with a Brownian potential including a zero potential part is considered. The limiting behavior of the process as time goes to infinity is studied. The maximum process and the minimum process of the diffusion process are also investigated.

- 5 Katusi Fukuyama (Kobe Univ.)^{*} Optimal bound for the discrepancies of lacunary sequences 5
Christoph Aistleitner
(Graz Univ. Tech.)
Yukako Furuya (Hitachi, Ltd.)

Summary: The law of the iterated logarithm for discrepancies of lacunary sequences is studied. An optimal bound is given under very mild Diophantine type condition.

- 6 Hiroaki Hata (Shizuoka Univ.)[#] Risk-sensitive portfolio optimization problems with a jump type stochastic factor model 15

Summary: Consider a factor process that we add a subordinator to Cox–Ingersoll–Ross interest rates. This affects the prices of a bank account and a risky stock. Under such a model, we treat risk-sensitive portfolio optimization problems on finite and infinite time horizon. In this talk, we treat HJB (Hamilton–Jacobi–Bellman) equation corresponding to the finite time horizon problem and the limit equation of HJB equation corresponding to the infinite time horizon problem. Our purpose is to obtain the explicit solutions of these equations.

- 7 Kazufumi Fujimoto (Bank of Tokyo-Mitsubishi UFJ) [#] Expected utility maximization under incomplete information and with Cox-processes observations 20

Summary: We consider the problem of maximization of expected terminal utility. The underlying market model is a regime-switching diffusion model where the regime is determined by an unobservable factor process forming a finite state Markov process. The main novelty is due to the fact that prices are observed and the portfolio is rebalanced only at random times corresponding to a Cox process where the intensity is driven by the unobserved Markovian factor process as well. This leads to a more realistic modeling for many practical situations, like in markets with liquidity restrictions; on the other hand it considerably complicates the problem to the point that traditional methodologies cannot be directly applied.

- 8 Teppei Ogihara (Osaka Univ.) [#] Maximum likelihood type and Bayes type estimation for diffusion processes with nonsynchronous observations 20
Nakahiro Yoshida (Univ. of Tokyo)

Summary: We study maximum likelihood type and Bayes type estimation for diffusion processes where observations occur in nonsynchronous manner. The problem of nonsynchronous observations appears when estimating the covariance of security returns using high-frequency financial data. We construct a quasi-likelihood function H for nonsynchronously observed diffusion processes and prove consistency and asymptotic mixed normality of the maximum-likelihood type estimator and the Bayes type estimator generated by H where $\max_{i,j}(|S^i - S^{i-1}| \vee |T^j - T^{j-1}|) \rightarrow^p 0$.

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

- Daisuke Shiraiishi (Kyoto Univ.) [#] Non-intersecting two-sided random walks

Summary: Two random walks conditioned never to intersect is considered in two dimensions. We first discuss about the construction of such two walks with help of knowledge of Brownian cases. After that, we consider path-properties of the conditioned paths. It has particularly interesting properties in two dimensions. In two dimensions, the conditioned path is transient and has infinite global cut-points almost surely. Moreover, the simple random walk on the conditioned path is subdiffusive. This is a similar flavor of a result obtained by Kesten (1986) who proved the subdiffusivity of the simple random walk on the incipient infinite cluster in two dimensions. Compared with the usual (unconditioned) simple random walk in two dimensions, these properties are peculiar ones. In the talk, we are going to explain why we considered such conditioned paths and these differences occur between them.

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

- Naoyuki Ichihara (Hiroshima Univ.) [#] Asymptotic problems for viscous Hamilton–Jacobi equations and stochastic control

Summary: This talk concerns asymptotic analysis for viscous Hamilton–Jacobi equations (or Hamilton–Jacobi–Bellman equations) appearing in stochastic optimal control. We are interested in characterizing recurrence/transience of the optimal control in terms of qualitative properties for solutions to viscous Hamilton–Jacobi equations. Such characterization plays a key role, typically, in studying the large time behavior of solutions to viscous Hamilton–Jacobi equations. We also discuss an application of our results to the criticality theory for viscous Hamilton–Jacobi equations.

March 21st (Thu) Conference Room IX

9:00–11:50

- 9 Satoshi Suzuki (Shimane Univ.)[#] Lagrange-type duality theorem and generator for quasiconvex programming 15
 Daishi Kuroiwa (Shimane Univ.)

Summary: In the study of mathematical programming, various duality theorems have been introduced, for example, Lagrange duality, Fenchel duality, surrogate duality, and so on. Also, constraint qualifications for such duality theorems have been investigated. There are so many constraint qualifications, and recently, necessary and sufficient constraint qualifications are investigated. In this talk, we introduce Lagrange-type duality theorem and its necessary and sufficient constraint qualification for quasiconvex programming. We define the notion of generator for quasiconvex functions, and we investigate Lagrange-type duality theorem.

- 10 Yusuke Saeki (Shimane Univ.)[#] On constraint qualification for DC programming problems 15
 Daishi Kuroiwa (Shimane Univ.)

Summary: We study some constraint qualifications for optimality conditions in DC (difference of convex functions) programming problems with convex inequality constraints. Recently, it was shown that a certain constraint qualification is necessary and sufficient for optimality conditions in convex programming problems. In this talk, we introduce a necessary and sufficient constraint qualification for local optimality conditions in DC programming problems with convex inequality constraints based on this research.

- 11 Teruo Tanaka (Hiroshima City Univ.)[#] A partially observable Markov decision process under a fractional criterion 10

Summary: We consider a partially observable Markov decision process with Borel state and action spaces under a discounted fractional criterion. At first, the fractional discounted partially observable Markov decision process is transformed to a discounted partially observable Markov decision process by using the parametric method. Next, assuming suitable conditions on the components of the corresponding partially observable Markov decision process, a standard approach is used to define an equivalent completely observable Markov decision process which evolves on the space of probability measures on the state space. Applying these procedures and the dynamic programming approach, we obtain the optimal value function and policy for our problem.

- 12 Toshiharu Fujita[#] Mutually dependent decision processes and Egg Dropping Problem ... 15
 (Kyushu Inst. of Tech.)

Summary: This paper introduces mutually dependent decision processes. In this framework, there are n processes ($n \geq 2$) and each stage reward depends on the optimal values of other processes. We formulate this type of problem and derive a system of recursive equations by using dynamic programming. Moreover we apply our result to an extended ‘Egg Dropping Problem’.

- 13 Sigeo Aki (Kansai Univ.)[#] On distributions of the number of pattern occurrences in undirected
 Kiyoshi Inoue (Seikei Univ.) graphical models 10

Summary: The method of probability generating functions is extended for obtaining exact distributions of the number of occurrences of a discrete pattern in undirected graphical models. General results for deriving the distributions are given with illustrative examples. Further, a device for reducing calculations is proposed. As an application of our results, the exact reliabilities of consecutive- k -out-of- n : F systems corresponding to the undirected graphical models are obtained.

- 14 Hironori Fujisawa (Inst. of Stat. Math.)[#] A family of skew-unimodal distributions with mode invariance 15
Toshihiro Abe (Tokyo Univ. of Sci.)

Summary: There have been many studies on a skew-symmetric distribution. It consists of an underlying symmetric density and a perturbation factor to control the skewness. The skew-symmetric distribution is very flexible, but not necessarily unimodal even if the underlying symmetric distribution is unimodal. It is often a hard task to investigate whether a new density is unimodal. To get relief from this task, a skew-unimodal distribution has been discussed recently. This paper incorporates the mode invariance into a skew-unimodal distribution. The mode remains unchanged for any transformation. The monotonicity of skewness can be shown under a weak condition. The condition obtained here is very simple by virtue of mode invariance and allows us to incorporate various favorable properties into a skew-unimodal distribution.

- 15 Tamio Koyama (Kobe Univ.)[#] The evaluation of orthant probabilities utilizing the holonomic gradient
Akimichi Takemura (Univ. of Tokyo) method 15

Summary: We apply the holonomic gradient method (HGM) introduced by Nakayama et al to the calculation of orthant probabilities of multivariate normal distribution. The holonomic gradient method applied to orthant probabilities is found to be a variant of Plackett's recurrence relation. However a straightforward implementation of the method yields recurrence relations more suitable for numerical computation. We derive some theoretical results on the holonomic system for the orthant probabilities and then show that numerical performance of our method is comparable or superior compared to existing methods.

- 16 Satoshi Aoki[#] Markov chain Monte Carlo methods for the regular two-level fractional
(Kagoshima Univ./JST CREST) factorial designs and cut ideals 20
Hidefumi Osugi
(Rikkyo Univ./JST CREST)
Takayuki Hibi
(Osaka Univ./JST CREST)

Summary: We consider Markov chain Monte Carlo methods for tests of factor effects when the observations are count and are given in the two-level regular fractional factorial designs. In this approach, one of the key notions is a Markov basis, which is characterized as a generator of well specified toric ideals. In this talk, we give a new result on the correspondence between the regular two-level fractional factorial designs and the algebraic concepts, namely, cut ideals.

- 17 Sanpei Kageyama[#] Complete existence of 3 pairwise additive BIB designs 15
(Hiroshima Inst. of Tech.)
Kazuki Matsubara (Hiroshima Univ.)

Summary: The existence of additive BIB designs and 2 pairwise additive $B(v, 2, 1)$ has been discussed with direct and recursive constructions in Sawa et al. (2007) and Matsubara et al. (2012). In this talk, by providing new methods of constructing pairwise additive BIB designs from other combinatorial structures, it is shown that 3 pairwise additive $B(v, 2, 1)$ can be constructed for any integer v .

- 18 Hiromu Yumiba (Int. Inst. for Nat. Sci.)[#] Existence conditions for balanced fractional factorial designs of resolution V derived from simple arrays with three symbols (II) 15
 Yoshifumi Hyodo
 (Okayama Univ. of Sci./Int. Inst. for Nat. Sci.)
 Masahide Kuwada
 (Int. Inst. for Nat. Sci.)

Summary: We consider a fractional 3^m factorial design derived from a simple array (SA), which is a balanced array of full strength, where $m \geq 4$. In this situation, we give a necessary and sufficient condition for an SA to be a balanced fractional 3^m factorial design of resolution V. Such a design is characterized by the suffixes of the index of an SA.

13:20–14:30

- 19 Kazuyoshi Yata (Univ. of Tsukuba)[#] Estimation on eigenvalues for high-dimensional data having power
 Makoto Aoshima (Univ. of Tsukuba) spiked model 15

Summary: In this talk, we consider a general spiked model called the power spiked model for the eigenvalues when the data dimension is extremely high. We first show that the conventional estimation on the eigenvalues is consistent under some sufficient conditions. The conditions should depend on the data dimension, the sample size and the high-dimensional noise structure. We develop two PCA methods, the noise-reduction methodology and the cross-data-matrix methodology, for high-dimensional data. We show that both the new PCAs establish consistent estimators under certain conditions that are much milder than before. We demonstrate that the new PCAs are quite efficient not only in large sample-size settings but also in small sample-size settings.

- 20 Hiroto Hyakutake (Kyushu Univ.)[#] On estimation of parameters in heteroscedastic random effects models
 Kengo Ueda (Kyushu Univ.) 10

Summary: A two-sample problem in heteroscedastic random effects models is considered. Approximated confidence regions are proposed and its accuracy of approximation is examined by simulation.

- 21 Shoichi Sasabuchi (Kyushu Univ.)[#] On the powers of tests for homogeneity of regression coefficient vectors
 under synchronized order restrictions 10

Summary: We consider the problem of testing homogeneity of regression coefficient vectors under synchronized order restrictions when the covariance matrix is unknown. Synchronized order restriction is a generalization of multivariate isotonic order restriction. For this problem, Hu and Banerjee (2012) proposed some test statistics, studied their distributions, and obtained some inequalities among their powers. In this presentation, we show that strict inequalities hold among these powers.

- 22 Fumiya Akashi (Waseda Univ.)[#] Empirical likelihood approach for stable processes 10
 Masanobu Taniguchi (Waseda Univ.)

Summary: An empirical likelihood approach is one of non-parametric statistical methods, which is applied to the hypothesis testing or construction of confidence regions for pivotal unknown quantities. This method has been applied to the case of i.i.d. observations and second order stationary processes. In recent years, we observe that financial data are frequently heavy-tailed data. In such cases, it is natural to consider a linear process with stable noise, called stable linear process. In this presentation, we introduce an empirical likelihood approach to the stable linear processes, and elucidate the asymptotics of the empirical likelihood ratio statistic.

- 23 Yan Liu (Waseda Univ.)[#] Hypothesis testing for vector stable processes 10
 Masanobu Taniguchi (Waseda Univ.)

Summary: In this talk, we introduce a nonparametric method to test pivotal quantity θ_0 in the multivariate time series model generated by infinite variance innovation sequence. Recently, the multivariate data with infinite variance appear in various fields like finance, economics and hydrology. It is difficult to analyze such data parametrically even if we assume the innovations are distributed as multivariate stable distribution. We propose an empirical likelihood ratio statistic based on the Whittle estimator to construct the confidence interval, and derive the asymptotic distribution of the statistic in the multivariate case. Numerical results will also be presented.

- 24 Kenta Hamada (Waseda Univ.)[#] Constrained Whittle estimators and shrinked Whittle estimators 10
 Masanobu Taniguchi (Waseda Univ.)

Summary: We consider a restricted estimator and a shrinkage estimator for a class of Gaussian linear process. This class includes Gaussian AR models (Autoregressive process) and Gaussian ARMA (Autoregressive Moving-average process) models. Because the Whittle type estimator is widely used in time series model, we propose a constrained Whittle estimator and shrinkage Whittle estimator. First, it is shown the asymptotic distribution of the constrained Whittle estimator. Second, we give that of Whittle shrinkage estimator. Although both of the methods have a similarity, we mention their difference. Numerical examples will be provided.

March 22nd (Fri) Conference Room IX

9:30–12:00

- 25 Yoshihiko Maesono (Kyushu Univ.)[#] Smoothing of sign test and approximation of its p-value 15
 Lu Mengxin (Kyushu Univ.)

Summary: In this talk we discuss theoretical properties of smoothed sign test, which based on a kernel estimator of the underlying distribution function of data. We show the smoothed sign test is equivalent to the usual sign test in the sense of Pitman efficiency, and its variance does not depend on the distribution under the null hypothesis.

- 26 Gaku Igarashi (Hokkaido Univ.)[#] Re-formulation of the inverse Gaussian, reciprocal inverse Gaussian and
 Yoshihide Kakizawa (Hokkaido Univ.) Birnbaum–Saunders kernel estimators 15

Summary: The standard kernel estimator does not have consistency near the boundary, that is, it has boundary bias when an estimated density has a compact or semi-infinite support. In order to solve such a boundary problem, some estimators were suggested in the literature. The inverse Gaussian, reciprocal inverse Gaussian and Birnbaum–Saunders kernel estimators (Jin and Kawczak, 2003; Scaillet, 2004) were suggested as alternatives to the gamma kernel estimator (Chen, 2000) that is free of boundary bias for a density with a semi-infinite support. However, we can see that these estimators do not solve, in general, the boundary problem. In this talk, we re-formulate them and study some asymptotic properties of the resulting estimators.

- 27 Shuya Kanagawa (Tokyo City Univ.)[#] Asymptotic expansion for sums of Hilbert space valued random variables and its application to V-statistics 15

Summary: We consider the Edgeworth expansion for V-statistics with a degenerate kernel of degree two. The scheme of the proof is constructed from the following three steps. The first step is to expand the kernel function by Fourier series. The second one is to transform the symmetric statistics into sums of Hilbert space valued random variables. The last step is applying the Edgeworth expansion for sums of Hilbert space valued random variables to the V-statistics.

- 28 Shintaro Hashimoto (Univ. of Tsukuba)[#] Information inequality for the Bayes risk 15
Ken-ichi Koike (Univ. of Tsukuba)

Summary: A lower bounds for the Bayes risk is obtained. The bound improves the Brown–Gajek bound and the asymptotic expression is derived. As an application of the bound, lower bounds for the local minimax risk and Bayes prediction risk are given.

- 29 Yiling Lin (Nagoya Univ.)[#] Optimal equi-difference conflict-avoiding codes of length $n = 2^a 3^b m$
Miwako Mishima (Gifu Univ.) and weight four 18
Masakazu Jimbo (Nagoya Univ.)

Summary: A conflict-avoiding code of length n and weight k is defined as a family \mathcal{C} of k -subsets (called codewords) of $\mathbb{Z}_n = \{0, 1, 2, \dots, n-1\}$, the ring of residues modulo n , such that $\Delta(c) \cap \Delta(c') = \emptyset$ for any $c, c' \in \mathcal{C}$, where $\Delta(c) = \{j - i \pmod{n} : i, j \in c, i \neq j\}$. The class of all the CACs of length n and weight k is denoted by $\text{CAC}(n, k)$. A code $\mathcal{C} \in \text{CAC}(n, k)$ is called an *equi-difference* code if every codeword $c \in \mathcal{C}$ has the form $\{0, i, 2i, \dots, (k-1)i\}$. In this talk, we will discuss upper bounds on the code size of equi-difference CACs of length $n = 2^a 3^b m$ and weight $k = 4$ for $a \geq 1$, $b \geq 1$ and $\gcd(m, 6) = 1$ by utilizing an integer programming method.

- 30 Hiroyuki Kurakami (Tokyo Univ. of Sci.)[#] Generalized marginal cumulative logistic model and decomposition of marginal symmetry for multi-way tables 10
Kouji Tahata (Tokyo Univ. of Sci.)
Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For multi-way contingency tables of same classifications with ordered categories, the marginal symmetry (MS) model which indicates that the marginal distributions of all variables are identical has been considered. This model can be expressed by the equivalence of the marginal cumulative logits of all variables. In this talk, we propose the generalized marginal cumulative logistic model which indicates that the difference between two marginal cumulative logits is the polynomial function of the category value. Using the proposed model, we give a theorem that the MS model holds if and only if both the proposed model and moment equality model hold.

- 31 Yusuke Saigusa (Tokyo Univ. of Sci.)[#] Extended palindromic symmetry models for square contingency tables with ordered categories 10
Kouji Tahata (Tokyo Univ. of Sci.)
Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For the square contingency tables with ordered categories, McCullagh (1978) considered the palindromic symmetry model and the generalized palindromic symmetry model. We consider the extended palindromic symmetry models.

- 32 Yayoi Tanaka (Tokyo Univ. of Sci.)[#] Sum-symmetry model and its decomposition for square contingency
 Kouji Yamamoto (Osaka Univ.) tables with ordered categories 10
 Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: We propose new kinds of symmetry model, and give a decomposition of the new model by introducing an extended model of it.

- 33 Fumika Shimada (Tokyo Univ. of Sci.)[#] Measure for symmetry using collapsed tables in square contingency
 Kouji Yamamoto (Osaka Univ.) tables with ordered categories 10
 Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For a square contingency table with ordered categories, the symmetry model was considered by Bowker(1948). When the symmetry model does not hold, we are interested in measuring the degree of departure from symmetry. We propose a measure which represents the degree of departure from symmetry, by considering some collapsed contingency tables obtained by combining adjacent categories in the original contingency table.

- 34 Motoki Ohama (Tokyo Univ. of Sci.)[#] Decompositions of symmetry using generalized linear diagonals-parameter
 Kouji Yamamoto (Osaka Univ.) symmetry model for square contingency tables 10
 Sadao Tomizawa (Tokyo Univ. of Sci.)

Summary: For the square contingency tables with ordinal categories, Yamamoto *et al.* (2007) showed that the symmetry (S) model (Bowker, 1948) holds if and only if both the linear diagonals-parameter symmetry (LDPS) model (Agresti, 1983) and the mean equality (ME) model hold, called decomposition of the model.

Yamamoto and Tomizawa (2012) also showed that the S model holds if and only if both the cumulative linear diagonals-parameter symmetry (CLDPS) model (Miyamoto *et al.*, 2004) and ME model hold.

We consider generalizations of those decompositions.

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

- Masanori Sawa (Nagoya Univ.)[#] The theory of cubature formulae and designs in numerical analysis,
 algebraic combinatorics and mathematical statistics

Summary: A cubature formula is an integration formula of a given function by approximating the integral value with an weighted average of the function values at finitely many specified points. A remarkable thing is, this object has been studied not only in the field of numerical analysis, but also in many other areas such as algebraic combinatorics, mathematical statistics and functional analysis, which are apparently not directly connected each other. In this talk you will know why, and enjoy how tightly those various areas are tied through the theory of cubature formulae. Here are some of the keywords you will see in my talk: Cubature formula, Euclidean design, Hilbert identity, isometric embedding, optimal experimental design, the mean-value theorem.

15:45–16:45 Award Lecture for 2012 Analysis Prize

- Masanobu Taniguchi (Waseda Univ.)[#] Non-standard analysis for time series

Summary: Time series analysis has been developed for the case when the models concerned are smooth with respect to unknown parameters, and the derivatives of score functions have finite moments. If these conditions are violated, the analysis is called “non-standard”. This talk surveys “non-standard analysis” for time series based on a series of papers by the author.

Applied Mathematics

March 20th (Wed) Conference Room VI

9:30–11:35

- 1 Atsuhiko Nakamoto [#] General extension to even triangulations 15
 (Yokohama Nat. Univ.)
 Kenta Ozeki
 (Nat. Inst. of Information/JST ERATO)
 Kenta Noguchi (Keio Univ.)

Summary: We define a triangulation as a graph embedded on a closed surface F^2 where every face is triangle. We call a triangulation all of whose vertices have even degree an even triangulation. Let G be a graph embedded on F^2 where every face is either a triangle or a quadrangle. In this talk, we decide the conditions of an embedded graph G which can be extended to an even triangulation by adding diagonal edges to quadrangular faces of G . We also decide the number of even triangulations extended from G . In particular, we show that any G where every face is quadrangle can be extended to an even triangulation.

- 2 Atsuhiko Nakamoto [#] Generating theorem for even multi-triangulations on the torus 15
 (Yokohama Nat. Univ.)
 Tsubasa Yamaguchi
 (Yokohama Nat. Univ.)

Summary: We prove a generating theorem for loopless even triangulations on the torus.

- 3 Atsuhiko Nakamoto [#] On 3-list-coloring of bipartite graphs on closed surfaces 15
 (Yokohama Nat. Univ.)
 Momoko Kobayashi
 (Yokohama Nat. Univ.)

Summary: We bound a choice number for bipartite graphs on surfaces.

- 4 Atsuhiko Nakamoto [#] A cyclic 4-colorability of graphs on surfaces 10
 (Yokohama Nat. Univ.)
 Kenta Ozeki
 (Nat. Inst. of Information/JST ERATO)
 Kenta Noguchi (Keio Univ.)

Summary: A vertex-coloring of graphs on a surface is called cyclic if any two vertices contained in a same face receive different colors. In this talk, we give a necessary and sufficient condition for graphs on a surface to have a cyclic 4-coloring.

- 5 Akira Saito (Nihon Univ.)[#] The local Chvátal–Erdős condition and 2-factors in graphs 15

Summary: A graph G is said to satisfy the Chvátal–Erdős condition if its independence number is bounded from above by its connectivity. It is a well-known fact that a graph satisfying the Chvátal–Erdős condition has a hamiltonian cycle. For a vertex x in G and a positive integer r , the ball with center x and radius r is the subgraph of G induced by the set of vertices whose distance from x is at most r . We say that G satisfies the local Chvátal–Erdős condition if the ball with center x and radius 1 satisfies the Chvátal–Erdős condition for every $x \in V(G)$. In this talk, we report a result that a connected graph satisfying the local Chvátal–Erdős condition has a 2-factor.

- 6 Kenjiro Ogawa (Tokai Univ.)[#] On strict-semi-bound graph 10
 Morimasa Tsuchiya (Tokai Univ.)
 Satoshi Tagusari (Tokai Univ.)

Summary: We consider strict-semi-bound graphs of posets. For a poset, the strict-semi-bound graph of the poset is the graph on the element set of the poset for which pair of vertices are adjacent if and only if there exists an element which is a strict common upper bound or lower bound of pair. We show some results on strict-semi-bound graphs.

- 7 Michitaka Furuya (Tokyo Univ. of Sci.)[#] Upper bounds on the diameter of domination dot-critical graphs with given connectivity 15

Summary: The domination number $\gamma(G)$ of a graph G is the minimum cardinality of any dominating set of G . An edge of a graph is called dot-critical if its contraction decreases the domination number. A graph is said to be dot-critical if all of edges are dot-critical.

It is known that the diameter of a connected dot-critical graph G is at most $3\gamma(G) - 3$. In this talk, we show that if a dot-critical graph G has the diameter exactly $3\gamma(G) - 3$, then G is a path. Furthermore, we consider dot-critical graphs with high connectivity, and prove that for $m \geq 2$, the diameter of an m -connected dot-critical graph G is at most $2\gamma(G) - 2$.

- 8 Kazunori Matsuda (Nagoya Univ.)^{*} Properties of weakly closed graphs 10

Summary: The notion of weak closedness is a generalization of the notion of closedness introduced by Herzog–Hibi–Hreindottir–Kahle–Rauh. In this talk, we state several basic properties of weakly closed graphs, including its perfectness.

14:15–16:25

- 9 Ryota Matsubara (Shibaura Inst. of Tech.)[#] On trees with constraints on the leaf degree 10
 Haruhide Matsuda (Shibaura Inst. of Tech.)

Summary: Let T be a tree of a graph G . The leaf degree of a vertex $x \in V(T)$ is defined as the number of end-vertices in T adjacent to x . Let f be an integer-valued function defined on $V(G)$ such that $f(x) \geq 0$ for all $x \in V(G)$. Then a tree T of G is said to be an **f -leaf-tree** of G if the leaf degree of each vertex $x \in V(T)$ is at most $f(x)$.

We obtain a criterion for a graph to have a spanning f -leaf-tree.

- 10 Shoichi Tsuchiya (Tokyo Univ. of Sci.)[#] On forbidden pairs implying a homeomorphically irreducible spanning tree 15
 Michitaka Furuya (Tokyo Univ. of Sci.)

Summary: A spanning tree with no vertices of degree two of a graph is called a homeomorphically irreducible spanning tree (or a HIST) of the graph. In this talk, we characterize forbidden pairs that imply the existence of a HIST in a connected (or 2-connected) graph of sufficiently large order.

- 11 Midori Kobayashi (Univ. of Shizuoka)[#] Dudeney's Bench problem 10
 Gisaku Nakamura (Univ. of Shizuoka*)

Summary: Consider a graph G and a subgraph H of G . A $D(G, H, \lambda)$ design is a collection \mathcal{D} of subgraphs of G each isomorphic to H so that every 2-path (path of length 2) in G lies in exactly λ subgraphs in \mathcal{D} . We call this design a Dudeney design.

In this talk, we consider $D(K_n, P_n, \lambda)$ designs and we obtain the following result.

Theorem

- (1) There exists a $D(K_n, P_n, 1)$ design when n is odd.
- (2) There exists a $D(K_n, P_n, 1)$ design when $n \equiv 0 \pmod{4}$.
- (3) There exists a $D(K_n, P_n, 2)$ design when $n \equiv 2 \pmod{4}$.

- 12 Kazuhiko Ushio (Kinki Univ.)[#] Balanced (C_9, C_{12}) -foil designs and related designs 15

Summary: In graph theory, the decomposition problem of graphs is a very important topic. Various type of decompositions of many graphs can be seen in the literature of graph theory. This paper gives balanced (C_9, C_{12}) -foil designs and related designs.

- 13 Kiyoshi Ando (Univ. of Electro-Comm.)[#] Some degree sum and forbidden subgraph conditions for k -contractible edges 15

Summary: An edge in a k -connected graph is said to be k -contractible if the contraction of the edge results in a k -connected graph. We say that a k -connected graph G satisfies ' m -degree-sum condition' if $\sum_{x \in V(W)} \deg_G(x) \leq mk + 1$ holds for any subgraph $W \subseteq G$ with $|W| = m$. Let k be an integer such that $k \geq 5$ and let G be a k -connected graph. We prove that if either " G is $\{K_1 + C_4, K_2 + (K_1 \cup K_2)\}$ -free and satisfies 3-degree-sum condition" or " G is $(K_1 + P_4)$ -free and satisfies 4-degree-sum condition", then G has a k -contractible edge.

- 14 Iwao Sato (Oyama Nat. Coll. of Tech.)[#] A generalized Bartholdi zeta function for a hypergraph 15

Summary: We introduce a generalization of the Bartholdi zeta function for a hypergraph, and present its determinant expression.

- 15 Kenji Kashiwabara (Univ. of Tokyo)[#] Fulkerson conjecture for cubic graphs, and clutter theory 15

Summary: We present a new conjecture about clutter theory. Every ideal clutter whose minimum transversals cover the ground set packs in terms of half integers. We show that this conjecture implies Fulkerson conjecture, that is, every bridgeless cubic graph has six 1-factors which doubly cover each edge.

- 16 Guantao Chen (Georgia State Univ.)[#] Clique minors, chromatic numbers for degree sequences in graphs 15
 Ryo Hazama (Keio Univ.)
 Katsuhiko Ota (Keio Univ.)

Summary: Given a graph G , Robertson and Song conjectured that there exists a graph H containing $K_{\chi(G)}$ as a minor and having the same degree sequence of G . The conjecture was confirmed by Dvořák and Mohar. In this talk, we shall give a short proof of this conjecture. By extending notion of coloring classes with minimum number of colors, our result is stronger than the original conjecture and independent from the results of Dvořák and Mohar. We also give a result on the maximum size of topological clique minor for given near-regular degree sequences.

16:40–17:40 Talk invited by Applied Mathematics Section

Jun Fujisawa (Keio Univ.)[#] On the existence of good structures in graphs

Summary: In this talk some results on the existence of “good” structures in graphs are presented. Here we regard 1-factors, 2-factors and hamiltonian cycles as “good” structures. To find such structures, several kinds of conditions are used. One of the useful condition is *forbidden subgraphs* condition. For a set \mathcal{H} of connected graphs, a graph G is said to be \mathcal{H} -free if G does not contain an induced copy of H for every $H \in \mathcal{H}$, and the set \mathcal{H} is often referred as *forbidden subgraphs*. If we choose \mathcal{H} appropriately, \mathcal{H} -free graphs may contain good structures. The relationship between forbidden subgraphs and the existence of a 1-factor, a 2-factor or a hamiltonian cycle was investigated by several researchers. The recent progress of this line of research is the main topic of this talk. Some related results, for example, the results on graphs embedded on a closed surface, or the results using degree conditions, are also given.

March 21st (Thu) Conference Room VI

9:30–11:35

17 Naoki Matsumoto (Yokohama Nat. Univ.)[#] The number of diagonal transformations in pentangulations on the sphere 15

Summary: A *pentangulation* is a 2-connected simple plane graph such that each face is bounded by a cycle of length five. *Diagonal transformations* in pentangulations consist of two transformations A and B. In 2007, Kanno et al. proved that any two pentangulations with the same number of vertices can be transformed into each other by diagonal transformations. Recently, Matsumoto and Yamamoto proved that any pentangulations with the same number of vertices can be transformed into each other only by A if they are not isomorphic to some pentangulation. In this talk, we focus on the number of diagonal transformations. In the above results, the authors use $O(n^2)$ diagonal transformations to transform a pentangulation into the other one, where n is the number of vertices. In this time, we prove that any two pentangulations with n vertices can be transformed into each other by $O(n)$ diagonal transformations.

18 Masahiro Hachimori (Univ. of Tsukuba) Discrete Voronoi games and related games on graphs, and Nash equilibria 15

Summary: A discrete Voronoi game on a graph is a noncooperative game where each player choose one vertex and his utility is determined by how many vertices are closer to him than other players. In this talk, we show that the discrete Voronoi game with 2 players on a graph of diameter upto 2 always has Nash equilibria. Here, the diameter and the number of players for this result are sharp. We also include results for the discrete Voronoi games on paths. We also show a variant of the discrete Voronoi game where Nash equilibria always exist on the graphs of diameter upto 2 for any number of players.

19 Shinya Fujita (Maebashi Inst. of Tech.)[#] Revisit of Erdős–Gallai’s theorem on the circumference of a graph 10
Linda Lesniak (Drew Univ.)

Summary: Let G be a graph of order n with m edges. We prove that, if both n and c are even integers with $n \geq c \geq 4$, and $m \geq (c - 1)(n - 2)/2 + 2$, then G contains a cycle of order at least c .

- 20 Yoshiyuki Mori (Okayama Univ. of Sci.)[#] A fast calculation of $a^{p-1} \equiv 1 \pmod{p^2}$ 10
 Ryuichi Sawae (Okayama Univ. of Sci.)
 Daisuke Ishi (Okayama Univ. of Sci.)

Summary: In Montgomery [2], it is stated that some number-theoretic questions such as Fermat’s conjecture require primes p satisfying $a^{p-1} \equiv 1 \pmod{p^2}$ (*) for given a not a power and its solutions for $2 \leq a \leq 99$ and $3 \leq p < 2^{32}$ are listed. Since we need the solutions for a proof of a prime factor in odd perfect numbers, its further calculation is needed. So, we have calculated the solutions of (*) for $2 \leq a \leq 99$ and $3 \leq p < 1.3 \times 10^{12}$. We have a news that Prof. Mochizuki of Kyoto University has released a 500 page proof of the ABC conjecture. If we employ the ABC conjecture, there is a possibility that the calculations related to odd perfect numbers will be extremely decreased. Then, the list of the solutions in this paper will be usefull data to complete the proof.

- 21 Yoshiyuki Mori (Okayama Univ. of Sci.)[#] On a calculation of the largest prime divisor of an odd perfect number 10
 Ryuichi Sawae (Okayama Univ. of Sci.)
 Miho Aoki (Shimane Univ.)
 Daisuke Ishii (Okayama Univ. of Sci.)

Summary: A perfect number is a positive integer n which satisfies $\sigma(n) = 2n$, where $\sigma(n)$ denotes the sum of all the divisors of n . All known perfect numbers are even. As for odd numbers, it is conjectured that no odd perfect numbers exist, but until now this nonexistence has yet to be proven. However, certain conditions that a hypothetical odd perfect number must satisfy have been found. Recently, Goto and Ohno [5] proved that the largest prime divisor of an odd perfect number must be greater than 10^8 .

Our result improves the lower bound for the largest prime divisor of an odd perfect number, proving that the largest prime divisor of an odd perfect number exceeds 10^9 . The proof follows the improved method used by Goto and Ohno, and others.

- 22 Yukiko Fukukawa (Osaka City Univ.)[#] Generalization of the Catalan number 10

Summary: The Catalan number C_n can be defined as the number of Dyck paths from $(0, 0)$ to (n, n) . We call P be a Dyck path when P is a staircase walk from $(0, 0)$ to (m, n) that lies strictly below (but may touch) the diagonal $y = \frac{n}{m}x$ for any $m, n \in \mathbb{N}$. I calculated the number of Dyck paths from $(0, 0)$ to (m, n) for any $m, n \in \mathbb{N}$.

- 23 Yutaka Sueyoshi (Nagasaki Univ.)^{*} On the maximal value of break intervals of equitable round-robin tour- 20
 Ryuichi Harasawa (Nagasaki Univ.) naments with home-away assignments
 Aichi Kudo (Nagasaki Univ.)

Summary: We study the maximal value of break intervals of equitable round-robin tournaments with home-away assignments. By computer search, we observe that the maximal break interval increases by one when the number of teams reaches a power of two. Further, we construct a schedule of an equitable round-robin tournament with maximal break interval k for 2^k teams.

- 24 Chie Nara (Tokai Univ.)[#] Affine classes of 3-dimensional parallelohedra —Their parametrization 15
 Jin-ichi Itoh (Kumamoto Univ.) and structure—
 Nikolai Dolbilin (Steklov Math. Inst.)

Summary: In addition to well-known classification of 3-dimensional parallelohedra we describe this important class of polytopes classified by the affine equivalence relation and parametrize representatives of their equivalent classes. Moreover, we discuss the structure of those affine classes.

13:15–14:15 Talk invited by Applied Mathematics Section

Hayato Chiba (Kyushu Univ.)[#] A spectral theory of linear operators on a Gelfand triplet and its application to the dynamics of coupled oscillators

Summary: Dynamics of systems of large populations of coupled oscillators have been of great interest because collective synchronization phenomena are observed in a variety of areas. The Kuramoto model is often used to investigate such phenomena. In this talk, an infinite dimensional Kuramoto model is considered, and Kuramoto's conjecture on a bifurcation diagram of the system will be proved.

It is well known that the spectrum (eigenvalues) of a linear operator determines a local dynamics of a system of differential equations. Unfortunately, a linear operator obtained from the infinite dimensional Kuramoto model has the continuous spectrum on the imaginary axis, so that the usual spectrum does not determine the dynamics. To handle such continuous spectra, a new spectral theory of linear operators based on Gelfand triplets is developed. Basic notions in the usual spectral theory, such as eigenspaces, algebraic multiplicities, point/continuous/residual spectra, Riesz projections are extended to those defined on a Gelfand triplet.

Furthermore, the theory is applied to nonlinear problems to prove Kuramoto's conjecture. In particular, a center manifold theorem on a certain space of distributions will be proved with the aid of the Gelfand triplet and the generalized spectrum.

March 22nd (Fri) Conference Room VI

9:00–11:45

- 25 Hiroataka Ebisui (Oval Research Center)[#] Example of error and difficulty in hard-soft PG manage and color-phase technology by Pachikuri multistructured mapping form using a sparial multi-phase positon in stratified sosity 10

Summary: I show the title-example by PDF-PC 6 output sheets. They can help mathematical theories or considerration in tecnology stratified sosity. Please enjoy these sheets context for better furture developing of them.

- 26 Shunzi Horiguchi[#] On relations between the enhancement of Tsuchikura–Horiguchi's (Yoshimasu Murase–Newton type's) recurrence formulas concerning algebraic equations and Horner method 15

Summary: Yoshimasu Murase gave formulas of x^*x in 1673. These lead to the Horner method at the same time to lead to the expansion of the Newton method. This shows originality of Japanese native mathematics (Wasan) of Japan.

- 27 Shy Der Lin[#] Laplace transform of the fractional derivative and its applications 15
(Chung Yuan Christian Univ.)

Chia-Hung Lu
(Chung Yuan Christian Univ.)

Summary: In the past two decades, the widely-investigated subject of fractional calculus has remarkably gained importance and popularity due to its demonstrated applications in numerous diverse fields of science and engineering. The object of the report is to present at the research work in the fields of Laplace transform of the fractional derivative to solve the useful fractional-order differential equations in the fields of applied mathematics which allied topics of mathematical analysis and applicable mathematics with the theoretic and applicable aspects of the Riemann–Liouville fractional integrals and fractional derivatives.

- 28 Fumio Nakajima (Iwate Univ.)* A mathematical approach to the policy of Atomic energy 15

Summary: In 1970's, Dr. Schumacher appealed that Atomic energy should be immediately abolished because of the various poisonous influences due to radition [1]. Even at the present day we have not found any safe disposal of the radioactive waste, and have proceeded to cool it from the time of starting point. In this talk we shall innovate a mathematical model of the policy of Atomic energy from the viewpoint of its cost and conduct Schumacher's claim.

- 29 Takehiko Kinoshita (Kyoto Univ.)# A numerical verification of the invertivity for elliptic partial differential
Yoshitaka Watanabe (Kyushu Univ.) operators 15
Mitsuhiro T. Nakao
(Sasebo Nat. Coll. of Tech.)

Summary: We will report on an improvement of a theorem for inverse operators in linear elliptic partial differential equations.

- 30 Akitoshi Takayasu (Waseda Univ.)# Verified computations for semilinear elliptic boundary value problems
Xuefeng Liu (Waseda Univ.) on arbitrary polygonal domains 15
Shin'ichi Oishi
(Waseda Univ./JST CREST)

Summary: In this talk, a numerical verification method is presented for second-order semilinear elliptic boundary value problems on arbitrary polygonal domains. On the basis of the Newton–Kantorovich theorem, our method can prove the existence and local uniqueness of the solution in the neighborhood of its approximation. In particular, a computer-assisted analysis procedure is proposed with respect to the invertibility of some elliptic operators. Using a verified eigenvalue evaluation for the Laplace operator, the inverse of an elliptic operator is proved with computer-assistance. It yields more accurate evaluation than the existing method. The efficiency of our method is shown through illustrative numerical results on several polygonal domains.

- 31 Mikio Murata # The direct method to transform parabolic differential equations into
(Tokyo Univ. of Agri. and Tech.) cellular automata 15

Summary: The direct method to transform parabolic differential equations into cellular automata is proposed. The transforming method is applied to the Gray–Scott model. The resulting cellular automaton is directly related to the elementary cellular automaton Rule 90.

- 32 Koya Sakakibara (Meiji Univ.)# An application of a method approximating holomorphic functions by
Masashi Katsurada (Meiji Univ.) linear combinations of $1/(z - \zeta)$: calculating the inverse of conformal
Hidenori Ogata mappings 15
(Univ. of Electro-Comm.)

Summary: We proposed in Sakakibara and Katsurada [3] a method approximating holomorphic functions in a given domain Ω by using their boundary values. This method can be used to compute the inverse mapping of a conformal mapping. In this talk, we consider calculating the inverse mapping of a conformal mapping, which is called the inverse conformal mapping, from a Jordan region Ω onto the unit disk.

- 33 Takashi Sakajo (Hokkaido Univ./JST CREST) [#] Word representation of streamline topologies for structurally stable vortex flows in multiply connected domains 15
Tomoo Yokoyama (Hokkaido Univ./JST CREST)

Summary: The instantaneous flow field of potential flows in two-dimensional domains is described by a Hamiltonian vector field whose Hamiltonian is equivalent to the stream function, which is the imaginary part of the complex potential. The flow is characterized topologically by the streamline pattern. We propose a new topological classification procedure of the structurally stable streamline patterns in two-dimensional multiply connected domains generated by many point vortices in the presence of the uniform flow. The procedure allows us to assign a maximal word to each structurally stable Hamiltonian vector field. In the present talk, I will explain how to give the word representation of the structurally stable streamline patterns and show all the streamline patterns in multiply connected domains of low genus with their word representations.

14:15–16:30

- 34 Takahito Kashiwabara (Univ. of Tokyo) [#] Some remarks on Navier–Stokes equations with leak boundary condition 15

Summary: We consider the incompressible Navier–Stokes equations in a 2D or 3D bounded domain supplemented with the leak boundary condition, in which the tangential velocity and normal stress are prescribed at the boundary. Unlike the Dirichlet or slip boundary condition cases, it still remains open whether one can obtain existence of a global-in-time solution, even in the 2D case. In this talk, we explain the reason for this situation, discussing two approaches to construct Galerkin approximations. Applications to the leak boundary condition of friction type are also considered.

- 35 Masahisa Tabata (Waseda Univ.) [#] Equivalence of an upwind FEM and a characteristics FEM 15

Summary: Upwind FEMs and characteristics FEMs are representative numerical methods for solving stably flow problems. We show that an upwind FEM and a characteristics FEM are equivalent under some condition.

- 36 Kenta Uemichi (Kwansei Gakuin Univ.) [#] A mathematical model for comb construction of honeybees 15
Koichi Osaki (Kwansei Gakuin Univ.)

Summary: We examined the behavior of European honeybees at the first stage of comb construction. From the result, we find two processes: one is the self-assembly stage of the honeybees, the other is the self-organization stage of constructing honeycomb. We propose for the first stage of the self-assembly, the scenario of nonlinear diffusion and assembly of insects by Shigesada et al. For the second stage of the self-organization, we propose the leading interactions among honeybees, beeswax and temperature.

- 37 Masaji Watanabe (Okayama Univ.) [#] Study on microbial depolymerization processes of exogenous type 15
Fusako Kawai (Kyoto Inst. Tech.)

Summary: Mathematical models for microbial depolymerization processes are described. Inverse problems to determine molecular factors of degradation rates are illustrated. Initial value problems to simulate transitions of weight distributions are formulated with time factors of degradation rates.

- 38 Hideki Murakawa (Kyushu Univ.)[#] On spatiotemporal patterns in a cell population model 15
 Arnaud Ducrot (Univ. Bordeaux 2)
 Frank Le Foll (Univ. de Le Havre)
 Pierre Magal (Univ. Bordeaux 2)
 Jennifer Pasquier (Univ. de Le Havre)
 Glenn F. Webb (Vanderbilt Univ.)

Summary: In this talk, we develop a mathematical model to describe spatial movement of an in vitro cell population. First, we present a two-compartment space and size structured model taking account of cell size, cell division, mortality, motility, contact inhibition, supply and demand for nutrition or oxygen, proliferative/quiescent states. Then we reduce the complicated two-compartment model to a single equation. The resulting simplified model consists of a nonlinear diffusion of porous medium type and a nonlocal reaction term. This model contains the complex phenomena present in the cell biology, but are simple enough to be theoretically analyzed. Numerical experiments are carried out to demonstrate the formation of cell colonies.

- 39 Hiroko Yamamoto (Tohoku Univ.)[#] Concentration point in the ground state of a reaction-diffusion equation
 Izumi Takagi (Tohoku Univ.) in heterogeneous media 15

Summary: Considered is the Neumann problem for a semilinear elliptic equation with variable coefficients arising from an activator-inhibitor system modeling biological pattern formation. We prove that if the diffusion coefficient is small, the ground state given by the mountain pass lemma concentrates around a point. To identify the concentration point, we introduce a locator function defined by the coefficients of the equation. The concentration point is near the minimum point of the locator function over the entire domain or over the boundary.

- 40 Kazuyuki Yagasaki (Hiroshima Univ.)[#] Existence of horseshoe dynamics in an asymmetric heavy top 15
 G. H. M. van der Heijden
 (Univ. College London)

Summary: We prove the existence of horseshoes in the nearly symmetric heavy top. This problem was previously addressed but treated inappropriately due to a singularity of the equations of motion. We introduce an (artificial) inclined plane to remove this singularity and develop a Melnikov-type approach to show that there exist transverse homoclinic orbits to periodic orbits on four-dimensional level sets. The price we pay for removing the singularity is that the Hamiltonian system becomes a three-degree-of-freedom system with an additional first integral, unlike the two-degree-of-freedom formulation in the classical treatment.

- 41 Yasuaki Hiraoka (Kyushu Univ.)[#] Protein structure analysis and persistent homology 15

Summary: In this talk, I will explain our recent researches on protein structure analysis by using persistent homology.

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

Takeshi Ohtsuka (Gunma Univ.)[#] A level set formulation for evolving spirals and their behavior in spiral crystal growth

Summary: This is a brief introduction to a simple level set formulation for spiral crystal growth and its mathematical analysis. When a crystal grows with aid of screw dislocations, one can find evolving spiral steps on the crystal surface. In the theory of the crystal growth, the steps evolve with an eikonal-curvature flow equation. In this talk we introduce a simple level set formulation for the evolving spirals. The crucial difficulty is caused by the fact that a spiral does not divide the domain into two regions. To overcome this difficulty, we present spirals by a level set of a single auxiliary function minus a pre-determined multi-valued sheet structure function. Our method enables us to clarify ‘interior’ of the evolving curves with a covering space reflecting the sheet structure function, which is useful to investigate the behavior of spirals. In this talk we present mathematical results on stability of a bunched spirals, and stationary curves under the ‘inactive pair’, which is a close pair with opposite orientations. The clarification of the interior is also convenient to reconstruct the crystal surface, which enables us to calculate the growth rate of the crystal surface. For applications of the above, we present some numerical results on the growth rate of the crystal surface by a single or a pair of screw dislocations.

Topology

March 20th (Wed) Conference Room II

9:30–12:00

- 1 Shin Satoh (Kobe Univ.)* OU sequence of knot diagram and its application 10
 Ryuji Higa (Kobe Univ.)
 Yasutaka Nakanishi (Kobe Univ.)
 Takuto Yamamoto (Kobe Univ.)

Summary: We go along a knot diagram, and get a sequence of over- and under-crossing points. We will study which kinds of sequences are realized by diagrams of the trefoil knot. As an application, we will characterize the Shimizu warping polynomials for diagrams of the trefoil knot.

- 2 Taizo Kanenobu (Osaka City Univ.)# Links which are related by a band surgery 10
 Hiromasa Moriuchi (Osaka City Univ.)

Summary: We give several criteria for two links to be related by a coherent band surgery using the determinant and the Jones polynomial. Then we give some examples.

- 3 Takuji Nakamura # The number of colors in a Fox coloring 10
 (Osaka Electro-Comm. Univ.)
 Yasutaku Nakanishi (Kobe Univ.)
 Shin Satoh (Kobe Univ.)

Summary: We introduce the notion of a graph associated with a Fox p -coloring of a knot, and show that any non-trivial p -coloring requires at least $\lfloor \log_2 p \rfloor + 2$ colors. This lower bound is best possible in the sense that there is a p -colorable virtual knot which attains the bound.

- 4 Makoto Ozawa (Komazawa Univ.)# Coexistence of coiled surfaces and spanning surfaces for knots and links 15

Summary: It is a well-known procedure for constructing a torus knot or link that first we prepare an unknotted torus and meridian disks in the complementary solid tori of it, and second smooth the intersections of the boundary of meridian disks uniformly. Then we obtain a torus knot or link on the unknotted torus and its Seifert surface made of meridian disks. In the present paper, we generalize this procedure by a closed fake surface and show that the resultant two surfaces obtained by smoothing triple points uniformly are essential. We also show that a knot obtained by this procedure satisfies the Neuwirth conjecture, and the distance of two boundary slopes for the knot is equal to the number of triple points of the closed fake surface.

- 5 Makoto Ozawa (Komazawa Univ.)# A destabilized bridge sphere of bridge number arbitrarily higher than
 Kazuto Takao (Osaka Univ.) the bridge number of the knot 10

Summary: We show that for any integer $n > 3$, there exists a 3-bridge knot which has a destabilized n -bridge sphere.

- 6 Masakazu Teragaito (Hiroshima Univ.)[#] Left-orderable fundamental group and Dehn surgery on twist knots ... 10
Ryoto Hakamata (Hiroshima Univ.)

Summary: For any hyperbolic twist knot in the 3-sphere, we show that the resulting manifold by r -surgery on the knot has left-orderable fundamental group if the slope r satisfies the inequality $0 \leq r \leq 4$.

- 7 Kazuhiro Ichihara (Nihon Univ.)[#] Exceptional surgeries on alternating knots 10
Hidetoshi Masai (Tokyo Tech)

Summary: We will report on the complete classification of exceptional surgeries on hyperbolic alternating knots. This work relies heavily on computer, actually we used TSUBAME the super-computer of Tokyo Institute of Technology. In this talk we will talk about theoretical background and the supercomputer-aided computation.

- 8 Toshifumi Tanaka (Gifu Univ.)[#] On the maximal Thurston–Bennequin number for knots in a spatial graph 10

Summary: We investigate Legendrian graphs in the standard contact 3-space. We show that there exists a Legendrian embedding of the complete graph on 4 vertices such that all its cycles realize their maximal Thurston–Bennequin number.

- 9 Isamu Miyato (Nagoya Inst. of Tech.)[#] On a certain parity of the Alexander polynomial 10

Summary: Let $H_L(t) = \Delta_L(t)/(1-t)^{\mu-1}$ be the Hosokawa polynomial of an oriented link L with μ components, where $\Delta_L(t)$ is the Alexander polynomial of L . By definition, the absolute values of each of $H_L(1)$ and $H_L(-1)$ is a link invariant. We consider whether or not $H_L(1)$ and $H_L(-1)$ coincide in sign. Namely, we consider $\text{Sign}(H_L(1)H_L(-1))$. $\text{Sign}(H_L(1)H_L(-1))$ becomes a link invariant when it is modified by the degree of $H_L(t)$. It is known that for any knot K , $\text{Sign}(H_K(1)H_K(-1))$ is determined by the signature of K . We show that for any link L , $\text{Sign}(H_L(1)H_L(-1))$ is determined by the signature and the linking signature of L .

- 10 Sakie Suzuki (Kyoto Univ.)[#] Bing doubling and the colored Jones polynomial 10

Summary: Bing doubling is an operation which gives a satellite of a knot. In this talk, we give an algebraic property of the colored Jones polynomials of Bing doubles, and give a divisibility property of the unified WRT invariant of integral homology spheres which are obtained from S^3 by surgery along Bing doubles.

- 11 Takefumi Nosaka (Kyushu Univ.)[#] Topological interpretation of link invariants from finite quandles I; main theorem 10

Summary: In this talk, I will demonstrate a topological meaning of quandle cocycle invariants of links with respect to finite connected quandles X , from a perspective of homotopy theory: Specifically, for any prime ℓ which does not divide the type of X , the ℓ -torsion of this invariants is equal to a sum of the colouring polynomial and a \mathbb{Z} -equivariant part of the Dijkgraaf–Witten invariant of a cyclic branched covering space.

- 12 Takefumi Nosaka (Kyushu Univ.)[#] Topological interpretation of link invariants from finite quandles II; some calculations 10

Summary: Furthermore, our homotopical approach involves application of computing some third homologies and second homotopy groups of the classifying spaces of quandles, from group cohomology.

- 13 Takefumi Nosaka (Kyushu Univ.)[#] On third homologies of groups and of quandles via Dijkgraaf–Witten invariant and Inoue–Kabaya map 10

Summary: We propose a simple method to produce quandle cocycles from group cocycles, as a modification of Inoue–Kabaya chain map. We further show that, in respect to “universal extension of quandles”, the chain map induces an isomorphism between their third homologies (modulo some torsion). For example, all Mochizuki’s quandle 3-cocycles are shown to be derived from group cocycles of some non-abelian group.

- 14 Rei Inoue (Chiba Univ.)[#] Cluster algebra and complex volume of 2-bridge links 15
Kazuhiro Hikami (Kyushu Univ.)

Summary: We introduce an application of the cluster algebra (with coefficients) to compute the hyperbolic volume and the complex volume of the 2-bridge link complement in S^3 .

14:30–15:30 Talk invited by Topology Section

- Takahiro Kitayama (Univ. of Tokyo)[#] Torsion functions on character varieties and an extension of Culler–Shalen theory

Summary: Culler and Shalen established a way to construct incompressible surfaces in a 3-manifold from ideal points of the SL_2 -character variety. We study related properties of torsion invariants on the variety, and present an extension of the theory for higher dimensional representations.

First we consider the rational function defined by the leading coefficients of twisted Alexander polynomials, and describe a sufficient condition on an ideal point for the function to take a finite value as Dunfield, Friedl and Jackson conjectured. We also discuss the problem of detecting fiberedness and the Thurston norm of a 3-manifold by the function. Next we introduce an analogous theory to construct certain kinds of branched surfaces in a 3-manifold from limit points of the SL_n -character variety. Such a branched surface induces a nontrivial presentation of the fundamental group as a 2-complex of groups.

This talk is partially based on joint works with Takashi Hara, with Taehee Kim and Takayuki Morifuji, and with Yuji Terashima.

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

- Makoto Sakuma (Hiroshima Univ.)[#] Simple loops on bridge spheres and Heegaard surfaces

Summary: Let M be a closed orientable 3-manifold (or a link complement) and S a Heegaard surface (or a bridge sphere) of M . Then we have the following natural questions. (1) Which essential simple loops on S are null-homotopic in M ? (2) For two distinct essential simple loops on S , when are they homotopic in M ? We describe the complete answers to the above questions for the case where M is a 2-bridge link complement and S is a 2-bridge sphere, which were obtained by a series of joint works with Donghi Lee. We also discuss application to McShane’s identity and possible generalizations.

March 21st (Thu) Conference Room II

9:30–12:00

- 15 Hiroki Takahashi (Kyoto Univ.)* Emergence of attractors at the first bifurcation of the Hénon family 15

Summary: We study the dynamics of strongly dissipative Hénon-like maps, around the first bifurcation parameter a^* at which the uniform hyperbolicity before the bifurcation is destroyed by the formation of tangencies inside the limit set. We show that a^* is a full Lebesgue density point of the set of parameters for which Lebesgue almost every initial point diverges to infinity under positive iteration.

- 16 Katsuhisa Koshino (Univ. of Tsukuba)* A Hilbert cube compactification of a function space into a 1-dimensional
Katsuro Sakai (Univ. of Tsukuba) locally compact AR with the compact-open topology 20

Summary: Let X be an infinite, locally compact, locally connected, separable metrizable space and let Y be a 1-dimensional locally compact AR. The space of all continuous functions from X to Y with the compact-open topology is denoted by $C(X, Y)$. In this talk, we show that if X is non-discrete or Y is non-compact, then the function space $C(X, Y)$ has a natural compactification $\overline{C}(X, Y)$ such that the pair $(\overline{C}(X, Y), C(X, Y))$ is homeomorphic to (\mathbf{Q}, \mathbf{s}) , where $\mathbf{Q} = [-1, 1]^{\mathbb{N}}$ is the Hilbert cube and $\mathbf{s} = (-1, 1)^{\mathbb{N}}$ is the pseudo-interior of \mathbf{Q} .

- 17 Wataru Yuasa (Tokyo Tech)* Hyperelliptic Goldman Lie algebra and its abelianization 15

Summary: The covering transformation group of a finite Galois covering of a surface acts on the Goldman Lie algebra of the total space. We show that the invariant part of this Lie algebra can be embedded in the Goldman Lie algebra of the base space. Furthermore, we introduce the Goldman Lie algebra of a 2-orbifold to extend the result to that for finite branched Galois coverings. As an application, we define the hyperelliptic Goldman Lie algebra of a surface equipped with a hyperelliptic involution and give a lower bound for the dimension of the abelianization.

- 18 Yusuke Kuno (Tsuda Coll.)* An extension of the Earle class to the Ptolemy groupoid 10
Robert Penner (Aarhus Univ./Caltech)
Vladimir Turaev (Indiana Univ.)

Summary: The Ptolemy groupoid is a combinatorial object constructed from trivalent fatgraphs and Whitehead moves. It contains the mapping class group of a surface in a non-canonical way. We discuss extensions of twisted 1-cocycles on the mapping class group of a once bordered surface to the Ptolemy groupoid.

- 19 Takuya Sakasai (Univ. of Tokyo)[#] Computations of Euler characteristics of graph homologies in low
Masaaki Suzuki (Akita Univ.) weights 15
Shigeyuki Morita (Univ. of Tokyo)*

Summary: We report our explicit computations of the Euler characteristics of graph homologies for commutative and Lie cases up to certain low weights. Then we mention their applications to characteristic classes of moduli spaces by using a theorem of Kontsevich.

- 20 Tatsuhiro Shimizu (Univ. of Tokyo)[#] An extension of degree one finite type invariant for rational homology 3-spheres to correspondences. 15

Summary: We define an invariant for correspondences between rational homology 3-spheres in two ways. In one of such constructions, we introduce the notion of fractional framings that is an extension of the notion of framings. As an application, we formulate an obstruction for a correspondence to be a graph of a map.

- 21 Tomohiko Ishida (Univ. of Tokyo)[#] Quasi-morphisms on the group of area-preserving diffeomorphisms of the 2-disk 10

Summary: Recently Gambaudo and Ghys proved that there exist infinitely many quasi-morphisms on the group $\text{Diff}_\Omega^\infty(D^2, \partial D^2)$ of area-preserving diffeomorphisms of the 2-disk D^2 . For the proof, they constructed a homomorphism from the space of quasi-morphisms on the braid group to the space of quasi-morphisms on $\text{Diff}_\Omega^\infty(D^2, \partial D^2)$. We prove the injectivity of the homomorphism.

- 22 Hidetoshi Masai (Tokyo Tech)[#] On commensurability of fibrations on a hyperbolic 3-manifold 10

Summary: We discuss the fibered commensurability of fibrations on a hyperbolic 3-manifold. The notion of fibered commensurability is defined by Calegari, Sun and Wang. We first discuss the existence of a unique minimal element of a hyperbolic fibered commensurability class for the case where manifolds have boundaries. Then we will give examples of hyperbolic manifolds with or without commensurable fibrations.

- 23 Kenta Hayano (Osaka Univ.)[#] Multisections of Lefschetz fibrations via mapping class groups 15
Refik İnanç Baykur
(Max Planck Inst. for Math./Brandeis Univ.)

Summary: Multisections of Lefschetz fibrations play a key role in Donaldson and Smith's work which gives some interpretation of Seiberg–Witten invariants of symplectic 4-manifolds in terms of Lefschetz fibrations. In this talk, we introduce a way to understand configurations and self-intersection numbers of multisections of Lefschetz fibration from mapping group theoretical point of view. We also show how this method can be applied for typical examples of multisections of Lefschetz fibrations, such as a spherical bisection with self-intersection -1 in Auroux's fibration, bisections with self-intersection 0 in knot surgered manifolds $E(n)_K$, and so on.

- 24 Naoyuki Monden (Kyoto Univ.)[#] Lefschetz fibrations with small slope 15

Summary: We construct Lefschetz fibrations over S^2 which do not satisfy the slope inequality. This gives a negative answer to a question of Hain.

13:30–14:30 Talk invited by Topology Section

- Kouichi Yasui (Hiroshima Univ.)[#] Corks and exotic 4-manifolds

Summary: It is known that every exotic smooth structure on a given simply connected closed smooth 4-manifold is obtained from the given 4-manifold by removing a contractible 4-manifold and regluing it via an involution on its boundary. Such a contractible 4-manifold is called a cork. In this talk, we discuss various cork structures on 4-manifolds. As applications of corks, we also give systematic constructions of exotic 4-manifolds and exotic embeddings of 4-manifolds. Time permitting, we also construct exotic Stein fillings of contact 3-manifolds, using log transform. This talk is mainly based on joint work with Selman Akbulut (Michigan State University).

March 22nd (Fri) Conference Room II

10:15–11:50

- 25 Tadayuki Haraguchi * Long exact sequences for de Rham cohomology of diffeological spaces
(Internat. Pacific Univ.) 15

Summary: In this lecture I talk about de Rham cohomology of diffeological spaces. We present the notion of de Rham cohomology with compact support and we introduce three long exact sequences.

- 26 Masaki Nakagawa (Okayama Univ.) * On the generalization of the Schur P , Q -functions which give the basis
Hiroshi Naruse (Okayama Univ.) for the generalized (co)homology of the loop spaces on classical groups
..... 15

Summary: Let $E^*(\cdot)$ be a complex oriented generalized cohomology theory. We define the E -(co)homology (factorial) Schur P - and Q -functions which represent the Schubert basis for the E -(co)homology of the based loop spaces on the infinite symplectic group $Sp = Sp(\infty)$ and the special orthogonal group $SO = SO(\infty)$.

- 27 Takahiro Matsushita (Univ. of Tokyo) * Fundamental groups of neighborhood complexes 10

Summary: We introduce the notions of 2-covering maps and 2-fundamental groups of graphs, and investigate their basic properties. These concepts are closely related to Hom complexes and neighborhood complexes. Indeed, we prove that the fundamental group of a neighborhood complex is isomorphic to a subgroup of the 2-fundamental group whose index is 1 or 2. We prove that the 2-fundamental group and the fundamental group of a neighborhood complex for a connected graph whose chromatic number is 3 have group homomorphisms onto \mathbb{Z} .

- 28 Yusuke Kawamoto * Higher homotopy commutativity of H -spaces and the cyclohedra 10
(Nat. Defense Acad. of Japan)

Summary: We define a higher homotopy commutativity of H -spaces using the cyclohedra $\{W_n\}_{n \geq 1}$ constructed by Bott and Taubes. An H -space whose multiplication is homotopy commutative of the n -th order is called a B_n -space. We also give combinatorial decompositions of the permutohedra $\{KP_n\}_{n \geq 1}$ introduced by Kapranov into union of product spaces of the cyclohedra. From the decomposition, we have a relation between the B_n -structures and another higher homotopy commutativity represented by the permutohedra.

- 29 Miho Hatanaka (Osaka City Univ.)[#] The uniqueness of decompositions of a (topological) toric manifold ... 10

Summary: A toric manifold is a closed smooth algebraic variety with an effective algebraic action of complex torus having an open dense orbit. A topological toric manifold is a closed smooth even dimensional manifold with an effective smooth action of complex torus, such that it is locally equivariantly diffeomorphic to a representation space of complex torus. The uniqueness of a direct decomposition of a closed smooth manifold does not hold in general up to diffeomorphism. However, it holds for decompositions of (topological) toric manifolds into products of real 2 or 4 dimensional (topological) toric manifolds up to diffeomorphism.

- 30 Yukiko Fukukawa (Osaka City Univ.)[#] The ring structure of the equivariant cohomology ring of the Peterson variety 10
 Megumi Harada (MacMaster Univ.)
 Mikiya Masuda (Osaka City Univ.)

Summary: The Peterson variety Y_n is the subvariety of the flag variety defined as a special class of the Hessenberg variety, and some codimension 1 subtorus S^1 in T^n acts on Y_n . The map from T^n -equivariant cohomology ring of the flag manifold to S^1 -equivariant cohomology ring of Y_n induced by inclusion map from Y_n to the flag variety is surjective. Thus, S^1 -equivariant cohomology ring of Y_n is generated by the images of ring generators of T^n -equivariant cohomology ring of the flag manifold. We determined the ring structure of the (S^1 -equivariant) cohomology ring of Y_n .

- 31 Takahito Naito (Shinshu Univ.)[#] On the loop coproducts of the relative loop spaces 10

Summary: Chas and Sullivan showed that the degree shifted homology of the free loop space of an oriented closed manifold has a graded commutative algebra structure. Moreover, Cohen and Godin generalized the product and showed that the homology is a commutative Frobenius algebra. The coproduct is called the loop coproduct. In this talk, I will present a construction of the loop coproducts of the relative loop spaces.

- 32 Kohei Tanaka (Shinshu Univ.)[#] A model structure on the category of small categories related to coverings 15

Summary: We construct a model structure on the category of small categories which is closely related to coverings and fundamental groups of small categories. It has morphisms inducing isomorphisms on fundamental groups as weak equivalences and categories fibered and cofibered in groupoids as fibrations. The class of fibrant objects in this model category is the class of groupoids, and the class of coverings is the class of fibrations whose fibers are all discrete. We also prove that the model structure admits a factorization of morphisms, which induces universal covers and groupoidification.

15:00–16:35

- 33 Atsuhide Mori (Osaka City Univ.)^{*} High dimensional confoliations and leafwise symplectic foliations 15

Summary: This is a note on Mitsumatsu's construction of a leafwise symplectic structure of the Lawson foliation on S^5 . We define 'strict' confoliations by means of almost contact geometry which include contact structures and leafwise symplectic foliations. Let α be an adapted contact form of an exact symplectic open-book O on a closed $(2n + 1)$ -manifold. Suppose that the binding B of O admits a closed 1-form ν and a closed 2-form Ω such that $\nu \wedge (d\alpha|_B)^{n-1} = 0$, $\nu \wedge (\varepsilon\Omega + d\alpha|_B)^{n-1} > 0$, and Ω extends to a pagewise closed 2-form of O . Then there exists a path of strict confoliations from the contact structure to a leafwise symplectic structure on the spinnable foliation associated with O .

- 34 Tomonori Fukunaga (Hokkaido Univ.)^{*} Evolute of fronts in the Euclidean plane 20
 Masatomo Takahashi
 (Muroran Inst. of Tech.)

Summary: In this talk, we define an evolute of a front and give properties of such evolute by using moving frame of a front and the curvature of the Legendre immersion.

- 35 Shunsuke Ichiki (Yokohama Nat. Univ.)[#] Distance-squared mappings 15

Summary: Distance-squared functions and height functions are significant in the application of singularity theory to differential geometry. The mappings of which each component is a height function are projections, and their properties are investigated well. However, the studies of the mappings of which each component is a distance-squared function are not seen. In this paper, we define naturally extended mappings of distance-squared functions, wherein each component is a distance-squared function. We investigate the properties of these mappings from the viewpoint of differential topology.

- 36 Tomoo Yokoyama (Hokkaido Univ.)[#] Almost periodic, recurrent, non-wandering properties for flows and foliations 15

Summary: We define almost periodicity, recurrence, “non-wandering”, and R -closedness for decompositions. Using these notions, we study codimension one and two foliations and topological dynamics. In this talk, we survey these results.

- 37 Shin Kiriki (Kyoto Univ. of Edu.)[#] C^2 -robust heterodimensional tangencies 15
Teruhiko Soma (Tokyo Metro. Univ.)

Summary: We give sufficient conditions for the existence of C^2 robust heterodimensional tangency, and present nonempty open sets in $\text{Diff}^2(M)$ with $\dim M \geq 3$ each element of which has a C^2 robust heterodimensional tangency on a C^2 robust heterodimensional cycle.

- 38 Yusuke Mizota (Kyushu Univ.)[#] Improving estimate of the highest degree of liftable vector fields 15

Summary: The speaker obtained estimate of the highest degree of liftable vector fields. However, this estimate was not so good. We improve this estimate for curve germs in this time.

Infinite Analysis

March 22nd (Fri) Conference Room VII

9:30–11:45

- 1 Kanehisa Takasaki (Kyoto Univ.)[#] Melting crystal model and Ablowitz–Ladik hierarchy 15

Summary: We introduce a modified melting crystal model and identify an integrable structure hidden therein. The partition function can be expressed in terms of 2D complex free fermion system. We use shift symmetries of an underlying quantum torus algebra to rewrite this fermionic expression to a tau function of the 2D Toda hierarchy. The associated Lax operators are shown to have a factorized form. Combining this fact with a result of Brini et al., we can deduce that this solution of the 2D Toda hierarchy is indeed a solution of the Ablowitz–Ladik hierarchy.

- 2 Hajime Nagoya (Kobe Univ.)[#] From Gauss to quantum Painlevé 20

Summary: The quantum sixth Painlevé equation admits hypergeometric integrals as special solutions which are obtained by the free field realizations in the conformal field theory. Inversely, those hypergeometric integrals characterize the quantum sixth Painlevé equation. Further, if we consider hypergeometric integrals of Euler type, then we obtain various Schrödinger equations, which we expect as a quantization of isomonodromy equations.

- 3 Shin Isojima (Hosei Univ.)[#] Ultradiscrete Ai function with parity variables and the number of restricted partitions 15
 Junkichi Satsuma (Aoyama Gakuin Univ.)
 Tetsuji Tokihiro (Univ. of Tokyo)

Summary: Ultradiscrete Ai function is directly derived through the ultradiscrete limit from a q -difference analog of Ai function. An infinite number of identities among the number of restricted partitions are obtained as by-products.

- 4 Gen Kuroki (Tohoku Univ.)[#] Quantized birational action of the product $\widetilde{W}(A_{m-1}^{(1)}) \times \widetilde{W}(A_{n-1}^{(1)})$ of the extended affine Weyl groups for coprime m, n 20

Summary: For any integers $m, n \geq 2$, Kajiwara, Noumi, and Yamada [arXiv:nlin/0106029] construct a certain birational action of the product $\widetilde{W}(A_{m-1}^{(1)}) \times \widetilde{W}(A_{n-1}^{(1)})$ of the extended affine Weyl groups on \mathbb{C}^{mn} . We shall quantize it when m and n are coprime.

- 5 Yoko Shigyo (Tsuda Coll.)[#] On addition formulae of BKP hierarchy 15

Summary: In this talk, I describe the addition formulae of BKP hierarchy. I prove that the total hierarchy is equivalent to the simplest equation of its addition formulae.

- 6 Tetsu Masuda (Aoyama Gakuin Univ.)[#] A q -analogue of Sasano systems 15

Summary: We propose a q -analogue of Sasano systems.

- 7 Takao Suzuki (Kinki Univ.)[#] 6-dimensional Painlevé equations and their particular solutions in terms of rigid equations 20

Summary: We propose a class of 6-dimensional Painlevé type differential equations which is derived as the monodromy preserving deformations of Fuchsian systems.

- 8 Yusuke Ikawa (Kobe Univ.)[#] Hypergeometric solutions for the q -Painlevé equation of type $E_6^{(1)}$ by Padé method 15

Summary: The q -Painlevé equation of type $E_6^{(1)}$ is obtained by Padé method. Special solutions in determinant formula to the q -Painlevé equation is presented.

14:15–15:35

- 9 Junichi Shiraishi (Univ. of Tokyo)[#] A conjecture about Macdonald polynomials of type B_2 15

Summary: We present a conjecture about Macdonald polynomials of type B_2 . The conjectural formula is given as a certain five-fold summation.

- 10 Masato Okado (Osaka Univ.)[#] Quantum coordinate ring and 3D reflection equation 20
Atsuo Kuniba (Univ. of Tokyo)

Summary: Soibelman's theory of quantum coordinate ring $A_q(SL_n)$ provides a representation theoretical scheme to construct a solution of the Zamolodchikov tetrahedron equation. We extend this idea originally due to Kapranov and Voevodsky to $A_q(Sp_{2n})$ and obtain the intertwiner K corresponding to the quartic Coxeter relation. Together with the previously known 3D R matrix, the K yields the first ever solution to the 3D analogue of the reflection equation proposed by Isaev and Kulish.

- 11 Katsuyuki Naoi (Univ. of Tokyo)[#] Graded limits of minimal affinizations over a quantum loop algebra 15

Summary: Minimal affinizations are finite-dimensional simple modules over a quantum loop algebra having some minimality. We realize the graded limit (variant of classical limit) of a minimal affinization of type ABC as a submodule of a tensor product of integrable highest weight modules over an affine Lie algebra. From this, we obtain a character formula for minimal affinizations in terms of Demazure operators.

- 12 Yosuke Saito (Tohoku Univ.)[#] Elliptic Ding–Iohara algebra and the free field realization of the elliptic Macdonald operator 15

Summary: Ding–Iohara algebra is a quantum algebra arising from the free field realization of the Macdonald operator. Starting from the elliptic kernel function obtained by Komori, Noumi and Shiraishi, we can construct an elliptic analog of the Ding–Iohara algebra. The free field realization of the elliptic Macdonald operator is not complete yet.

- 13 Yosuke Saito (Tohoku Univ.)[#] Elliptic q -Virasoro algebra and its free field realization 15

Summary: Applying the idea used in the construction of the elliptic Ding–Iohara algebra to the free field realization of the q -Virasoro algebra, we can construct an elliptic analog of the q -Virasoro algebra. Screening currents of the elliptic q -Virasoro algebra are also obtained, and a product of the screening current reproduces the elliptic kernel function and the elliptic weight function.

15:45–16:45 Talk invited by Infinite Analysis Special Session

Zengo Tsuboi [#] Baxter Q-operators and tau-function for quantum integrable systems
(Humboldt-Univ. zu Berlin)

Summary: The Baxter Q-operators were introduced by Baxter when he solved the 8-vertex model. His method of the Q-operators is recognized as one of the most powerful tools in quantum integrable systems. Our goal is to construct the Q-operators systematically, to express the T-operators (transfer matrices) in terms of the Q-operators, and to establish functional relations among them. For this purpose, we consider an embedding of the quantum integrable system into the soliton theory. The key object is the master T-operator (tau-function in the soliton theory), which is a sort of a generating function of the transfer matrices. The Q-operators are defined as residues of the master T-operator. T-operators can be written as Wronskian-like determinants in terms of the Q-operators. If one restricts representations to the ones labeled by rectangular Young diagrams, one will obtain a solution of the T-system. As a related topic, I will mention a Wronskian-like determinant solution of the T-system for AdS_5/CFT_4 spectral problem. The Q-operators can also be defined as the trace of monodromy matrices, which are product of some L-operators. In general, such L-operators are image of the universal R-matrix for q-oscillator representations of a Borel subalgebra of the quantum affine algebra. I will also talk about a construction of such L-operators for the Q-operators for the quantum affine superalgebra $U_q(\hat{gl}(M|N))$.

March 23rd (Sat) Conference Room VII

9:45–11:40

14 Diogo Kendy Matsumoto [#] Idempotent dynamical braiding maps and dynamical semigroups with
(Waseda Univ.) left unit 15
Youichi Shibukawa (Hokkaido Univ.)

Summary: In this talk, we construct idempotent dynamical braiding maps associated with dynamical semigroups with left unit, and introduce a framework of this idempotent dynamical braiding maps by using the tensor category.

15 Choon-Lin Ho (Tamkang Univ.) [#] Confluence of apparent singularities in multi-indexed orthogonal poly-
Ryu Sasaki (Kyoto Univ.) nomials: the Jacobi case 15
Kouichi Takemura (Chuo Univ.)

Summary: The multi-indexed Jacobi polynomials are the main part of the eigenfunctions of exactly solvable quantum mechanical systems obtained by certain deformations of the Pöschl–Teller potential. By fine-tuning the parameter of the Pöschl–Teller potential, we obtain several families of explicit and global solutions of certain second order Fuchsian differential equations with an apparent singularity of characteristic exponent -2 and -1 .

16 Genki Shibukawa (Kyushu Univ.) [#] Operator orderings and Meixner–Pollaczek polynomials 15

Summary: The aim of our talk is to give identities which are generalizations of the formulas given by Bender et al [Phys. Rev. Lett. 56 (1986)], [J. Math. Phys. 29 (1988)], Koornwinder [J. Math. Phys. 30, (1989)] and Hamdi–Zeng [J. Math. Phys. 51, (2010)]. Our proofs are much simpler than and different from the previous investigations.

- 17 Yoshiaki Goto (Hokkaido Univ.)[#] Twisted period relation for Lauricella's F_C 15

Summary: To study the twisted (co)homology for Lauricella's F_C , we construct twisted cycles which correspond to a basis of local solution space of the differential equation system for F_C . We calculate intersection numbers of these cycles, and the self-intersection number of one cocycle. Hence we obtain a twisted period relation which is a quadratic relation of F_C .

- 18 Kohei Motegi (Okayama Inst. for Quant. Phy.)[#] Quantum inverse scattering approach to the totally asymmetric simple exclusion process 15
Kazumitsu Sakai (Univ. of Tokyo)
Jun Sato (Ochanomizu Univ.)

Summary: We formulate the exact relaxation dynamics of the totally asymmetric simple exclusion process by the quantum inverse scattering method. This approach also allows us to study the long time asymptotics, and we find new scaling exponents of the asymptotic amplitudes of the local densities and currents. We moreover find that the relaxation times starting from the step and alternating initial conditions are governed by different eigenvalues of the Markov matrix.

- 19 Shu Oi (Rikkyo Univ.)[#] The Riemann–Hilbert problem and the connection problem of the KZ
Kimio Ueno (Waseda Univ.) equation 20

Summary: We characterize the multiple polylogarithms by the recursive Riemann–Hilbert problem of additive type. This problem is regarded as the inverse problem of the connection problem between the normalized solutions of the KZ equation of one variable around $z = 0$ and $z = 1$.

- 20 Shu Oi (Rikkyo Univ.)[#] The hexagon relations for dilogarithms and the Riemann–Hilbert prob-
Kimio Ueno (Waseda Univ.) lem 20

Summary: We solve the hexagon relations for dilogarithms by the Riemann–Hilbert problem (Birkhoff–Plemelj decomposition) of additive type.

14:30–15:30 Talk invited by Infinite Analysis Special Session

Kentaro Nagao (Nagoya Univ.) Quivers with potential, 3d Calabi–Yau categories and the cohomological Hall algebras

Summary: I will give a survey on quivers with potential, 3d Calabi–Yau categories associated with them and moduli theory of objects in the categories.