

数理解析研究所講究録 2060

RIMS 共同研究 (公開型)

変換群を核とする代数的位相幾何学

京都大学数理解析研究所

2018年4月

数理解析研究所講究録は、京都大学数理解析研究所の共同利用研究集会および共同研究の記録として1964年に刊行が開始されました。現在の共同利用・共同研究拠点（2010年発足）の前身である、全国共同利用研究所として当研究所が発足した翌年のことでしたが、以来半世紀、毎年数十巻を刊行し、2016年には第2000巻が刊行されるに至りました。第1巻から第2000巻までに収録された論文数は29,265編、総頁数は342,960頁という膨大なものであり、最先端の数学・数理科学分野の研究状況を伝えるのみならず、我が国の数学・数理科学の発展の歴史を留める文献として、他に類例を見ない論文集となっています。

講究録の内容は当研究所のウェブサイトおよび京都大学の学術情報リポジトリにおいても公開され、年間の総アクセス数は1,344,499回（2016年度）を数えるなど、多数の方にご利用いただいています。

講究録の使用言語は論文著者の判断に任されていますが、結果的に日本語が多用されていることが特徴の一つとなっています。その結果、講究録は、数学・数理科学の広い領域における最先端の専門知識に母国語でアクセスできるものとして、近年の英語化の流れの中で、重要な文献となりつつあります。

当研究所の共同利用事業に参加し講究録の論文を執筆していただいた多数の方々に対し、講究録を大きく成長させていただいたことを深く感謝いたしますとともに、これからも、当研究所の共同利用・共同研究拠点としての活動にご参加いただき、講究録の発展にご協力いただけますよう心よりお願い申し上げます。

*RIMS Kôkyûroku 2060*

*Algebraic Topology focused on  
Transformation Groups*

*May 22 ~26, 2017*

*edited by Takao Satoh*

*April, 2018*

*Research Institute for Mathematical Sciences*

*Kyoto University, Kyoto, Japan*

This is a report of research done at the Research Institute for Mathematical Sciences,  
a Joint Usage/Research Center located in Kyoto University.  
The papers contained herein are in final form and will not be submitted for publication elsewhere.

Research Institute for Mathematical Sciences



## **Algebraic Topology focused on Transformation Groups**

Organized by

Takao Satoh

(Tokyo University of Science)

May 22nd – May 26th, 2017

### **Introduction by the Organizer**

This is a report on the conference on Algebraic Topology focused on Transformation Groups held at the Research Institute for Mathematical Sciences (RIMS), Kyoto University, from May 22 to May 26, 2017.

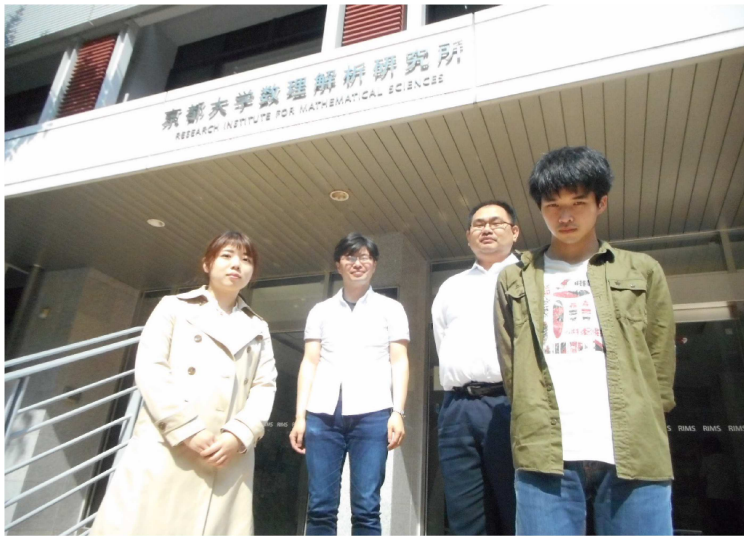
In a broad sense, the subject of Transformation group theory is the study of symmetries for topological spaces, in particular, manifolds and cell complexes. One of the progenitors of the subject is considered to be Felix C. Klein who advocated the new concept of geometry in the Erlangen program in 1870s. The theory has been developed by a huge number of authors including Karol Borsuk and Stanislaw Ulam. It has multiple facets and widespread applications in a broad range of Mathematics, for instance, Differential Geometry, Algebraic Geometry, Differential Topology, Algebraic Topology, Homotopy Theory, Representation Theory, Group Theory and so on.

A conference on Transformation group theory holds at RIMS each year. The first conference was held in 1973, organized by Professor Katsuo Kawakubo. So far, many prominent Japanese mathematicians including Minoru Nakaoka and Akio Hattori continued developing the theory over several decades. Recent topics discussed in the conference have a great diversity, for instance the classification of toric manifolds and Bott manifolds, tangential representations and the Smith equivalence, generalizations of Borsuk-Ulam theorem, the classification of isovariant maps on smooth manifolds, the structure of definable manifolds, the classification of Hessenberg varieties and the structures of the diffeomorphism groups and the mapping class groups of surfaces. Needless to say, these researches have been studied with a wide variety of techniques including Homology and Homotopy theory, Lie group and Lie algebra theory, K-theory and L-theory, Surgery theory, Symplectic geometry and so on. The conferences have played important roles on sharing new developments and new techniques, and on the interaction of researchers of the field.

This conference brought together researchers working in various aspects of the field. In particular, in this year we laid weight on interactions between Transformation group theory and Homotopy theory. The conference of this year was well attended by 43 participants including researchers from abroad, Korea and Pohland. The organizer kept a balance between young researchers (graduate students, post-doctors) and newcomers to the field on the one hand, and senior specialists on the other hand. We hope that this report goes a long way toward providing valuable images of further developments of the field.

The organizer would like to express his sincere gratitude to all participants for his/her contribution to the success of the conference. In particular, thanks to his students Mr. Kazuki Horiguchi and Ms. Ayumi Takabe for their supports as an organizing staff. He appreciates all of secretaries of RIMS, in particular Ms. Nobuko Tamura for her continued supports for site management and accounting works. He also thanks Ms. Hiroko Watanabe at RIMS and Ms. Junko Yamagishi at Tokyo University of Science for their works and time to edit this report. Finally, the organizer expresses his sincere appreciation to RIMS for the financial support and its warm hospitality.

Takao Satoh,  
Bonn, Germany  
(Visiting Professor at the Mathematical Institute of  
the University of Bonn)  
September 2017



RIMS Conference

## Algebraic Topology focused on Transformation Groups

We are planning to hold the conference supported by Research Institute for Mathematical Science in Kyoto University.

Organizer: **Satoh, Takao** (Tokyo University of Science)

**Date:** May 22 - 26, 2017

**Place :** Research Institute for Mathematical Science in Kyoto University

**Address :** Kitashirakawaiwake-cho, Sakyo, Kyoto city. 606-8502. Japan

### Program

#### 22nd May 2017

- 13:00~13:50 Tomohiro Kawakami** (Wakayama University)  
Definable  $C^r$  fiber bundle structures of a definable fiber bundle
- 14:00~14:50 Takahito Naito** (The University of Tokyo)  
Algebraic structures on the reduced loop homology
- 15:00~15:50 Shun Wakatsuki** (The University of Tokyo)  
String topology on rational Gorenstein spaces
- 16:00~16:50 Masaharu Morimoto** (Okayama University)  
Computation of quotient groups of inverse limits of Burnside rings

#### 23rd May 2017

- 9:30~10:20 Hiroaki Ishida** (Kagoshima University)  
Transverse Kähler structures on central foliations
- 10:30~11:20 Seonjeong Park** (Osaka City University)  
Real toric manifolds and shellable posets arising from graphs

- 13:00~13:50 Ryouzuke Fujita** (University of Fukui)  
On the finite space with a finite group action II
- 14:00~14:50 Yasuhiro Hara** (Osaka University)  
Borsuk-Ulam type theorems and equivariant simplicial maps
- 15:00~15:50 Masayuki Kawashima** (Okayama University of Science)  
On torus decompositions and Zariski multiple
- 16:00~16:50 Mikiya Masuda** (Osaka City University)  
Classification of toric manifolds over  $n$ -cube with one vertex cut

#### 24th May 2017

- 9:30~10:20 Tatsuhiko Yagasaki** (Kyoto Institute of Technology)  
Survey on topological properties of spaces of Riemannian metrics
- 10:30~11:20 Shintaro Kuroki** (Okayama University of Science)  
Quasitoric manifolds, root systems and J-constructions of polytopes
- 13:00~13:50 Ikumitsu Nagasaki** (Kyoto Prefectural University of Medicine)  
A study of Borsuk-Ulam type inequalities
- 14:00~14:50 Takahiro Matsushita** (Kyoto University)  
Fundamental groups of neighborhood complexes
- 15:00~15:50 Takashi Sato** (Osaka City University)  
Hessenberg varieties and their cell decompositions and cohomology rings
- 16:00~16:50 Krzysztof Pawalowski** (Adam Mickiewicz University)  
Almost complex and symplectic group actions on manifolds

## 25th May 2017

**9:30~10:20 Hiraku Abe** (Osaka City University)

A connection between projective embeddings and cohomology rings of regular nilpotent Hessenberg varieties

**10:30~11:20 Shoji Shiro** (Osaka University)

Group actions on Hom complexes

**13:00~13:50 Susumu Hirose** (Tokyo University of Science)

Dehn twist presentations of finite group actions on oriented surfaces of genus 3

**14:00~14:50 Hajime Fujita** (Japan Women's University)

Equivariant Riemann-Roch number of non-compact symplectic manifolds

**15:00~15:50 Daisuke Kishimoto** (Kyoto University)

Right-angled Coxeter quandles and polyhedral products

## 26th May 2017

**9:30~10:20 Tatsuya Horiguchi** (Osaka City University)

The cohomology rings of regular semisimple Hessenberg varieties

**10:30~11:20 Takuro Abe** (Kyusyu University)

Hyperplane arrangements, Solomon-Terao algebras and applications to Hessenberg varieties





変換群を核とする代数的位相幾何学  
Algebraic Topology focused on Transformation Groups  
RIMS 共同研究（公開型）報告集

2017年5月22日～5月26日  
研究代表者 佐藤 隆夫 (Takao Satoh)

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講究録

Kôkyûroku

RIMS Kôkyûroku was started in 1964 as the proceedings of symposia, colloquia and workshops supported by RIMS, the Research Institute for Mathematical Sciences, Kyoto University. It was the next year of the establishment of RIMS as one of the nationwide Cooperative Research Centers, the preceding system of the current Joint Usage/Research Centers that started in 2010. For half a century since then, about 50 to 60 volumes have been issued each year, and the 2,000th volume was issued in 2016. The volumes of Kôkyûroku from the 1st through the 2,000th, containing enormous 29,265 articles and 342,960 pages, not only deliver the latest research activities in mathematics and mathematical sciences but also constitute valuable and incomparable collections of articles that pass down history of progress of mathematics and mathematical science in Japan.

Articles in Kôkyûroku are available on the websites of RIMS and Kyoto University Research Information Repository. They are very frequently accessed on the internet, with a total of as many as 1,344,499 accesses in 2016.

The authors choose the languages to write articles, and many are written in Japanese, which is one of the characteristics of Kôkyûroku. As a result, Kôkyûroku is regarded as a significant and important literature which allows easy access to the latest specialized knowledge in the large fields of mathematics and mathematical sciences written in native language for Japanese readers, while more and more research papers are being written in English in recent years.

We are deeply grateful to many of those who have participated in cooperative research activities of RIMS and greatly developed Kôkyûroku. We heartily ask for your continuous participation in research activities at RIMS as a Joint Usage/Research Center and your warm support and cooperation for the fruitful development of Kôkyûroku.