

2. Introduction of activities in FY 2009

1) Overview



and research allowances for Super-Postdoctoral Fellow (one million yen ×1) and Postdoctoral Fellows (0.5 million yen ×3) in order to promote their spontaneous activities.

The Global COE Program at this university, “Formation and Development of Mathematical Sciences Based on Modeling and Analysis”, has rolled out its activities in Annex 3 of University Building 2 on the Ikuta campus, Meiji University, which was established with the object of promoting our program immediately and steadily after adoption. In FY 2009, six students (enrollment quota: 5) started the MIMS Ph.D. Program. As a part of the educational program for those students, we provide the most advanced research results in Mathematical Sciences Based on Modeling and Analysis by coordinating the “Project Based Analysis and Research Cluster” (Inter Departmental Curriculum for Doctoral course) (4 subjects). In terms of young researchers, we employed one Super-Postdoctoral Fellow and three Postdoctoral Fellows in Meiji University Global COE Program. In addition, we granted research funds to the “Project for Young Researchers” (three projects adopted)

For publicity activities on Mathematical Sciences Based on Modeling and Analysis, besides the website of our Program, we issued the Meiji GCOE News Letter containing interview articles written by a science writer and the Lecture Note relating the research lectures, as well as research report in which fruits of researches are provided.



Toward the global expansion of the “Mathematical Sciences Based on Modeling and Analysis”, we concluded a framework agreement for interuniversity exchange with Shizuoka University in March 2010 in addition to Hiroshima University and Ryukoku University in Japan. In terms of overseas universities, we concluded a research exchange agreement in October 2009 with the Istituto per le Applicazioni del Calcolo, with which we had already signed memorandums of understanding. Moreover, we continuously rolled out a joint project with the French Centre National de la Recherche Scientifique (CNRS), LIA197.

Our efforts different from the initial targets and plans include the following. A GCOE Program Member, Associate Professor Kazushi AHARA (Simulation Group), who is a leading member of the “Program for Enhancing Systematic Education in Graduate Schools: ‘Advanced Graduate Program in Mathematical Sciences’”, on which the Department of Mathematics, Graduate School of Science and Technology, Meiji University, is working, decided to resign from the GCOE Program Member in order to concentrate on the program in Graduate School. However, we further enhanced our organization by receiving Professor Kokichi SUGIHARA (Simulation Group) and Associate Professor Hirokazu NINOMIYA (Mathematical Analysis Group) as Program Members.

The result of a questionnaire survey with overseas researchers involved in Mathematical Modeling, Analysis and Simulation conducted as a part of self-inspection indicates that the effectiveness of our characteristic program is favorably accepted. In this regard, we are earnestly considering to build the organizational system for inspection and evaluation. Establishing the system and related internal regulations are our tasks for the next fiscal year.

Major purposes of the expenses spent in the grant are for the cultivation of young researchers (hiring expense, research allowance for Super-Postdoctoral and Postdoctoral fellows in Meiji University GCOE Program, and the Mathematical Modeling and Analysis Project for Young Researchers), the expenses for inviting frontline researchers in Mathematical Sciences Based on Modeling and Analysis from home and abroad to various joint workshops which were held



to introduce the latest researches to graduate students and young researchers, the budgets for public relations (publication of the Meiji GCOE News Letter, DVD of GCOE young researcher profiles), and so on. In addition, a set of the equipment for videoconferences with partner universities of our program, and various electronic devices required for the expansion of Mathematical Modeling, Analysis and Simulation (cluster-based simulators, personal computers, graphic server, etc.) are effectively used.

As an extension of this Global COE Program, we are working on founding the Graduate

School of Advanced Mathematical Sciences (provisional name) in FY 2011. In this regard, an establishment outline was organized by the Advisory Committee of the Graduate School of Advanced Mathematical Sciences (provisional name) that was established within the “New Department Establishment Review Committee” chaired by the university president. At present, the preparation is promoted by the Establishment Preparation Committee of the Graduate School.

Department of Mathematical and Life Sciences, Graduate School of Science, Hiroshima University (a partner university of our program), rolls out an education research on the “Formation and Development of Mathematical Sciences Based on Modeling and Analysis” with emphasis on the understanding and description of life phenomena, as a mission for the subcenter. In FY 2009, the Department held the Kick-off

Forum of our Global COE Program under the title “Formation and Development of Mathematical and Life Sciences” as a memorial event for its tenth anniversary of the foundation. Hiroshima University rolls out a research on the integration of Mathematical Sciences and Life Science, which will not only promote this Global COE Program but also serve as a central part for the entire Department of Mathematical and Life Sciences by employing two postdoctoral fellows involved in nonlinear non-equilibrium science.



2) Results of activities

(1) Creating research environment

This Global COE Program aims to cultivate and produce young researchers who can assume an active role in various fields of the society as well as to expand the research of Mathematical Modeling, Analysis and Simulation with model building as a mainstay. To this end, we established a management system to promptly implement the process from planning to execution through the integration of academic and administrative affairs and implement the following program promotion plans under the leadership of the university president. (1) In terms of graduate education, we established the MIMS Ph.D. Program in FY 2009, in



which students are able to receive scholarship system (waiver of tuition fees) and to be employed as a Global COE Program student researcher as financial support, and six students enrolled in the Ph.D. Program (quota of five students per year). Also, we gave the MIMS Ph.D. Program entrance examination for FY 2010 in July and February, and selected six successful applicants. (2) In terms of enhancement of



assistance for researchers, teachers and educational and research supporters, we employed two new faculties, one professor for a Program Member and one lecturer as a research fellow. These employment enabled us to perform a function as the GCOE center for important application fields of Mathematical Sciences Based on Modeling and Analysis such as modeling by data assimilation and illusory mathematics. In addition, we welcomed one associate professor from the Department of Fundamental Science and Technology, Graduate School of Science and Technology, as a Program Member to further enhance the field of mathematical analysis. We also employed eight postdoctoral fellows (SPD/PD) for FY 2009, out of which four were employed with this Global COE Program budget, and the other four with the university's budget. Hiroshima University has been continuously employing two postdoctoral fellows since FY 2008. (3) As for the education and research network of Mathematical Sciences Based on Modeling and Analysis, in addition to Hiroshima University and Ryukoku University (FY 2008), we concluded a framework agreement and a memorandum of understanding for student exchange with Shizuoka University to establish research guidance and the credit transfer systems.

(2) Cultivation of young researchers

i) guidance structure and education programs



At Meiji University, referring to researcher cultivation programs in other countries, we have been implementing the MIMS Ph.D. Program, which is a doctoral course education program, since FY 2009. In the field of Mathematical Sciences Based on Modeling and Analysis, researchers are required to have knowledge for three methods, i.e., modeling, mathematical analysis and simulation, and at the same time, to understand phenomena that should be analyzed. With a system where only one supervisor provides research guidance to students, it is not easy to cultivate researchers who have diversified knowledge and a multifaceted perspective in the field of “Mathematical Sciences Based on Modeling and Analysis”. Therefore

we have established a multiple guidance structure where “team fellows” provide advice. Three professors who instruct modeling, mathematical analysis, and simulation respectively are selected from the MIMS Fellows and research fellows as team fellows, to provide cooperative and complementary research instruction. We selected one team fellow for each of six students who entered in MIMS Ph.D. Program in FY 2009 to provide educational activities. In the future, we will implement more flexible guidance structure where we can

rearrange team fellows according to changes in students' research theme and so forth.

Furthermore, we provide "Advanced Mathematical Sciences I and II" as Inter-Departmental Course for all the doctoral students in the university. We focus on the most advanced research results of this Global COE Program when selecting the lectures. These classes are invaluable opportunities for young researchers to learn the cutting-edge researches directly from the global leaders on the field.

ii) System which enables young researchers to fulfill their potentials

The postdoctoral fellows of our Program are given sufficient research time and space (the building for research promotion), and we are implementing a system where not only they are engaged in their research activities as they did conventionally, but also they actively participate in the operation of the research organizations. In other words, through voluntarily organizing and operating research seminars and meetings (Symposium for Young Researchers of Mathematical Sciences Based on Modeling and Analysis: Held twice in FY 2009, regular seminars [MAS Seminar: held 18 times in FY 2009, MEE Seminar: held 18 times in FY 2009]), a research network of young researchers are naturally formed. Also, we established an open-type project "GCOE Projects for Young Researchers", which applicants are mainly doctoral course students and postdoctoral fellows, to provide young researchers with an opportunity to make plans and promote challenging project researches on Mathematical Sciences Based on Modeling and Analysis, and help them become independent researchers.

Reference website URLs

- [Symposium for Young Researchers of Mathematical Sciences Based on Modeling and Analysis](http://gcoe.mims.meiji.ac.jp/jpn/events/PD-Conference/index.html)
<http://gcoe.mims.meiji.ac.jp/jpn/events/PD-Conference/index.html>
- [MAS Seminar](http://gcoe.mims.meiji.ac.jp/jpn/events/MAS/index.html)
<http://gcoe.mims.meiji.ac.jp/jpn/events/MAS/index.html>
- [MEE Seminar](http://gcoe.mims.meiji.ac.jp/jpn/events/MEE/index.html)
<http://gcoe.mims.meiji.ac.jp/jpn/events/MEE/index.html>
- [Project for Young Researchers of Mathematical Sciences Based on Modeling and Analysis](http://gcoe.mims.meiji.ac.jp/jpn/research/wakate_project.html)
http://gcoe.mims.meiji.ac.jp/jpn/research/wakate_project.html

iii) Nurture global human resources

In order to promote the acceptance of superior students from other countries and the internationalization of domestic students, we invite well-known researchers on Mathematical Sciences Based on Modeling and Analysis from inside and outside Japan to provide lecture series in English, "Advanced Mathematical Sciences I and II", which are held in an omnibus style. These are formal subjects at the Graduate School of our university, but in order to spread the Mathematical Sciences Based on Modeling and Analysis outside the university as well, we widely accept young researchers both in Japan and other countries to attend these classes, making them an international school of Mathematical Sciences Based on Modeling and Analysis. English is also used at regular seminars organized by postdoctoral fellows and doctoral course students (MAS Seminars and



MEE Seminars). In addition, in order to make contributions to the cultivation of global personnel in the field of Mathematical Sciences Based on Modeling and Analysis, we have been cooperating with five educational and research organizations in overseas countries, i.e., the Centre National de la Recherche Scientifique in France, the Institute of Mathematics, Vietnamese Academy of Science and Technology in Vietnam, the Centre d'Analyse et de Mathématique Sociales in France, the Institute of Mathematical Modeling and Scientific Computing in Taiwan and the Instituto de Matemática Interdisciplinar in Spain. Furthermore, in FY 2009, we concluded an agreement with the Istituto per le Applicazioni del Calcolo "Mauro Picone" in Italy with whom we already had signed a memorandum.

iv) School for young researchers

We implemented the Project-based Analysis and Research Cluster course of the Inter-departmental Curriculum for the Doctoral course (4 subjects). We made these classes function as "Mathematical Sciences Based on Modeling and Analysis School" by opening them to the public and by supporting travel expenses for graduate students from other universities with the university budgets.

• Project-based Analysis and Research Cluster courses (MIMS's subjects)

- (1) Advanced Study of Mathematical Sciences I "New Discovery from Time Series",
from Monday August 17th to Thursday August 20th, 2009
- (2) Advanced Study of Mathematical Sciences II "Mathematical Sciences in Society and Ecosystem",
from Monday September 14th to Thursday September 17th, 2009
- (3) Advanced Mathematical Sciences I "Mathematical Modeling and Analysis in Neuroscience",
from Tuesday June 9th to Friday June 12th, 2009
- (4) Advanced Mathematical Sciences II "Mathematical modeling of cancer growth and treatment",
from Tuesday October 27th to Friday October 30th, 2009

(3) Research exchange activities

In order to further cooperate and encourage exchanges between researchers in the GCOE center and outside researchers on the related fields, we held regular research seminars and symposium such as the GCOE Colloquium, the Symposium on the Development of Mathematical Sciences Based on Modeling and Analysis in the Nonlinear Time Series, the Symposium on the Development of Mathematical Sciences Based on Modeling and Analysis in the Nonlinear Non-equilibrium System and RDS Seminar. Through them, we mutually exchange knowledge about research activities in diversified fields and adopt methods and concepts of the other fields, which has been helping promote research activities.

• GCOE Colloquium

<http://www.mims.meiji.ac.jp/education/courses.html>

• Symposium on the Development of Mathematical Sciences Based on Modeling and Analysis in the Nonlinear Time Series

<http://gcoe.mims.meiji.ac.jp/jpn/events/jikeiretsu/index.html>

• Symposium on the Development of Mathematical Sciences Based on Modeling and Analysis in the Nonlinear Non-equilibrium System

<http://gcoe.mims.meiji.ac.jp/jpn/events/nns/index.html>

• **RDS Seminar**

<http://nnrds.math.meiji.ac.jp/activities/seminar/RDS/index.html>

(4) Introduction of Mathematical Sciences Based on Modeling and Analysis (Outreaching activities)

- “Mathematics in Nature”, SSH (Super Science High School) Mathematical Science Experiment, High School attached to Hiroshima University, Hiroshima, October 17th, 2009
- SSH (Super Science High School) Special Lecture, High School attached to Hiroshima University, Hiroshima, October 7th, 2009
- “Diamond Twins”, Japan Mathematical Olympiad (JMO) Camp, The Mathematical Olympiad Foundation of Japan, Kiyosato, Yamanashi, August 25th, 2009
- “Invitation to Modern Geometry”, Gunma Prefectural Ota High School, Gunma, October, 2009
- “Invitation to Modern Geometry”, Kanagawa Prefectural Tama High School, Kanagawa, November, 2009
- “Riemann Hypothesis”, Science Cafe KOBE, The Action Research Center for Human and Community Development, Hyogo, December 12th, 2009
- “Seek the Mystery of Living Creatures – A Challenge by a Mathematician –”, SSH (Super Science High School) Special Lecture, The Society for Mathematics and Science People at Okinawa Prefectural Kaiho Senior High School, Naha City, Okinawa, October 8th, 2009
- “Seek the Mathematics that Appears in Sunflower Patterns”, SSH (Super Science High School) Special Lecture, High School attached to Hiroshima University, Hiroshima, November 30th, 2009
- “Seek the Mathematics that Appears in Nature”, Lecture by the Department of Mathematics and Science at Okinawa Prefectural Kaiho Senior High School, Naha City, Okinawa, December 24th, 2009
- “Played Videos that Were Awarded at a Film Festival Every Day and Exhibited Ten 3D Illusions”, Trick Museum, The Sapporo Science Center, Sapporo, July 25th to August 23rd, 2009
- “Held ‘Welcome to the Wonderland of Impossible Objects: Escher’s Illusion Paintings Reproduced as Objects’”, Ikuta Library at the Meiji University, Gallery ZERO, Kanagawa, November 18th to 26th, 2009
- “Cooperated in Exhibiting 3D Visual Illusions at the ‘Mystical Laboratory 2 : Mystery of Light and Vision’”, Hiroshima City Ebayama Museum of Meteorology, Hiroshima, January 16th to March 22nd, 2010
- “Mathematics Hidden in Illusion Pictures ---Discovery of New Three-Dimensional Visual Illusions”, SSH (Super Science High School) Special Lecture, Okinawa Prefectural Kaiho Senior High School, Naha City, Okinawa, June 4th, 2009
- “Mathematics Vision --- Illusion Pictures and 3D Visual Illusions”, Lecture by the Chubu Chapter of the Information Processing Society of Japan, The Chubu Chapter of the Information Processing Society of Japan, Nagoya University, July 2nd, 2009
- “Illusion Pictures and 3D Visual Illusions--- Rethink about What It Is to See Things with Our



- Eyes Based on Optical Illusion”, Science Lecture, Nara Municipal Ichijo Senior High School, Nara, July 10th, 2009
- “Shapes and How We See Them --- What Causes 3D Visual Illusions?”, Open Lecture, The Institute of Sciences and Technology at Meiji University, Meiji University, Kanagawa, July 18th, 2009
 - “Children’s Summer Projects Guided by Scientists”, Toda City Science Festival, The Toda City Board of Education, Toda City, Saitama, July 27th, 2009
 - “Science School for Grown-ups – Let’s Enjoy Trick Art”, Inagi City, i Plaza in Inagi City, Tokyo, November 28th and December 5th, 2009
 - “Illusion Pictures and 3D Visual Illusions: Do We See Things As They Are?”, SSH (Super Science High School) Special Lecture, Senior High School at Komaba, University of Tsukuba, Tokyo, December 18th, 2009
 - “In Pursuit of the Establishment of an Accident Investigation Institution with the Authority – Find Accident Causes before Looking for Criminals! –”, “Let’s Think about Safety” Symposium, The Aka-Tombo Society, The Takanawa Kumin Center in Minato-ku, Tokyo, May 31st, 2009 (Consumer Law News Additional Volume: pp.36 to 68, pp121 to 123)
 - “Encouragement for Safety – Principles of Safety and Technical Flow –“, Industrial Safety Insurance Expert Training Course, The Institute for Science of Labour, Kanagawa, May 15th, 2009
 - “The Ministry of Economy, Trade and Industry’s ‘Awards for Best Contributors to Product Safety’ Review Committee Chairman”, Tokyo Marine and Nichido Risk Consulting Co., Ltd., The Tokyo International Forum Hall, Tokyo, November 16th, 2009
 - “Special Lecture about Safety 1 – Think about Safety in Daily Lives –“, Lecture donated by UL Japan, Inc., Liberty Academy at Meiji University, Tokyo, April 1st to May 9th, 2009
 - “Frontier Sciences and Innovation 3 – Mechanical Risk Assessment -, - Product Safety -“, Lecture donated by UL Japan, Inc., Liberty Academy at Meiji University, Tokyo, October 24th to November 14th, 2009
 - “ Eliminate the ‘Financial Technique is to Blame’ Theory”, Financial Services Agency, Tokyo, September 6th, 2009
 - “Mysteries of Amoeba Which Can Calculate”, Suzumine Girls’ Senior High School, Hiroshima, July 31st, 2009
 - Sorpresas del Cosmos (Wonders of the Universe) Symposium”, Instituto Cervantes, Tokyo, October 8th, 2009
 - “Front Line Solar Research Tour’ for university students in science course ” Nagoya University, Kyoto University, National Astronomical Observatory of Japan, Nagoya, Hida, Mitaka, November 21st to 23rd, 2009

(5) PR of the Program

We conducted the following publicity activities in order to extensively introduce the initiatives of our Program.

- i) We have issued “Meiji GCOE News Letter” four times – Vol.0 (16 pages, English version: 16 pages), Vol.1 (12 pages), Vol.2 (12 pages) and Vol.3 (16 pages) (we are preparing the English versions for the issues Vol.1 to 3), and distributed them to various quarters as well as posting the contents on the Global COE website. In these newsletters, we introduce a variety of our activities in an easy-to-understand manner, such as research meetings,

lectures, seminars and Projects for Young Researchers of Mathematical Sciences Based on Modeling and Analysis organized by our Program as well as introduction of our research activities through interviews with GCOE Program Members and introduction of spontaneous research activities of young researchers through interviews with them. For the interviews in particular, we hire a science writer to write articles that are easy to understand for the general public, which is our top priority.

- ii) We wrote a 20-page feature article, “Mathematical Sciences Based on Modeling and Analysis of Meiji University Will Change the World” in the quarterly journal “Meiji”. In this article, we introduced the purpose and background of establishment of MIMS, research activities of the Global COE Program, the significance of building of the education research network with Hiroshima University (our partner university) and others, in a manner that is easy to understand for general public.
- iv) We broadly introduce the research activities of this Program in science journals such as “Mathematical Seminar”, “Mathematical Sciences” and “Japan Journal of Industrial and Applied Mathematics” through explanation of Mathematical Sciences Based on Modeling and Analysis.
- v) We produced a DVD to introduce the research activities of young researchers called “Invitation for Mathematical Sciences Based on Modeling and Analysis” and distributed it to various quarters as well as posting it on the Global COE website. In this DVD, the research activities by six postdoctoral fellows who were the members of this Program in FY 2009 are introduced in an omnibus style. The DVD is constructed that viewers can understand the width and diverseness of research fields at this Program well.
- vi) We constantly update the Global COE website and disclose all the major activities of the Program. When we host or co-host events such as research symposium, we post announcement posters and event reports on the website. Also, English translations of major articles are posted to disseminate our activities to the world.
- vii) Through the outreaching activities described in the previous section, the members introduced this Program as a whole or part of its research activities by using as many opportunities as they could.
- viii) We hosted the GCOE Colloquium to broadly introduce Mathematical Sciences Based on Modeling and Analysis within and outside the university.

