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## 0. Research Areas and Interest

Algebraic Combinatorics (Combinatorial Designs, Spherical Designs, Codes)  
Numerical Analysis (Combinatorial Designs, Spherical Designs, Codes)  
Design of Experiments (Optimal Designs)  
Discrete Geometry (Isometric Embedding of Metric Spaces and Normed Spaces,  
Distance Sets)  
Quadratic and Higher Forms (Hilbert identities, Sylvester's Law of Inertia and its Extensions)  
Applied Mathematics (Optical Code-Division Multiple Access, Graph Partitioning and  
Fluid Engineering)

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## 1. Education

Sept. 2007 Ph.D in Information Science, Nagoya University, Japan  
Thesis: On combinatorial designs via compositions and finite groups  
Advisor: Prof. Masakazu Jimbo  
Mar. 2005 M.S. in Mathematics, Hiroshima University, Japan  
Advisor: Prof. Hikoe Enomoto

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## 2. Regular Positions

Apr. 2008 – Mar. 2009  
Kagawa National College of Technology, Assistant Professor  
Apr. 2009 – present  
Nagoya University, Assistant Professor

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### 3. Professional Experience

Apr. 2005 – Sept. 2007

Research fellow of the Japan Society for the Promotion of Science, DC 1

Oct. 2007 – Mar. 2008

Research fellow of the Japan Society for the Promotion of Science, PD

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### 4. Visiting Positions

July 2010 – Sept. 2010

Visiting Assistant Professor. Department of Mathematics,  
Texas University at Brownsville.

Mar. 2011 – June 2011

Courtesy Assistant Professor. Department of Mathematics,  
University of Oregon.

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### 5. Organizers of Conferences, Meetings, and Workshops

- [1] M. Sawa, Y. Fujiwara, K. Momihara.  
Discrete Mathematics and its Applications.  
Graduate School of Mathematics, Nagoya Univ., Japan. Nov 2011.
  - [2] M. Sawa, J. Fujisawa, M. Hirao, H. Nozaki.  
RIMS Joint Research: Designs, Codes, Graphs and Related Areas.  
Research Institute for Mathematical Sciences, Kyoto Univ., Japan. July 2012.
  - [3] C.-M. Kau, H.-L. Fu, K. Ota, M. Jimbo, M. Mishima, M. Sawa.  
The 2<sup>nd</sup> Japan-Taiwan Conference on Combinatorics and its Applications.  
Nagoya University ES Hall, Japan. Nov 2012.
  - [4] H. Tanaka, T. Taniguchi, M. Sawa.  
Algebraic Graph Theory and Spectral Graph Theory.  
Nagoya University, Japan. Jan 2013.
  - [5] M. Sawa, H. Nozaki, H. Masatake, J. Fujisawa.  
The 2<sup>nd</sup> RIMS JointWork "Designs, Codes, Graphs and Related Areas".  
RIMS. July 2013. (to be confirmed)
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## 6. Grants

- [1] Grant-in-Aid for Challenging Exploratory Research 23654031. 2011-2014. (with M. Jimbo)
- [2] Grant-in-Aid for Young Scientists (B) 22740062. 2010-2013.
- [3] Grant-in-Aid for Scientific Research (B) 22340016. 2010-2011. (with M. Jimbo)
- [4] Grant-in-Aid for JSPS Fellows. 2005-2008.

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## 7. Publications -- Refereed Papers

- [1] H. Nozaki, M. Sawa.  
Remarks on Hilbert identities, isometric embeddings, and invariant cubature.  
*St Petersburg Mathematical Journal* (to appear).
- [2] M. Sawa, Y. Xu.  
On positive cubature rules on the simplex and isometric embeddings.  
*Mathematics of Computation* (to appear).
- [3] M. Hirao, H. Nozaki, M. Sawa, V. Vatchev.  
A new approach for the existence problem of minimal cubature formulas based on the Larman-Rogers-Seidel theorem.  
*SIAM Journal on Numerical Analysis*, Vol.**50**, 2716-2728 (2012).
- [4] S.Watanabe, K.Ishii, M.Sawa.  
A  $q$ -analogue of the addressing problem of graphs by Graham and Pollak.  
*SIAM Journal on Discrete Mathematics*, Vol.26, 527-536 (2012).
- [5] H. Nozaki, M. Sawa.  
Note on cubature formulae and designs obtained from group orbits.  
*Canadian Journal of Mathematics*, Vol.64, 1359-1377 (2012).
- [6] M. Hirao, M. Sawa.  
On minimal cubature formulae of odd degrees for circularly symmetric integrals.  
*Advances in Geometry*, Vol.12, 483-500 (2012).
- [7] Ei. Bannai, E. Bannai, M. Hirao, M. Sawa.

On the existence of minimum cubature formulas for Gaussian measure on  $\mathbb{R}^2$  of degree  $t$  supported by  $\lfloor t/4 \rfloor + 1$  circles.

*Journal of Algebraic Combinatorics*, Vol.35, 109-119 (2012).

- [8] A. Munemasa, M. Sawa.  
Steiner quadruple systems with point-regular abelian automorphism groups.  
*Journal of Statistical Theory and Practice*, Vol.6, 97-128 (2012).
- [9] M. Hirao, M. Sawa, Y. Zhou.  
Some remarks on Euclidean tight designs.  
*Journal of Combinatorial Theory Series A*, Vol.118, 634-640 (2011).
- [10] M. Jimbo, Y. Kuniyama, R. Laue, M. Sawa.  
Unifying some known infinite families of combinatorial 3-designs.  
*Journal of Combinatorial Theory Series A*, Vol.118, 1072-1085 (2011).
- [11] Ei. Bannai, Et. Bannai, M. Hirao, M. Sawa.  
Cubature formulas in numerical analysis and Euclidean tight designs.  
*European Journal of Combinatorics*, Vol.21, 423-441 (2010).
- [12] M. Sawa.  
Optical orthogonal signature pattern codes with weight 4 and maximum collision parameter 2.  
*IEEE Transactions on Information Science*, Vol.56, 3613-3620 (2010) .
- [13] M. Sawa, K. Matsubara, D. Matsumoto, H. Kiyama, S. Kageyama.  
Decomposition of an all-one matrix into incidence matrices of a BIB design.  
*Journal of Statistics and Applications*, Vol.4, 285-294 (2009).
- [14] M. Sawa, S. Kageyama.  
Optimal optical orthogonal signature pattern codes of weight 3.  
*Biometrical Letters*, Vol.46, 89-102 (2009).
- [15] M. Hirao, M. Sawa.  
On minimal cubature formulae of small degrees for spherically symmetric integrals.  
*SIAM Journal on Numerical Analysis*, Vol.47, 3195-3211 (2009).

- [16] M. Sawa, M. Jimbo, S. Kageyama.  
Compatibility of BIB designs.  
*Statistics and Applications*. Vol.6, 56-71 (2008).
- [17] M. Sawa.  
A cyclic group action on resolutions of quadruple systems.  
*Journal of Combinatorial Theory Series A*, Vol.114, 1350-1356 (2007).
- [18] A. Munemasa, M. Sawa.  
Simple abelian quadruple systems.  
*Journal of Combinatorial Theory Series A*, Vol.114, 1160-1164 (2007).
- [19] H. Fujii, M. Sawa.  
An addressing scheme on complete bipartite graphs.  
*Ars Combinatoria*, Vol.86, 363-369 (2007).
- [20] M. Sawa, K. Matsubara, D. Matsumoto, H. Kiyama, S. Kageyama.  
The spectrum of additive BIB designs.  
*Journal of Combinatorial Design*, Vol.15, 235-254 (2006).
- [21] K. Matsubara, M. Sawa, D. Matsumoto, H. Kiyama, S. Kageyama.  
An addition structure on incidence matrices of a BIB design.  
*Ars Combinatoria*, Vol.86, 113-122 (2006).

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## 8. Publications -- Non-refereed Papers

- [1] T. Nakashima, M. Sawa.  
Discussion on a graph partitioning problem and geometric separators  
— Toward a better domain decomposition method for computational uid dynamics  
*RIMS Kokyuroku*, Vol.1844. (to appear).
- [2] M. Hirao, M. Sawa, M. Jimbo.  
Constructing optimal designs and related topics.  
*RIMS Kokyuroku*, Vol.1844. (to appear).

- [3] M. Sawa  
On an identity involving a sum of powers of integers.  
Proceedings of the 9<sup>th</sup> Symposium on Algebra and Computation.  
Tokyo Metropolitan University. 87-92 (2012).
- [4] M. Sawa  
On 3-designs with point-regular abelian automorphism groups.  
RIMS Kokyuroku, Vol.1564, 123-130 (2007).
- [5] M.Sawa.  
Additive structure  
RIMS Kokyuroku, Vol.1476, 186-195 (2006).
- [6] H.Fujii, M.Sawa.  
An addressing scheme on complete bipartite graphs.  
Joint Workshop on Applied Mathematics. Pp.45-46, 2004.

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## 9. Presentations at International Conferences, Seminars, and Workshops

- [1] “Constructions of optimal experimental designs of degree 3”.  
2012 Shanghai Conference on Algebraic Combinatorics.  
Shanghai Jiao Tong Univ., Shanghai, China, Aug 17-22, 2012.
- [2] “Optimalities of designs and configurations of points on the sphere”.  
The 2<sup>nd</sup> Institute of Mathematical Statistics Asia Pacific RIM Meeting.  
Tsukuba Univ., Japan, July 2-4, 2012. (with M. Hirao, M. Jimbo)
- [3] “An approach to the existence problem of minimal formula based on the LRS theorem”.  
The 9<sup>th</sup> Japan-Korea Workshop on Algebra and Combinatorics.  
Tohoku Univ., Japan, Jan 2011.
- [4] “Cubature formula for some special integral”.  
The 3<sup>rd</sup> Pacific Workshop on Discrete Mathematics.  
Tokai University Pacific Center, Hawaii, Dec 2010.
- [5] “Cubature formula and spherical design”.  
Mathematics Department Seminar.

University of Texas at Brownsville, USA, Sept 2010.

- [6] “Cubature formula and integral with some symmetry”.  
Geometry Seminar.  
University of Texas at Brownsville, USA, Aug 2010.
- [7] “Steiner quadruple systems with point-regular automorphism groups”.  
International Workshop on Combinatorics.  
Kyoto Univ., Japan, June 2007.
- [8] “On 3-designs with an abelian group as its automorphism group”.  
The 14<sup>th</sup> Algebraic Combinatorics Seminar.  
Pohang University of Science and Technology, Korea, Aug 2006.
- [9] “An additive structure of BIB designs”.  
The 20<sup>th</sup> British Combinatorial Conference.  
Durham Univ., UK, July 2005.

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## **10. Selected Presentations at Conferences, Seminars, Workshops in Japan**

### **Invited Talks:**

- [1] On Hilbert identities and cubature formulae on the simplex.  
The 5<sup>th</sup> Discrete Geometry and Algebraic Combinatorics Conference.  
South Padre Island, Texas, USA. April 17-20, 2013.
- [2] The theory of cubature formulae and designs in numerical analysis, algebraic combinatorics and mathematical statistics.  
Statistics and Probability Section, Mathematical Society of Japan,  
2013 Annual Meeting. Kyoto Univ., March.2013.
- [3] Hilbert identity, cubature formula, and combinatorial design.  
Joint Workshop on Applied Mathematics. Ryukoku Univ., Dec. 2012.
- [4] Cubature formula.  
The 6<sup>th</sup> Combinatorial Conference for Young Scientists. Keio Univ., Feb. 2010.
- [5] Introduction to Design Theory.  
Kagawa Mathematics Seminar. Kagawa Univ., July 2009..

### **Others:**

- [1] On additive structure of BIBDs.  
Mathematical Society of Japan Meeting: Statistics Session.  
Okayama Univ., Sept 2005.
- [2] An eigensharp addressing scheme on graph.  
Design of experiments and related areas – discrete structures and applications.  
Fukui. Nov. 2005.
- [3] Asymptotic existence of 3-designs with 1-rotational automorphism groups.  
Mathematical Society of Japan Meeting: Statistics Session.  
Chuo Univ., Mar 2006.
- [4] On 3-(v,4,3) design with point-regular abelian automorphism groups.  
Komaba Group Theory Seminar.  
Univ. of Tokyo, July 2006.
- [5] On 3-design with point-regular abelian automorphism groups.  
Mathematical Society of Japan Fall Meeting: Algebra Session.  
Osaka City Univ., Sept 2006.
- [6] On constructions of 3-design with point-regular abelian automorphism groups.  
Design of experiments and related areas – discrete structures and applications.  
Yamagata., Nov. 2006.
- [7] On simple 3-designs with abelian groups as automorphism groups.  
Group Theory and Related Areas.  
Kyoto Univ., Dec 2006.
- [8] On the tightness of Gaussian designs.  
Mini-Workshop on Algebraic Combinatorics.  
Kyusyu Univ., Mar 2007. (with M.Hirao)
- [9] On cubature formulae for integrals invariant under orthogonal transformations  
The 24th Symposium on Algebraic Combinatorics.  
Kinki Univ., Aug 2007.
- [10] Zeros of orthogonal polynomials and cubature  
The 19th Kusatsu Group Theory Seminar.  
Kusatsu Seminar House, Aug 2007.
- [11] On cubature formula of degree  $4k+1$ .  
Development of Algebraic Statistics.  
Hotel Nikko, Toyohashi, Oct 2007.



- [12] On the non-existence of tight Gaussian designs of degree 9.  
Algebraic Coding Theory and Combinatorial Design.  
RIMS, Oct 2008.
- [13] Steiner quadruple systems extending affine triple systems.  
Algebraic Coding Theory and Combinatorial Design.  
RIMS, Oct 2008. (with A. Munemasa)
- [14] Compatibility of BIB designs.  
Mathematical Society of Japan Fall Meeting: Statistics Session.  
Osaka Univ., Sept 2009. (with M.Jimbo, S.Kageyama)
- [15] On the existence of minimal cubature for spherically-symmetric integrals  
Mathematical Society of Japan Fall Meeting: Applied Mathematics Session.  
Osaka Univ., Sept 2009. (with M.Hirao)
- [16] 3-designs and their applications  
Conference on Applied Mathematics.  
Ryukoku Univ., Dec 2009.
- [17] A unified construction of combinatorial 3-designs: its application to  
the theory of cubature  
RIMS Joint Research "Algebraic Coding Theory, Design Theory and  
Related Areas". RIMS, Mar 2011.
- [18] Identities involving sums of powers of intergers and cubature formulae  
The 9th Workshop on Algebra and Computing.  
Tokyo Metropolitan Univ., Nov 2011.
- [19] Hilbert identities and cubature formulae"  
Group Theory Seminar.  
Kumamoto Univ., Jan 2012.
- [20] Distance matrices, quasi-isometric embeddings, decompositions of graphs  
The 9th Combinatorial conference for Young Scientists,  
Keio Univ., Mar 2013.