

Perspectives of Representation Theory of Algebras Celebrating

Kunio Yamagata's 65th birthday

The 13th International Conference
Graduate School of Mathematics, Nagoya University
第13回 名古屋国際数学コンファレンス

Perspectives of Representation Theory of Algebras

celebrating Kunio Yamagata's 65th birthday

November 11-15, 2013 in Nagoya University

Main Speakers

Karin Erdmann (Oxford)
Otto Kerner (Düsseldorf)
Helmut Lenzing (Paderborn)
Idun Reiten (NTNU, Trondheim)
Claus Michael Ringel (Bielefeld)
Jun-ichi Miyachi (Tokyo Gakugei)
Andrzej Skowroński (Nicolaus Copernicus, Toruń)
Changchang Xi (Capital Normal, Beijing)
Yuji Yoshino (Okayama)
Dan Zacharia (Syracuse)

Plenary Speakers

Takuma Aihara (Nagoya)
Jerzy Białkowski (Nicolaus Copernicus, Toruń)
Laurent Demonet (Nagoya)
Yoshiyuki Kimura (Osaka City)
Piotr Malicki (Nicolaus Copernicus, Toruń)
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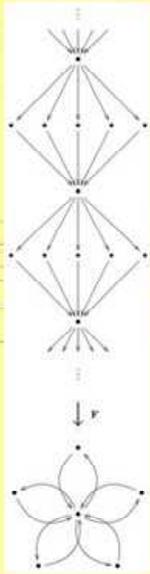
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Dedicate to
Kunio Yamagata
on his 65th birthday

Works and History



By Masahisa SATO

I am Masahisa Sato.

I am very glad I will introduce Professor Kunio Yamagata.

First of all, I would like to say "Congratulation" to Professor Kunio Yamagata on his retirement and 65th birthday with good health.

ICRA XIV TOKYO 2010 held by Yamagata

Workshop : **August 6 - 9, 2010**
Conference : **August 11 - 15, 2010**

The Independent Administrative Institution
National Olympics Memorial Youth Center (NYC),
Shibuya, Tokyo



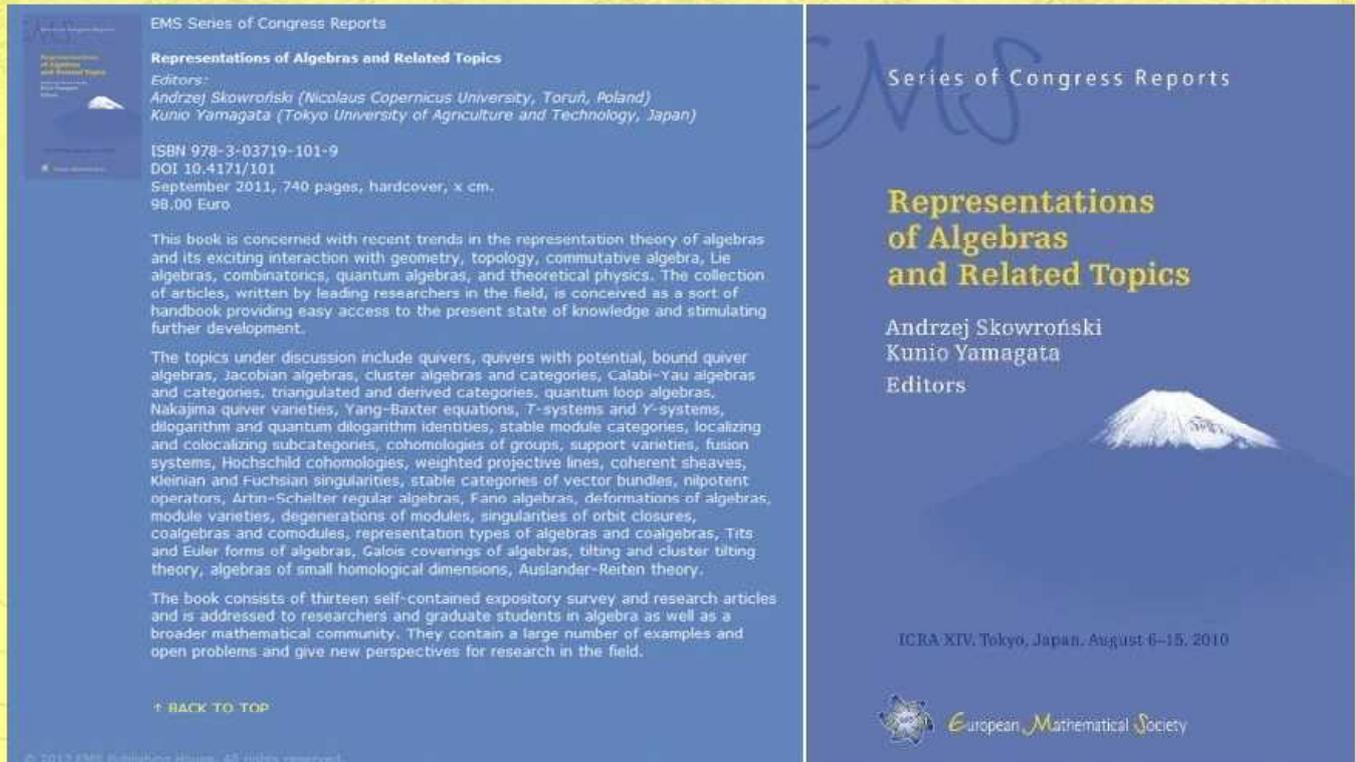
Now I believe everyone remembers the ICRA 14 held in Tokyo in 2010.

ICRA XIV TOKYO 2010 held by Yamagata



As the main organizer, Yamagata gave great efforts to hold ICRA 14 and it ended with great success such as Masaki Kashiwara gave series of lectures and we had many participants, particularly from abroad.

PROCEEDING OF ICRA XIV



EMS Series of Congress Reports

Representations of Algebras and Related Topics

Editors:
Andrzej Skowroński (Nicolaus Copernicus University, Toruń, Poland)
Kunio Yamagata (Tokyo University of Agriculture and Technology, Japan)

ISBN 978-3-03719-101-9
DOI 10.4171/101
September 2011, 740 pages, hardcover, x cm.
98,00 Euro

This book is concerned with recent trends in the representation theory of algebras and its exciting interaction with geometry, topology, commutative algebra, Lie algebras, combinatorics, quantum algebras, and theoretical physics. The collection of articles, written by leading researchers in the field, is conceived as a sort of handbook providing easy access to the present state of knowledge and stimulating further development.

The topics under discussion include quivers, quivers with potential, bound quiver algebras, Jacobian algebras, cluster algebras and categories, Calabi-Yau algebras and categories, triangulated and derived categories, quantum loop algebras, Nakajima quiver varieties, Yang-Baxter equations, T-systems and Y-systems, dilogarithm and quantum dilogarithm identities, stable module categories, localizing and colocalizing subcategories, cohomologies of groups, support varieties, fusion systems, Hochschild cohomologies, weighted projective lines, coherent sheaves, Kleinian and Fuchsian singularities, stable categories of vector bundles, nilpotent operators, Artin-Schelter regular algebras, Fano algebras, deformations of algebras, module varieties, degenerations of modules, singularities of orbit closures, coalgebras and comodules, representation types of algebras and coalgebras, Tits and Euler forms of algebras, Galois coverings of algebras, tilting and cluster tilting theory, algebras of small homological dimensions, Auslander-Reiten theory.

The book consists of thirteen self-contained expository survey and research articles and is addressed to researchers and graduate students in algebra as well as a broader mathematical community. They contain a large number of examples and open problems and give new perspectives for research in the field.

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Series of Congress Reports

Representations of Algebras and Related Topics

Andrzej Skowroński
Kunio Yamagata
Editors

ICRA XIV, Tokyo, Japan, August 6–15, 2010

 European Mathematical Society

Here is the Proceeding of ICRA 14 published by European Mathematical Society.

ICRA V TSUKUBA 1990

held by Tachikawa



This ICRA was held in 20 years after ICRA5 had been organized by Professor Tachikawa in Tsukuba in 1990.

UNIVERSITY of TSUKUBA now



Here is a picture of Tsukuba University.

TSUKUBA before 1970



20 year seems to be special. Tsukuba developed in about 20 years from this kind of deep forest.

With Supervisor Tachikawa



Next I will introduce some mathematicians relating to Professor Yamagata and me in his history.

Yamagata's supervisor was Professor Tachikawa.

Unfortunately he can not attend this meeting due to his advanced age 83.

Professor Kiichi MORITA

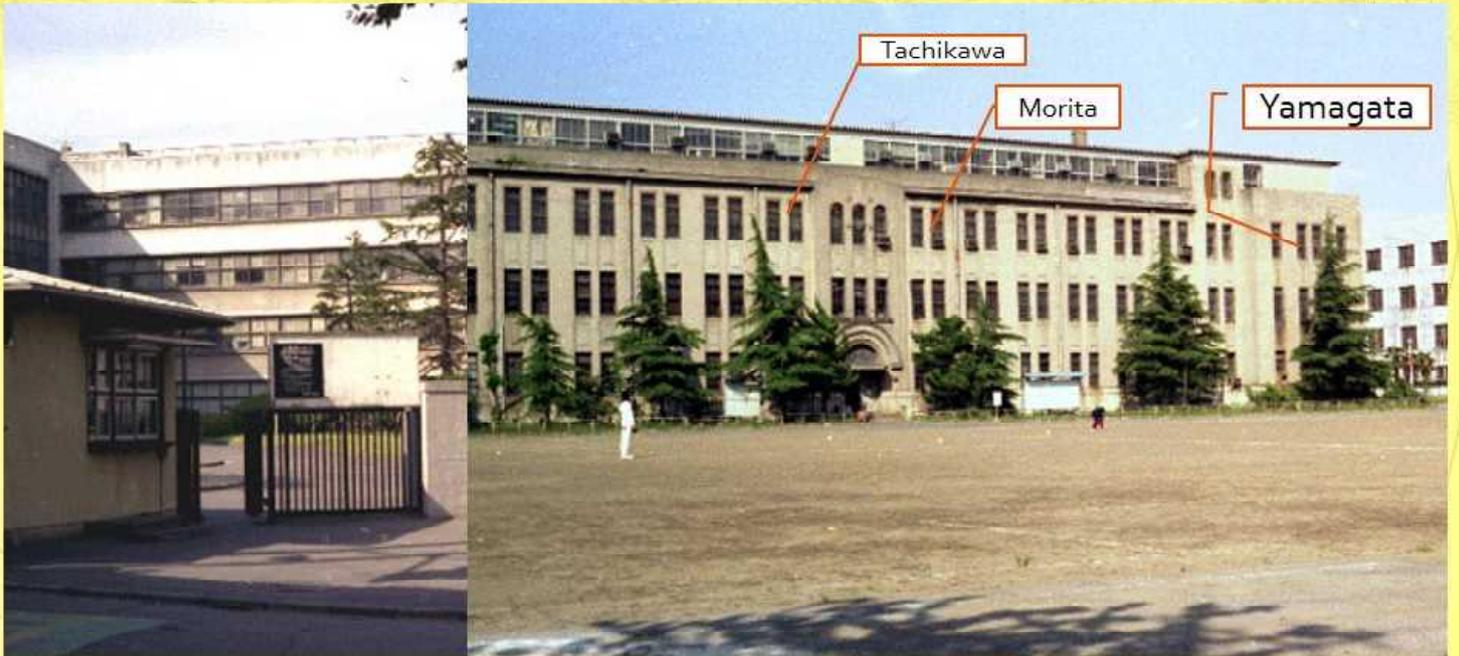
The supervisor of Tachikawa



1915 February 11 — 1995 August 4

Tachikawa's supervisor was Professor Kiichi Morita who is very famous for Morita duality and so on. So Yamagata is a grand student of Morita. Morita was in charge of the class of Yamagata for four years in the under graduate course of Tokyo University of Education.

TOKYO UNIVERSITY OF EDUCATION



In 1972 , Yamagata became an assistant Porfessor

They were member of Tokyo University of Education.
In this picture, you can refer to their offices.

TOKYO UNIVERSITY OF EDUCATION in 1974



Seminar for undergraduate students with Tachikawa, Iwanaga and Yamagata

We were first students Yamagata gave a lecture

In undergraduate course, Yamagata took our class in 1972 for the first time as an assistant professor.

Also I selected Tachikawa seminar in 1974.

Iwanaga and Yamagata as well as Tachikawa took care of us for one year in this seminar.

Member of
Tachikawa School



This is a member of Tachikawa school at that time.

Colleagues & K.R.Fuller

Photo on the top of Tsukuba Mountain



They are all my teachers

(Wakamatsu, Yamagata, Miyashita, Kato, Masaie
Tachikawa, Mrs. Fuller, K.R.Fuller)

Maybe you may recognize some of them and feel that they were young.

Tokyo University of Agriculture and Technology



1997-2012 as Professor

Now we move ages 20 years ahead. He was professor of Tokyo University of Agriculture and Technology for 15 years from 1997 after he moved from Tsukuba.

TEXT BOOK for STUDENTS
Linear Algebra(Japanese)



I also attended there once a week from around 2000 and used this text book he published for students.

Publication (Book)

AMERICAN MATHEMATICAL SOCIETY
MathSciNet
Mathematical Reviews
ISSN 1147-1149

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University of Yamagata

Profile Name: **Yamagata, Kunio**
MR Author ID: **226187**
Earliest Indexed Publication: 1972
Total Publications: **49**
Total Author/Related Publications: **52**
Total Citations: **250**

View Publications
View Author/Related Publications
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Collaboration Distance
Citations

Co-authors (by number of collaborations)

Balkowski, Jerzy | Karpić, Maciej | Kerner, Otto | Ohnuki, Yosuke | **Skowroński, Andrzej** | Takada, Kaoru
Uematsu, Morio | Zacharia, Dan

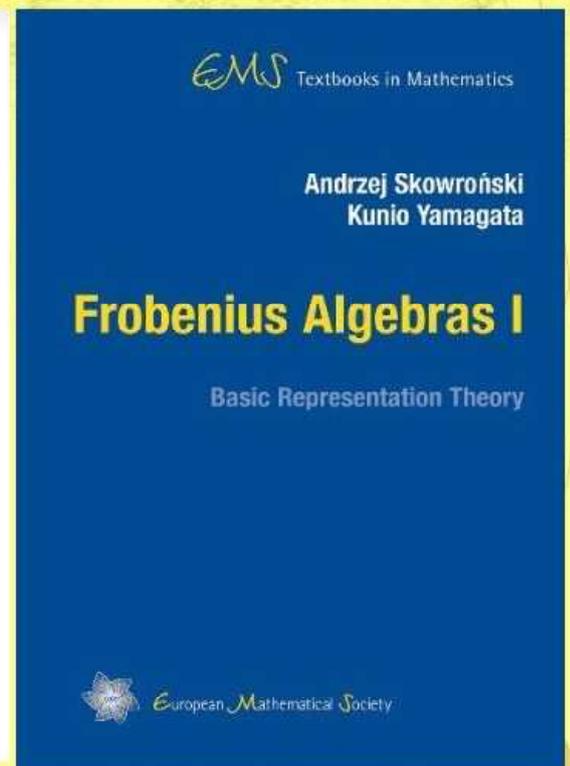
Publications (by number in area)

Associative rings and algebras Category theory; homological algebra

Publications (by number of citations)

Associative rings and algebras

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Also he published a book
"Frobenius algebras I"
with Skowroński from European Math. Society as a
specialist of Frobenius algebra.

In 1991, collaborations with Skowroński about
representations of Frobenius algebras had started, and
until now, 13 joint articles were published.

Publication (Review)



EMS Textbooks in Mathematics

Andrzej Skowroński (Nicolau Copernicus University, Toruń, Poland)
Kunio Yamagata (Tokyo University of Agriculture and Technology, Japan)

Frobenius Algebras I
Basic Representation Theory

ISBN 978-3-03719-102-6
DOI 10.4171/102
December 2011. 661 pages, hardcover, 16.5 x 23.5 cm.
58.00 Euro

This is the first of two volumes which will provide a comprehensive introduction to the modern representation theory of Frobenius algebras. The first part of the book serves as a general introduction to basic results and techniques of the modern representation theory of finite dimensional associative algebras over fields, including the Morita theory of equivalences and dualities and the Auslander-Reiten theory of irreducible morphisms and almost split sequences.

The second part is devoted to fundamental classical and recent results concerning the Frobenius algebras and their module categories. Moreover, the prominent classes of Frobenius algebras, the Hecke algebras of Coxeter groups and the finite dimensional Hopf algebras over fields are exhibited.

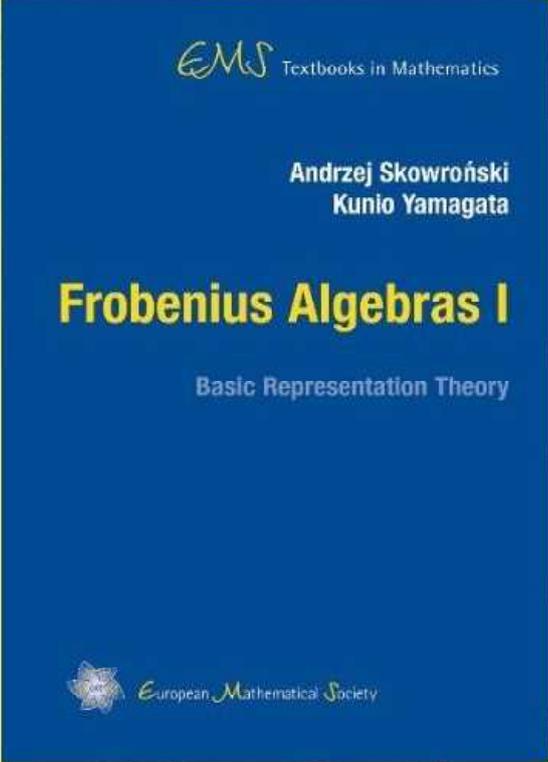
This volume is self-contained and the only prerequisite is a basic knowledge of linear algebra. It includes complete proofs of all results presented and provides a rich supply of examples and exercises.

The text is primarily addressed to graduate students starting research in the representation theory of algebras as well mathematicians working in other fields.

Further Information
[Review in Zentralblatt MATH 05988530](#)
[Review in MR 2894798](#)

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EMS Textbooks in Mathematics

Andrzej Skowroński
Kunio Yamagata

Frobenius Algebras I
Basic Representation Theory



European Mathematical Society

It will give good informations for students and mathematicians to study ring theory and representation theory.

Publications (Papers)



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プライバシーについて

The total number of papers is 49.

Main concern in the first stage Decomposition Problem

● First Paper

Non-singular rings and Matlis's problem, Sci. Rep. Tokyo
Kyoiku Daigaku 11, 186-192(1972)

Challenge to unsolved Problem w.r.t. Krull-Remark-
Schmidt-Azumaya

Is the direct summand of completely decomposable
module is also completely decomposable ?

Matlis' Problem: In the case of modules being a direct sum of
indecomposable injectives, is it true only for noetherian ring ?

Under much weaker conditions,
It is true  **Still the best result now !**

I will talk about his concerns in his early stage because Professor Skowróński will talk about his achievement on representation theory in his middle and recent ages.

Yamagata's first concern was

Krull-Remark-Schmidt-Azumaya Theorem.

His first paper was published from Science Report of Tokyo University of Education.

In this paper, he challenged to unsolved problem with respect to Krull-Remark-Schmidt-Azumaya Theorem about the decomposition of direct summand of a

complete decomposable module.

Particularly in the case of injective direct-summand, there is so called "Matlis' problem" which says that this problem holds affirmatively only for noetherian rings. But Yamagata showed that this problem holds under much weaker conditions.

This result is still best result even now.

Main concern in the first stage

[Crawley-
Jónsson's
Paper]

- Does finite exchange property imply exchange property?

[Fuller-
Reiten's
paper]

- This paper gave him some inspiration between exchange property and finite representation type

Shift his research to Artinian Rings
of Finite Representatio Type

Next step was the influence of P.Crawley-B.Jónsson's paper about exchange property. Also through Fuller-Reiten's paper, he realized that exchange property is relating to a ring of finite representation type.

These made him to shift his research to representation theory, naturally.

Remark: The problem of P.Crawley-B.Jonsson (1964) itself is still open.

Exchange Property About Thesis(1977)

- (1974) TFAE for a complete decomposable module M whose indecomposable summands are injective.
 - A) M has exchange property
 - B) M has **finite exchange property** 
 - C) The system of indecomposable direct summands is **locally semi-T-nilpotent**
- (1974) Semi-perfect ring is **perfect** if and only if any projective module has **exchange property**

Equivalent in
1975 in general

So the main topic of his thesis in 1977 was about exchange property. He discussed problem if finite exchange property implies exchange property or not, and relation to perfect rings.

Also he discussed relation between finite representation type and exchange property.

Around in 1976, Yamagata had stated the study of trivial extension algebras of arbitrary hereditary algebras and, in 1997 he completely determined all indecomposable modules and irreducible maps over the trivial extension algebras based on those over the

hereditary algebra. Though the results were published later in 1981, he took the initiative the study of representations of trivial extension algebras over hereditary algebras and, then many ring theorists followed him.

Exchange Property and Finite type

- (1975) TFAE for artinian ring R
 - A) R is of **finite representation type**
 - B) Every left and right R -module has **exchange property**
 - C) Every left and right R -module has **finite exchange property**

- (Yamagata 1974,1975; B.&W.Zimmerman 1984)
TFAE for a complete decomposable module M
 - A) M has exchange property
 - B) M has finite exchange property
 - C) The system of indecomposable direct summands is **locally semi-T-nilpotent**

Though Yamagata shifted his research to representation theory, as you know, the theorem was completed by Birge Zimmermann and Wolfgang Zimmermann in 1984 by proving that $c \Rightarrow a$.

We can say that Yamagata approached just in front of goal since Yamagata already had proved $B \Leftrightarrow C$ ($A \Rightarrow B$ is trivial).

This experience must give him Good teaching

"Never give up !"

Big Result of Representation Theory in the first stage

On Artinian rings of finite representation type,
J. Algebra 50(2), 276-283 (1978)



Let M be an indecomposable module over an artinian ring of finite representation type, then there is a chain of irreducible map $S \rightarrow \cdots \rightarrow M$ starting from some simple module S

But even Yamagata shifted his research to representation theory, he has given nice results. One of these is the following result for a ring of finite type.

"There is a chain of irreducible maps for any indecomposable module M starting from some simple module S ."

Remark: His proof implicitly says that any two indecomposable modules are connected by irreducible maps.

We wish Good Luck to YAMAGATA



I believe Professor Yamagata feel some kind of relief because Professor Iyama with many other Japanese has worked very actively as one of representatives of ring theory in Japan also all over the world.

We have strong duty that Japanese ring-theorists must develop ring theory, traditionally inherited from Morita through Yamagata.

I would like to conclude my talk by wishing Professor Yamagata's Good Luck in the following his life.

Thank you.