

Laboratory of Mathematical Design for Advanced Cryptography

Apr. 1, 2015 Estab.

先進暗号数値デザイン室

Recent advances in information and telecommunication technologies bring forward new applications of cryptographic theory. In turn, newly developed cryptographic methods and constructions as well as their security evaluation require application of a wide range of mathematical theories, beyond those conventionally used for cryptography. The Laboratory of Mathematical Design for Advanced Cryptography, leveraging the cooperation between academic research institutes, industry and the governmental institutions, aims at development of the next-generation cryptographic technologies featuring a wide variety of secure functionalities, with the ultimate goal of achieving safe and sustainable society. Through the cooperation between academia, industry, and the governmental institutions, the Laboratory will continue to promote the newest advances in mathematical cryptography towards design and development of the next-generation cryptographic constructions meeting the highest international standards.

Division of Strategic Liaison

Apr. 1, 2023 Estab.

リエゾン戦略部門

The Division of Strategic Liaison establishes an optimal system to meet the rapidly growing needs of society, industry, and academic fields by carrying out the following three missions:

- (1) strengthening the promotion and support functions of joint research,
- (2) operating the Mathematics for Industry Platform (MfIP), and
- (3) pursuing joint research in a practical manner.

Australia Branch

Mar. 1, 2015 Estab.

オーストラリア分室

Australia Branch was established in La Trobe University (Melbourne, Australia) in March, 2015, and is managed by the academic staffs employed in Australia to be the hub for promoting the activities such as joint researches with institutes in Oceania area, student exchanges and international internships. It also coordinates the cooperation with major research institutes in Australia and New Zealand.

Division of Fujitsu Mathematical Modeling for Decision Making

Dec. 1, 2022 Estab.

富士通意思決定数値モデリング共同研究部門

This department promotes research on social modeling and analysis for decision making in real world through the collaboration with Fujitsu Limited.

Office for Promotion of Collaboration and Technical Consultation

Apr. 1, 2011 Estab.

連携推進・技術相談室

This office is manned by a joint research coordinator in charge of promoting collaboration and providing technical consultation. It serves as an interface between industrial technologies and mathematics.

Visitors Section

Apr. 1, 2011 Estab.

客員部門

This section invites researchers from companies, research institutions, and other universities in Japan and overseas and researches advanced problems to deal with ever-changing problems in the industrial sector.



Institute of Mathematics for Industry Kyushu University

九州大学 マス・フォア・インダストリ研究所

744 Motoooka, Nishi-ku, Fukuoka 819-0395, Japan
Phone: +81-92-802-4402 Fax: +81-92-802-4405
URL <http://www.imi.kyushu-u.ac.jp/>

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Overview



DIVISIONS

Division of Advanced Mathematics Technology

Apr. 1, 2011 Estab.

数学テクノロジー先端研究部門

This department promotes joint research with companies and researchers in other fields. Researching groundbreaking mathematical technologies, it works to solve mathematical problems that companies have by joint or commissioned research.

Division of Applied Mathematics

Apr. 1, 2011 Estab.

応用理論研究部門

This department develops mathematical methods to refine existing mathematical techniques and investigates theories having broad application to demonstrate the universality of mathematics. The members of this department will perform joint research on occasion with members of industry and researchers in various scientific fields and will promote theoretical research with an eye to application.

Division of Fundamental Mathematics

Apr. 1, 2011 Estab.

基礎理論研究部門

This department is staffed with pure mathematicians having an interest in application, who, in cases where the problem is clear but the mathematical technique for solving the problem is not, perform basic research to clarify that technique. The department performs basic research to drive technical innovation.

Division of Intelligent Societal Implementation of Mathematical Computation

Apr. 1, 2019 Estab.

数理計算インテリジェント社会実装推進部門

This division implements cutting edge mathematical technologies for highly convenient social designs in large scale through collaboration with many industrial partners, and thus leads IMI's industry-academia cooperation. By creatively amalgamating leading techniques in mathematical modeling with AI, we contribute to the construction of ultra-smart society based on Society 5.0.

Division of Industrial and Mathematical Statistics

Apr. 1, 2022 Estab.

産業数理統計研究部門

In the division of Industrial and Mathematical Statistics, along with we cooperate with researchers in statistics and related fields inside and outside the university to deepen the scientific principles of statistics and related fields, in society, industry, and various scientific fields, we will play a role in contributing to solving various problems. In addition, in response to the needs of society, we will carry out human resource development projects related to statistics and related fields both inside and outside the university under the governance of the university.

GREETING

Director
Institute of Mathematics for Industry,
Kyushu University
Kenji KAJIWARA



The Institute of Mathematics for Industry (IMI) at Kyushu University was established in April 2011 and celebrated its 10th anniversary in April 2021. During this period, IMI has grown into a unique institute in the world that combines and integrates deep and advanced mathematical research with the development of mathematics that meets the needs of industry and society. The area of data science is rapidly advancing with the development of various technologies related to big data and AI, and is changing industry and society at large. As a result, not only traditional applied mathematics and statistics-related fields, but also algebra, geometry, discrete mathematics, and foundation of mathematics are now directly utilized not only as a basis but also as cutting-edge science and technology. The importance of mathematics is repeatedly mentioned in the basic documents of the government's science and technology policy, and research projects based on mathematics are adopted in major research projects. The environment surrounding mathematics is changing dramatically with the growing understanding and expectations that mathematics is indispensable for the future development of society and science and technology.

Under these circumstances, I succeeded to the position of the fourth director of the IMI in October 2022, and I will further strengthen the activities of the IMI and accelerate its development. The IMI will further promote mathematical research; respond to the high needs for mathematics in industry, society, and academia; support research activities in mathematics and related communities in Japan and abroad; foster young researchers who can contribute to solving social problems through mathematical research; and enhance international research activities with an emphasis on the Asia-Pacific region. Through these efforts, we intend to further develop the IMI as an international research center and contribute to the creation of a prosperous and sustainable society through the use of mathematics. I would like to express my deep appreciation for the cooperation of academic institutions in mathematics and related areas in Japan and abroad, companies, municipalities, and government agencies that have shared in the activities of the IMI, and above all, I would like to express my gratitude to all those who have deepened and made use of mathematics, and I look forward to your continued support in the future.

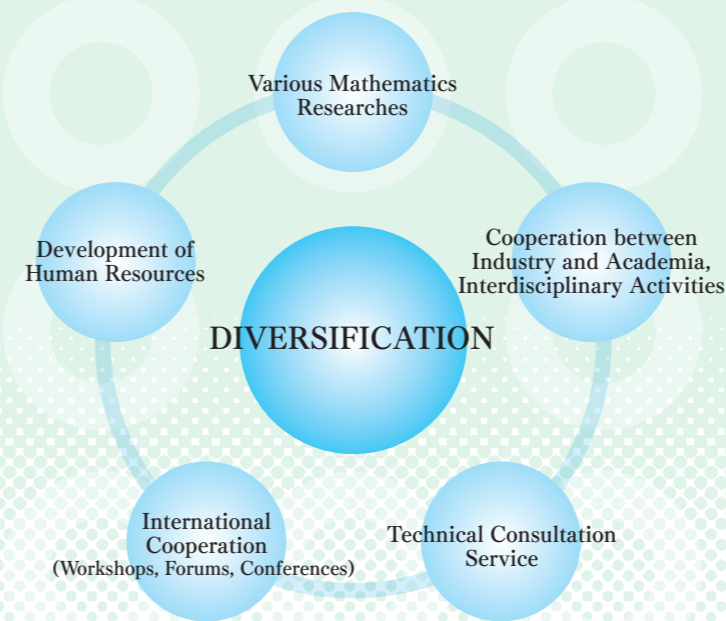
OVERVIEW

In today's functionally advanced society, mathematics can be seen as a lighthouse. Mathematics is actually the foundation of almost all advanced technologies driving modern society such as information security, network systems, CT scans, MRIs, and other medical technologies, airplane and automobile development technologies, smelting-furnace and nuclear-reactor control technologies, scheduling in the transport and distribution sectors, and finance and insurance support systems, as well as technologies for resource exploration, disaster prediction, and even entertainment. Today, there is a need like never before in many scientific and technical fields for research personnel skillful in mathematics and the mathematical sciences, and there is no doubt that this need will continue to grow in the years to come on an international scale.

To meet this global demand, the Institute of Mathematics for Industry (IMI) at Kyushu University was founded on April 1, 2011 as the first institute in Asia for industrial mathematics based on diverse fields of mathematics research. IMI was also authorized as the MEXT Joint Usage/Research Center entitled "Center for Collaborative Research in Advanced and Fundamental Mathematics for Industry" from the Ministry of Education, Culture, Sports, Science and Technology on April 1, 2013. Mathematics for Industry (MI) is a new research area that will serve as a hub for creating future technologies. It was launched with the aim of responding to the needs of the industrial sector by reorganizing and merging pure and applied mathematics into flexible and versatile forms. The IMI is involved in the following activities to promote MI.

- Joint research in response to the needs of industry inside and outside Japan and various types of mathematics research in support of joint projects
- Education and training of junior researchers. In particular, producing future leaders in the global stage.
- Organization of joint researches as the MEXT Joint Usage/Research Center
- Organization of workshops and international conferences
- Organization of study groups (training camps for solving outstanding problems in industry and other fields)
- Organization of joint seminars between academia and industry and other fields
- International cooperation with particular focus on Asia-Pacific area
- Technical Consultation
- Tutorials on mathematical key technologies
- Publication of International Journal of Mathematics for Industry (IJMI), proceedings of international conferences, Lecture Note Series and Preprint Series
- Matching and managing internships (long-term doctoral programs, medium-term Master's programs)
- The following departments have been established in IMI to promote the above activities in an efficient manner.

ACTIVITIES



 **Joint Research Center for Advanced and Fundamental Mathematics-for-Industry**
文部科学大臣認定「産業数学の先進的・基礎的共同研究拠点」
九州大学マス・フォア・インダストリ研究所

The Institute of Mathematics for Industry (IMI) at Kyushu University was founded in April 2011 as the first institute in Japan for industrial mathematics based on diverse fields of mathematics research. IMI was also authorized as the MEXT Joint Usage/Research Center entitled "Joint Research Center for Advanced and Fundamental Mathematics-for-Industry" from the Ministry of Education, Culture, Sports, Science and Technology, Japan, in April 2013. We aim to realize our philosophy, "Math-for-Industry". As one of the core projects, the Institute conducts joint usage research and calls for research proposals once a year (around November to January).

FUTURE PERSPECTIVE



Results from fundamental or pure mathematics, though not in a form that can be imagined or predicted in advance, will contribute to the development of various sciences in the future and will be useful for solving real-world problems. In addition, applied researches in mathematics developed to solve these problems will certainly result in creation of new mathematics and its deepening. The figure above shows:

[Mathematical Research]

- has no limit,
- is continuously expanding more and more in the "universe of the real world",
- has no preferred order for pure and applied Mathematics for its evolution or deepening, and
- in its fundamental aspects that is being conducted at present is all industrial Mathematics for the future.

The mathematical research area viewed from this perspective is the true meaning of "Mathematics-for-Industry".