



2019 年  
九州大学 組合せ数学セミナー  
Hakata Workshop 2019; Winter Meeting<sup>1</sup>

下記のようにセミナーを開催しますので、ご案内申し上げます。

世話人: 溝口 佳寛 (九大 IMI) 谷口 哲至 (広島工大)  
島袋 修 (長崎大) 田上 真 (九州工大)  
栗原大武 (北九州高専) 千葉周也 (熊本大)  
三枝崎 剛 (琉球大) Daniel GAINA (九州大)  
加葉田 雄太朗 (九州大) 森山 卓 (九州大)  
アドバイザー: 坂内 英一

記

日時: February 21, 2019

場所: IMI Auditorium (W1-D-413) (4F, West Zone 1, Kyushu University)

プログラム

**10:27–10:30** Opening (Tetsuji Taniguchi)

**10:30–11:10** Makoto Tagami (Kyushu Institute of Technology)  
Harmonic Index  $t$ -design in Hamming Schemes

**11:20–12:00** Hirotake Kurihara (National Institute of Technology, Kitakyushu College)  
Lagrangian subalgebras and rooted tree graphs

**13:20–14:00** Shoichi Kamada (Kumamoto University)  
An introduction to combinatorial  $q$ -fractal dimensions for a subset sum function

**14:10–14:50** Shoichi Tsuchiya (Senshu University)  
Large homeomorphically irreducible trees in path-free graphs

**15:00–15:40** Asuka Takatsu (Tokyo Metropolitan University)  
Convergence of combinatorial Ricci flows to degenerate circle patterns

**16:00–17:30** Poster Session (Software in Mathematics Demonstration Track in Hakata Workshop 2019)

**17:30–17:35** Closing (Yoshihiro Mizoguchi)

**19:00–** Post-meeting party

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<sup>1</sup> This conference was supported by Graduate School of Mathematics, Kyushu University, JSPS KAKENHI(Grant-in-Aid for Scientific Research (C)) Grant Number 25400217, JSPS KAKENHI(Grant-in-Aid for Scientific Research (C)) Grant Number 17K05346.

## Poster Session

Theme: Software in Mathematics Demonstration Track

Speakers and Titles:

1. 矢澤明喜子（信州大学大学院総合理工学研究科）行列式点過程を用いた条件付き spanning tree の個数の数え上げについて
2. Semin Oh（Pusan National University）Finding Minimal UFA-free Graphs
3. Xiaolu Xu（Dalian University of Technology）An R package for identifying driver genes and driver pathways
4. 森山 卓（九州大学マス・フォア・インダストリ研究所）非負値行列因子分解を用いた多峰性関数の分解についての検討
5. 原田 海音（琉球大学 教育学部）一般化正多面体の仮想的対称性
6. 富安 亮子（九州大学 IMI）Powder indexing software CONOGRAPH
7. 久米 美沙紀（琉球大学 教育学部）高種数タット多項式の計算プログラム
8. 栗原寛明（九州大学大学院数理学府）トポロジーの手法を用いた点群のクラスタリング手法
9. Ye Yuan（Graduate School of Mathematics, Kyushu University）Experimental Studies in Implementations of Post-Quantum Key Exchange Protocols using HTML5 Multithreading Approach
10. 高橋康（九州大学大学院数理学府）Gröbner 基底計算を用いた同種写像問題求解法の提案と実装

## Abstract

Makoto Tagami (Kyushu Institute of Technology)

Title: Harmonic Index  $t$ -design in Hamming Schemes

Abstract: The notion of harmonic index (or simply HI) spherical design was introduced as a finite set on sphere in the form extending the notion of usual spherical designs by Bannai-Okuda-T (2015). They studied about a fisher type inequality and a construction for HI spherical design and argued about the non-existence of tight HI spherical designs. While, Zhu-Bannai-Bannai-Ikuta-Kim(2017) reintroduced the notion of HI  $t$ -design in symmetric association schemes and they studied about HI  $t$ -designs in binary Hamming schemes. In this talk, we will study them in Hamming scheme  $H(n, q)$  for arbitrary  $q$  following BOT and ZBBIK .

Hirotake Kurihara (National Institute of Technology, Kitakyushu College)

Title: Lagrangian subalgebras and rooted tree graphs

Abstract: The study of Lagrangian submanifolds in Kähler manifolds is a fruitful area in differential geometry of submanifolds. If an ambient space has a structure of Hermitian symmetric space, then "homogeneous" Lagrangian submanifolds are obtained from certain Lie subalgebras, which is called Lagrangian subalgebras. In my talk, I will show constructions of Lagrangian subalgebras of Lie algebras derived from certain Hermitian symmetric spaces of noncompact type, obtained from rooted tree graphs. This is a joint work with Takahiro Hashinaga (National Institute of Technology, Kitakyushu College).

Shoichi Kamada (Kumamoto University)

Title: An introduction to combinatorial  $q$ -fractal dimensions for a subset sum function

Abstract: The subset sum problem, which is NP-hard, can be replaced by finding an inverse image of a subset sum function. Many of cryptosystems based on the subset sum problem have been broken since the hardness of this problem depends on its density. In this talk, we introduce the notion of a combinatorial  $q$ -fractal dimension for a subset sum function. This notion is a combinatorial analogue of the generalized dimension in multi-fractal analysis and includes the density of the subset sum problem. We give a lower bound for a combinatorial  $q$ -fractal dimension. The method is combinatorial rather than algebraic.

Shoichi Tsuchiya (Senshu University)

Title: Large homeomorphically irreducible trees in path-free graphs

Abstract: A connected graph  $G$  is said to be  $P_n$ -free if  $G$  contains no path of order  $n$  as an induced subgraph. A subgraph of  $G$  is a homeomorphically irreducible tree (or a HIT) if it is a tree with no vertices of degree two. If a HIT of  $G$  is a spanning subgraph of  $G$ , it is called a homeomorphically irreducible spanning tree (or a HIST). When  $n = 4$  or  $5$ , connected  $P_n$ -free graphs with a HIST were characterized. From these results, we can guarantee a large HIT in connected  $P_n$ -free graphs when  $n = 4$  or  $5$ . In this talk, we consider a problem whether connected path-free graphs  $G$  contain a HIT with linear order of  $|G|$ .

Asuka Takatsu (Tokyo Metropolitan University)

Title: Convergence of combinatorial Ricci flows to degenerate circle patterns

Abstract: On a connected, oriented, closed surface, a circle pattern metric determines a geometric structure (Riemannian metric of constant curvature) from a topological structure (weighted triangulation). A criterion for the existence of a circle pattern metric on a surface of nonpositive Euler characteristic was first proved by Thurston. Chow-Luo gave the algorithm, so-called the combinatorial Ricci flow, to find circle pattern metrics. Chow-Luo raised some questions about the combinatorial Ricci flow, one of which is to investigate the combinatorial Ricci flow when a circle pattern metric does not exist. In my talk, I address this question.