JSPS Core-to-Core Program
FY2008 Implementation Plan (Project No. : 18005)

Research Theme New Developments of Arithmetic Geometry, Motive, Galois Theory, and Their Practical Applications

Duration of Project April 1,2008 to March 31, 2011 (36 months)

Core Institution in Japan (Co-Chair) Hiroshima University
(Makoto Matsumoto, Professor)

Implementing Organizations

○ **Japan**

Japan	Core Institution	Hiroshima University	
	Co-Chair (name and title)	Makoto Matsumoto, Professor	
	Cooperating Institutions	University of Tokyo Kyoto University Nagoya University Tohoku University	Number of Cooperating Institutions 4

○ **Partner Countries**

USA	Core Institution	Duke University	
	Co-Chair (name and title)	Richard Hain, Professor	
	Cooperating Institutions		Number of Cooperating Institutions

Italy	Core Institution	Padova University	
	Co-Chair (name and title)	Bruno Chiarellotto: Professor	
	Cooperating Institutions		Number of Cooperating Institutions

France	Core Institution	Universite Paris 11 Orsay	
	Co-Chair (name and title)	Jean-Marc Fontaine: Professor	
	Cooperating Institutions	Universite de Rennes Ecole Normale Superieure Universite Paris 13	Number of Cooperating Institutions 3

Canada	Core Institution	Montreal University	
	Co-Chair (name and title)	Pierre L'Ecuyer: Professor	
	Cooperating Institutions		Number of Cooperating Institutions

Objectives of Research Exchange (including the five years after the project finishes)

The objectives of this project are: 1. to develop modern pure mathematics, 2. to extract applicational ideas from the futile soil of pure mathematics, from classicals to most advanced ones, and develop these ideas to the level of practical computer programs, such as cryptography and pseudorandom number generations, and 3. to feed back the requirements or mathematical questions from the practioners to pure mathematicians. This project develops modern mathematics such as arithmetic geometry, Galois theory, Motive theory, and at the same time gathers feedbacks from practioners to pure theorists, and contrives new methods in practical applications such as communication theory, cryptography and random number generations. We establish lasting relationships between the joining institutes.

Results to the present

In 2006 and 2007, the project jointly organized four conferences in France and Italy, and 10 conferences in Japan. A number of international joint research results were published or accepted, such as non-injectivity of pro-ell completion of Torelli group in the relative pro-ell mapping class groups, and fast jumping ahead of linear random number generators.

SFMT, SIMD oriented Mersenne Twister random number generator program, is being delivered via a homepage. The codes are downloaded more than 15000 times.

Summary of FY 2008 Exchange Plan

Joint Research

Richard Hain, Gregory Perlstein, Tomohide Terasoma, and Makoto Matsumoto are jointly working on the relative completion of the mapping class groups. Nobuo Tsuzuki, Chiarellotto, and Caro are working on arithmetic aspects on p-adic differential equations. Pierre L'Ecuyer, Hiroshi Haramoto and Makoto Matsumoto are working on high-performance random number generation.

Seminar

The project jointly organizes four conferences in Tokyo, Hiroshima, and Kagoshima in Japan, and one conference in Canada, France, Italy for each. They are on arithmetic geometry, Monte Carlo methods, p-adic geometry, and motives.

Researcher Exchanges

In the above-mentioned conferences, a number of Japanese researchers visit the member countries, and foreign members visit Japan. In addition, Terasoma and Matsumoto visit MSRI in California, to promote the joint work on the Hodge and Galois theory of relative completions with Hain and Perlestein. Ph.D students are going to give talks at conferences. E.g., Hiroshi Haramoto and Mutsuo Saito are going to give talks in Canada, Montreal on random number generation.