Mini workshop on algebraic and geometric topology

Dates: January 5〜6
Place: Room number 110, Department of Mathematics, Koto University

1/5 10:30〜11:30 SGU special lecture by Ben Knudsen
14:00〜14:50 Tanaka
15:10〜16:00 Kishimoto
16:20〜17:10 Irikura
1/6 9:30〜10:20 Minowa
10:40〜11:30 Tsutaya
11:50〜12:40 Arakawa

Titles and Abstracts

Kensuke Arakawa
Title: Theory and metatheory of relative operads
Abstract: A central theme in higher category theory is that ∞-categories can often be accessed through ordinary categories equipped with a chosen class of weak equivalences. This raises a fundamental question: when such presentations exist and how unique they are. Barwick–Kan's theorem provides a definitive answer, establishing an equivalence between the homotopy theory of ∞-categories and that of relative categories—ordinary categories endowed with a collection of morphisms to be inverted.
Motivated by natural examples (e.g., factorization algebras), there is a growing interest in extending these localization techniques to the operadic setting. An operad is a category-like gadget in which operations admit multiple inputs, and localizing an operad at a set of unary operations gives rise to an ∞-operad. In this talk, we show that this localization procedure induces an equivalence between the homotopy theory of ∞-operads and that of relative operads, thereby establishing an operadic analogue of Barwick–Kan's theorem. After explaining the key inputs to this theorem, we will explain how this theorem gives a remarkably effective method for comparing different models of ∞-operads. As

an application, we give an affirmative answer to an open question posed by Harpaz.
This is joint work with Francesca Pratali and Victor Carmona.

Daiki Irikura

Title: Configuration space integrals and some infinite-dimensional rational homotopy groups of long embeddings
Abstract: A long embedding is an embedding between Euclidean spaces that coincides with the standard linear inclusion outside a compact set.There are two main approaches to studying the rational homotopy type of such spaces.One is a homotopy-theoretic approach, which shows that a combinatorial model describes the rational homotopy type modulo immersions when the codimension is greater than 2.The other is a geometric approach using configuration space integrals. This method is conjectured to give a geometric description of the combinatorial model. While this description is currently verified only for a part of the model, the method is effective even in codimension 2. In this talk, we extend the verified range of this description. As a corollary, we prove that for any odd integer $j ¥ge 3$, the rational homotopy groups of long embeddings of $¥mathbb{R}^j$ into $¥mathbb{R}^{j+2}$ are infinite-dimensional in infinitely many degrees. I will first briefly explain configuration space integrals, and then use the remaining time to outline the idea of the proof.

Daisuke Kishimoto

title: Torsion in the space of commuting elements in a Lie group
abstract: The space of homomorphisms from a finitely generated abelian group to a Lie group, equivalently, the space of commuting elements in a Lie group, has been studied in various geometric and topological contexts. Nevertheless, its (co)homological properties remain poorly understood. I will talk about joint work with Masahiro Takeda on torsion in the homology of this space. I will explain how to express this space as a suitable homotopy colimit, and describe the resulting spectral sequence, whose computation reduces to that of the homology of a simplicial complex defined by combinatorial data of the Weyl group.

Ben Knudsen

https://www.math.kyoto-u.ac.jp/ja/node/5901

Yuki Minowa

title: On the topological complexity of spaces with nontrivial fundamental groups

abstract: Topological complexity is a numerical homotopy invariant that measures the instability of motion planning in a space. To study the topological complexity of non-simply connected spaces, Costa and Farber introduced a canonical cohomology class, which provides both upper and lower bounds. In this talk, I will survey recent developments in this direction, with particular emphasis on the spectral sequence approach developed by Farber and Mescher. I will then show that this spectral sequence is natural with respect to group homomorphisms. Finally, I will also discuss some computational examples that follow from this naturality.

Ryokichi Tanaka

title: Noise sensitivity problem on groups and homological winding statistics

abstract: The general noise sensitivity problem asks: Given a stochastic process X defined in terms of i.i.d. variables, does resampling a small fraction of these variables produce an almost independent copy of X ? or a highly correlated copy? In this talk, we discuss the following questions: Can random walk on a group be noise sensitive? Which groups admit a noise sensitive random walk? [Talk based in part on joint work with Timothée Bénard (Paris).]

Mitsunobu Tsutaya

Title：Uniform Lefschetz fixed point theory

Abstract： Let M be an oriented closed manifold and $f¥colon M¥to M$ a continuous map. When the set of fixed points of f is discrete, the classical Lefschetz-Hopf theorem states that the sum of the indices of the fixed points is a homotopy invariant (equal to the Lefschetz trace). If this invariant is nonzero, then f cannot be deformed into a fixed point-free map. The goal of this talk is to generalize this result to uniformly continuous maps on noncompact manifolds. To achieve this, we develop a new (co)homology theory and an obstructions theory for uniformly continuous maps. This talk is based on joint work with Tsuyoshi Kato and Daisuke Kishimoto.

Organizer: Tsuyoshi Kato （tkato@math.kyoto-u.ac.jp）