# Kazuo Iwama

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## Personal Information

**Date of Birth:** January 1, 1951

**Marital Status:** Married

**Nationality:** Japanese

## Education

Ph.D., Electrical Engineering, Kyoto University, 1980.

M.E., Electrical Engineering, Kyoto University, 1975.

B.E., Electrical Engineering, Kyoto University, 1980.

## Employment

Professor, School of Informatics, Kyoto University, 1997–present.

Professor, Department of Information Science, Kyushu University, 1992–1997.

Associate Professor, Department of Information Science, Kyushu University, 1990–1992.

Visiting Associate Professor, Computer Science Division, UC Berkeley, 1983-1984.

Associate Professor, School of Science, Kyoto Sangyo (Industrial) University, 1982–1990.

Assistant Professor, School of Science, Kyoto Sangyo (Industrial) University, 1978–1982.

## Invited Talks, Lectures and Short Courses

*Keynote Speech*

8th IEEE Symposium on Parallel Architectures, Algorithms, and Networks, (ISPAN 2005), December 7-9. 2005, Las Vegas, Nevada, USA.

10th Scandinavian Workshop on Algorithm Theory (SWAT 2006), Riga, Latvia, July 6-8, 2006.

17th International Symposium on Algorithms and Computation (ISAAC 2006), Kolkata, India, December 18-20, 2006.

11th International Conference on Theory and Applications of Satisfiability Testing (SAT 2008), May 12 - 15 2008, Guangzhou, P. R. China.

6th Workshop on Algorithms and Computation (WALCOM 2012). February 15-17, 2012, Dhaka, Bangladesh.

16th International Conference on Developments in Language Theory (DLT 2012), August 14-17, 2012, Taipei, Taiwan.

*Seminar Talks*

MIT, Yale University, University of Toronto, McGill University, Brown University, IBM Watson Research, University of Maryland, Indiana University, University of California (Berkeley), University of Washington, University of Paris, University of Tuebingen, MPI (Saarbrucken), Lund University, University of Leicester, University of Jena, ETH and more

*Major Invited Talks*

Dagstuhl-Seminar (1998, 1999, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2012, 2013), FoCM 2008, Spring School at Zhejiang University (2005), EQIS(2001, 2003), MS+S2004, 2nd Japanese-Hungarian Symposium on Discrete Mathematics and Its Applications (Budapest, 2001), Workshop on Meta-Arithmetic and Computation (Sendai, 1997), DIMACS Workshop on Satisfiability Problem: Theory and Application(1996), JSPP'93 (1993).

# Professional Activities

*Academic Organisations and Conferences*

**Organising Committee Chair:** 23rd ACM-SIAM Symposium on Discrete Algorithms (SODA 2012), Kyoto, Japan, 2012.

**Organising Committee Chair:** ICALP/LICS 2015, Kyoto, Japan, 2015.

**Founder and Chair of Executive Board:** Asian Association for Algorithms and Computation (AAAC), 2007-.

**Editor–in–Chief:** Bulletin, European Association for Theoretical Computer Science (EATCS), 2013-.

**Council Member:** EATCS, 2002-2006.

**Steering Committee Member:** European Symposium on Algorithms (ESA), 2003-2007.

**Organising Committee co-Chair:**

Dagstuhl Seminar 08431 on Moderately Exponential Time Algorithms, 2008.

MATCH-UP: Matching Under Preferences -Algorithms and Complexity- (Satellite workshop of ICALP 2008).

Asian Conference on Quantum Information Science (AQIS 2007)

14th International Symposium on Algorithms and Computation (ISAAC 2003).

1997 Japan-Korea Joint Workshop on Algorithms and Computation, 1997.

**Program Committee Chair or co-Chair:** PDCAT 2014, QIT 2012, AAAC (2009-2011), ISAAC 1992.

**Program Committee:** SWAT2000, ISAAC2000, FCT2001, ISAAC2001, ESA2002, IFIP-TCS2002, ICALP2003, CIAC'03, CIAA'03, ICALP2006, TAMC2007, WG2007, MFCS2007, STACS2008, ICALP2009, ISAAC2009, COCOON2009, SAT2009, ICALP2010, SAT2010, WG2010, CIAC2010, COCOON2012, CSR2012, ISAAC2012, MFCS2012, SAT2012, TAMC2012, ICALP2013 and more.

*Editorial Board:*

Algorithmica, 2012-.

ACM Transactions on Computation Theory, 2007-.

International Journal of Foundations of Computer Science, 2005-.

Information Processing Letters, 1998-2010.

Parallel Computing, 1998-2005.

Journal on Satisfiability, Boolean Modeling and Computation, 2005-.

Encyclopedia of Algorithms (Springer), 2005-.

Book Series, Theoretical Computer Science (World Scientific), 2008-.

## Research Grants

*Major Projects*

**Chair:** New Horizons in Computing (NHC), Ministry of Education, Science, Sports and Culture of Japan (Monbusho), 2004-2008.

**Group-Leader:** Quantum Computation and Information, ERATO (Exploratory Research for Advanced Technology, Japan Science and Technology), 2000-2005

*KAKENHI, Ministry of Education, Japan*

Approximated computation for incomplete big data (Principal Investigator, 2013-2015, 47,320,000 JPY).

Research on algorithms enhancing spatial information augmentation (Principal Investigator, 2010-2012, 42,470,000 JPY).

Design and analysis of algorithms enhancing information augmentation (Principal Investigator, 2007-2009, 33,410,000 JPY).

Research on engineering-based performance guarantee of discrete algorithms (Principal Investigator, 2004-2006, 11,100,000 JPY).

Research on engineering-based performance augmentation of discrete algorithms (Principal Investigator, 2001-2003, 12,100,000 JPY).

Developments of high-speed routing algorithms based on randomization and adaptation (Principal Investigator, 1998-2001, 10,900,000 JPY).

High-speed search of feasible and approximated solutions for real-world problems (Principal Investigator, 1998-2000, 6,500,000 JPY).

Solving Real-World Combinatorial Problems using High-Speed SAT-Algorithms (Principal Investigator, 1997-1999, 6,200,000 JPY)

Research and Development of Advanced Database Systems for Integration of Media and User Environments (Principal Investigator, 1996-1998, 12,000,000 JPY).

Fast and Mass Generation of Random Benchmark Circuits That Are Not Too Artificial (Principal Investigator, 1996-1998, 4,000,000 JPY).

Studies on How to Generate Random Benchmark-Test Instances (Principal Investigator, 1995-1997, 3,600,000 JPY).

## Honors

Member, Academia Europae, 2012-.

Honorary Doctorate from University of Latvia, 2008.

Member, Science Council of Japan, 2005.

## Research Topics

**Stable Matchings:** Most well-known research group together with the one at University of Glasgow. Algorithms and complexity of most general version of the stable marriage problems with incomplete lists and ties, including

the first approximation bound less than 2.0.

**Boolean Satisfiability:** Long history for improving the upper bound for the complexity of 3SAT, one of the most important and popular NP-complete problems. Two time (currently, too) world records.

**Circuit Complexity:** Obtaining lower bounds for the number of logic gates for Boolean circuits has been popular in the sense that it is one of the direct approach for proving P$\neq$NP. The $5n$ lower bound for general circuits given by us in 2002 is still world best.

**Online Algorithms:** Wide variety of results, including auction algorithms, online knapsack problems, online randomized $k$-server problems and average-case analysis of several online problems.

**Quantum Computation:** First introduction of design theory for quantum circuits. Series of results on quantum query complexity including the one for the counterfeit coin problems.

**Approximation Algorithms :** For several graph problems other than for the above stable matching problems.

**Parallel and Distributed Algorithms :** PRAM algorithms and mesh routing algorithms.

# Major Publications

K. Iwama, S. Miyazaki, H. Yanagisawa: A 25/17-Approximation Algorithm for the Stable Marriage Problem with One-Sided Ties. Algorithmica 68(3): 758-775 (2014)

K. Iwama, Y. Yoshida: Parameterized testability. ITCS 2014: 507-516

K. Iwama, A. Nagao: Read-Once Branching Programs for Tree Evaluation Problems. STACS 2014: 409-420

N. Bansal, Xin Han, K. Iwama, M. Sviridenko, Guochuan Zhang: A Harmonic Algorithm for the 3D Strip Packing Problem. SIAM J. Comput. 42(2): 579-592 (2013)

K. Iwama, S. Miyazaki, H. Yanagisawa: Improved approximation bounds for the Student-Project Allocation problem with preferences over projects. J. Discrete Algorithms 13: 59-66 (2012)

K. Iwama, H. Nishimura, R. Raymond, J. Teruyama: Quantum counterfeit coin problems. Theor. Comput. Sci. 456: 51-64 (2012)

R. Cleve, K. Iwama, F. Le Gall, H. Nishimura, S. Tani, J. Teruyama, S. Yamashita: Reconstructing Strings from Substrings with Quantum Queries. SWAT 2012: 388-397

H. Fujiwara, K. Iwama, Y. Sekiguchi: Average-case competitive analyses for one-way trading. J. Comb. Optim. 21(1): 83-107 (2011)

W. Bein, K. Iwama, J. Kawahara, L. Larmore, J. Oravec: A randomized algorithm for two servers in cross polytope spaces. Theor. Comput. Sci. 412(7): 563-572 (2011)

K. Iwama, S. Miyazaki, H. Yanagisawa: A 25/17-Approximation Algorithm for the Stable Marriage Problem with One-Sided Ties. ESA (2) 2010: 135-146

K. Iwama, S. Miyazaki, H. Yanagisawa: Approximation algorithms for the sex-equal stable marriage problem. ACM Transactions on Algorithms 7(1): 2 (2010)

David Manlove, Robert W. Irving, Kazuo Iwama: Guest Editorial: Special Issue on Matching Under Preferences. Algorithmica 58(1): 1-4 (2010)

K. Iwama, Guochuan Zhang: Online knapsack with resource augmentation. Inf. Process. Lett. 110(22): 1016-1020 (2010)

K. Iwama, K. Seto, S. Tamaki: The complexity of the Hajos calculus for planar graphs. Theor. Comput. Sci. 411(7-9): 1182-1191 (2010)

K. Iwama, H. Morizumi, J. Tarui: Negation-Limited Complexity of Parity and Inverters. Algorithmica 54(2): 256-267 (2009)

K. Hamada, K. Iwama, S. Miyazaki: An improved approximation lower bound for finding almost stable maximum matchings. Inf. Process. Lett. 109(18): 1036-1040 (2009)

K. Iwama, E. Miyano, H. Ono: Drawing Borders Efficiently. Theory Comput. Syst. 44(2): 230-244 (2009)

Xin Han, K. Iwama, Guochuan Zhang: Online Removable Square Packing. Theory Comput. Syst. 43(1): 38-55 (2008)

K. Iwama, H. Morizumi, J. Tarui: Reductions for monotone Boolean circuits. Theor. Comput. Sci. 408(2-3): 208-212 (2008)

H. Fujiwara, K. Iwama, K. Yonezawa: Online chasing problems for regular polygons. Inf. Process. Lett. 108(3): 155-159 (2008)

K. Iwama, S. Miyazaki, N Yamauchi: A (2-c(1/sqrt(N)))-Approximation Algorithm for the Stable Marriage Problem. Algorithmica 51(3): 342-356 (2008)

Bein, W., Iwama K., Kawahara, J., "Randomized Competitive Analysis for Two-Server Problems," Proc ESA 2008, 2008.

Iwama K., Nishimura, Paterson, M., H., Raymond, R., and Yamashita S., "Polynomial-Time Construction of Linear Network Coding," Proc ICALP 2008, 2008.

Iwama, K., Lingas, A., Okita M., "Max-Stretch Reduction for Tree Spanners," Algorithmica 50(2), 223-235, 2008.

Iwama, K., Guochuan Zhang, "Optimal Resource Augmentations for Online Knapsack," APPROX-RANDOM 2007, 180-188, 2007.

Iwama, K., Miyano, E., and Ono H., "Drawing Borders Efficiently," FUN 2007, 213-226, 2007.

Iwama K., Nishimura, H., Raymond, R., and Yamashita S., "Unbounded-Error One-Way Classical and Quantum Communication Complexity," ICALP 2007, 110-121, 2007.

Iwama K., Miyazaki S., and Yanagisawa, H., "Approximation Algorithms for the Sex-Equal Stable Marriage Problem," WADS 2007, 201-213, 2007.

Ambainis A., Iwama K., Kawachi A., Raymond R., and Yamashita, S. "Improved algorithms for quantum identification of Boolean oracles," Theor. Comput. Sci. 378(1), 41-53,, 2007.

Iwama, K., and Tamaki, S., "Exploiting partial knowledge of satisfying assignments," Discrete Applied Mathematics 155(12), 1596-1603, 2007.

Halldorsson, M., Iwama K., Miyazaki S., and Yanagisawa, H., "Improved approximation results for the stable marriage problem," ACM Transactions on Algorithms 3(3), 2007.

Hayashi, M., Iwama K., Nishimura, H., Raymond, R., and Yamashita S., "Quantum Network Coding," Proc. STACS 2007, 610-621, 2007.

Bansal N., Han X., Iwama K., Sviridenko M. and Zhang G. "Harmonic Algorithm for 3-Dimensional Strip Packing Problem," Proc. SODA 2007, 1197-1206, 2007.

Iwama K., Miyazaki S., and Yamauchi N. "A 1.875–Approximation Algorithm for the Stable Marriage Problem," Proc. SODA 2007, 288-297, 2007.

M Hayashi, K Iwama, H Nishimura, R Raymond and S Yamashita, "(4,1)-Quantum random access coding does not exist? one qubit is not enough to recover one of four bits," New J. Phys. 8 129, 2006.

M. Hayashi, K. Iwama, H. Nishimura, R. Raymond, S. Yamashita, "(4,1)-Quantum random access coding does not exist," Proceedings of IEEE International Symposium on Information Theory (ISIT 2006), pp. 446-450, 2006.

Adcock M., Cleve R., Iwama K., Raymond R., Yamashita S. "Quantum lower bounds for the Goldreich-Levin problem," Inf. Process. Lett. 97(5): 208-211 (2006).

Iwama K., "Classic and Quantum Network Coding" (invited talk) Proc. SWAT 2006, 3-4, 2006.

Ambainis A., Iwama K., Kawachi A., Raymond R., and Yamashita, S. "Improved Algorithms for Quantum Identification of Boolean Oracles," Proc. SWAT 2006, pp. 280-291, 2006.

Iwama K., joint work with Hayashi, M., Nishimura, H., Raymond, R., and Yamashita S., "Quantum Network

Coding," QIP 2006, Paris, Jan. 2006.

Ito H., Iwama K. and Osumi T. "Linear-Time Enumeration of Isolated Cliques," Proc. ESA 2005, 119-130, 2005.

Iwama K., Lingas A. and Okita M. "Max-Stretch Reduction for Tree Spanners," Proc. WADS 2005, pp. 122-133, 2005.

Fujiwara, H. and Iwama K. "Average-Case Competitive Analyses for Ski-Rental Problems," Algorithmica 42(1): 95-107 (2005).

Imamura, T. and Iwama, K. "Approximating Vertex Cover on Dense Graphs," Proc. SODA 2005, pp. 582-589, 2005.

M. Halldorsson, K. Iwama, S. Miyazaki, and H. Yanagisawa, "Randomized approximation of the stable marriage problem," Theor. Comput. Sci. 325(3): 439-465 (2004).

Fujiwara, T., Iwama, K. and Iwamoto, C. "Partially effective randomization in simulations between ARBITRARY and COMMON PRAMs," J. Parallel Distrib. Comput. 64(3), 319-326, 2004.

Iwama, K. and Yonezawa, K. "The orthogonal CNN problem," Inf. Process. Lett. 90(3), 115-120, 2004.

Iwama, K., Miyazaki, S. and Okamoto, K. "A (2-c(log N/N))-Approximation Algorithm for the Stable Marriage Problem," Proc. SWAT 2004, 349-361, 2004.

Iwama, K. "Worst-case upper bounds for kSAT," EATCS Bulletin, No. 82, 61-71, 2004.

Ambainis, A., Iwama, K. Kawachi, A., Masuda, H., Putra, R., Yamashita, S. "Quantum Identification of Boolean Oracles," Proc. STACS 2004, 105-116, 2004.

Iwama, K. and Tamaki, S., "Improved Upper Bounds for 3-SAT," Proc. SODA 2004, 2004.

K. Iwama, and M. Okita, "Compact Routing for Flat Networks," Proc. DISC 2003, pp.196–210, Oct. 2003.

M. Halldorsson, R. Irving, K. Iwama, D. Manlove, S. Miyazaki, Y. Morita, and S. Scott, "Approximability Results for Stable Marriage Problems with Ties," Theoretical Computer Science, vol.306, 1-3, pp.266–277, Sep. 2003.

M. Halldorsson, K. Iwama, S. Miyazaki, and H. Yanagisawa, "Improved Approximation of the Stable Marriage Problem," Proc. ESA 2003, LNCS 2832, pp.266–277, Sep. 2003.

H. Ito, K. Iwama, Y. Okabe, and T. Yoshihiro, "Polynomial time computable backup tables for shortest path routing," Proc. SIROCCO 2003, pp.163–177, 2003.

K. Amano, K. Iwama, A. Maruoka, K. Matsuo, and A. Matsuura, "Inclusion-exclusion for $k$-CNF formulas," Information Processing Letters 87, pp. 111-117, 2003.

Ito, H., Iwama, K., Okabe, Y., and Yoshihiro T., "Avoiding Routing Loops on the Internet," Proc. SIROCCO2002, pp. 197-210 (2002).

Iwama, K. and Okita, M., "Compact Routing for Average-Case Networks (brief presentation)," Proc. ACM PODC2002 pp. 255 (2002).

Iwama, K. and Taketomi, S., "Removable On-Line Knapsack Problems," Proc. ICALP2002, pp. 293-303 (2002).

Iwama, K. and Yamashita, S.,"Transformation Rules for Designing CNOT-based Quantum Circuits,"Proc. 39th ACM/IEEE DAC, pp. 419-424 (2002).

Halldorsson, M., Iwama, K., Miyazaki, S. and Taketomi S.,"Online Independent Sets," Theoretical Computer Science, pp. 953-962 (2002).

Asahiro, Y., Hassin, R. and Iwama, K., "Complexity of Finding Dense Subgraphs," Discrete Applied Mathematics 121, pp. 15-26, 2002.

Iwama, K. and Miyano, E., "An O(square root of N) Oblivious Routing Algorithm for 2-D Meshes of Constant Queue-Size," J. Algorithms 41, 262-279, 2001.

Manlove, D., Irving, R., Iwama, K., Miyazaki, S., and Morita, Y., "Hard Variants of Stable Marriage," Theoretical Computer Science, 276, pp. 261-279, 2002.

Iwama, K. and Miyano, E., "A Lower Bound for Elementary Oblivious Routing on Three-Dimensional Meshes," J. Algorithms 39, 145-161, 2001.

Iwama, K., and Miyano, E., "A (2.954 + e)n Oblivious Routing Algorithm on 2D Meshes," Proc. ACM SPAA 2000, pp. 186-195 (2000).

Asahiro, Y., Iwama, K., Tamaki, H., and Tokuyama T. "Greedily Finding a Dense Subgraph" J. Algorithms, 34, pp. 203-221 (2000) .

Iwama, K., Kambayashi, Y., and Takaki, K. "Tight Bounds on the Number of States of DFA's That Are Equivalent to n-State NFA's" Theoretical Computer Science 237, pp. 485-494 (2000).

Iwama, K., Miyano, E., Tajima, S., and Tamaki, H. "Efficient randomized routing algorithms on the two-dimensional mesh of buses" Theoretical Computer Science 261, 227-239, 2001.

Iwama, K., and Miyano, E. "Oblivious Routing Algorithms on the Mesh of Buses" J. Parallel and Distributed Computing, 60, pp. 137-149, (2000).

Iwama, K., and Miyano, E., "Multipacket routing on 2-D meshes and its applications to fault-tolerant routing," Proc. ESA'99, pp. 53-64, 1999.

Iwama, K., Miyazaki, S., Manlove, D., and Morita, Y., "Stable Marriage with Incomplete Lists and Ties," Proc. ICALP'99, pp. 443-452, 1999.

Amano, M., and Iwama, K., "Undecidability on Quantum Finite Automata," Proc. STOC'99, pp. 368-375, 1999.

Iwama, K., and Miyano, E., "An $O(\sqrt{N})$ Oblivious Routing Algorithms for 2-D Meshes of Constant Queue-Size," Proc. SODA'99, pp. 466-475, 1999.

Iwama, K., Kambayashi, Y. and Miyano, E., "New Bounds for Oblivious Mesh Routing" Proc. ESA'98 (LNCS 1461) pp. 295-306, 1998.

Iwama, K., and Miyano, E., "Better approximations of non-Hamiltonian graphs," Discrete Applied Mathematics 81, pp. 239-261 (1998).

Iwama, K., and Iwamoto, C., "A canonical form of vector machines," Information and Computation 141, pp. 37-65 (1998).

Iwama, K.," Complexity of Finding Short Resolution Proofs" Proc. 22nd Symposium on Mathematical Foundation of Computer Sceince (MFCS'97), LNCS 1295, pp 309 – 318 (1997).

Iwama, K. and Miyano, E., "Three-dimensional mashes are less powerful than two-dimesional ones in oblivious routing" Proc. Fifth Europian Symposium on Algorithms (ESA'97), LNCS1284, pp 284–295 (1997).

Cha, B., Iwama, K., Kambayashi, Y., and Miyazaki, S. "Local search algorithms for partial MAXSAT" Proc. AAAI'97, pp 263 – 268 (1997).

Iwama, K., Iwamoto, C., and Ohsawa, T. "A faster parallel algorithm for k-connectivity" Inform. Process. Lett. 61, pp. 265-269 (1997).

Asahiro, Y., Iwama, K. Tamaki, H. and Tokuyama, T. "Greedily finding a dense subgraph," Proc. Fifth Scandinavian Workshop on Algorithm Theory (SWAT96), pp. 136–148, Reykjavik, July 1996.

Cha, B., Iwama, K. "Adding new clauses for faster local search," Proc. 13th National Conference on Artificial Intelligence (AAAI'96), pp. 332-337, Aug 1996.

Iwama, K. and Iwamoto, C. "Parallel complexity hierarchies based on PRAMs and DLOGTIME-uniform circuits" Proc. 11th IEEE Conference on Computational Complexity (Complexity 96), pp. 24–32, May 1996.

Iwama, K. and Iwamoto, C. "$\alpha$-Connectivity: A gradually non-parallel graph problem" J. Algorithms, 20, 3, pp 526–544, May 1996.

Iwama, K., Miyano, E., Kambayashi, Y., "Routing problems on the mesh of buses" J. Algorithms 20, 3, pp. 613–631, May 1996.

Cha, B., Iwama, K. "Performance test of local search algorithms using new types of random CNF formulas"

Proc. International Joint Conference on Artificial Intelligence (IJCAI-95), Montreal, pp.304–310, Aug 1995.

Iwama, K., Miyano, E. "Intractability of Read-Once Resolution" Proc. 10th IEEE Structure in Complexity Theory Conference, pp. 29-36, Mineapolis, Jun 1995.

Iwama, K., Pitassi, T. "Exponential lower bounds for he tree-like Hajós calculus" Inform. Process. Lett. 54, pp. 289-294, 1995.

Iwama, K., Iwamoto, C. and M Morshed, "Time lower bounds do not exist for CRCW PRAMs" Theoretical Computer Science 155, pp. 411–424, 1996.

Iwama, K., Hino, K. "Random generation of test instances for logic optimizers" Proc. 31st ACM/IEEE Design Automation Conference, San Diego, 430-434, San Diego, June 1994.

Iwama, K., Kambayashi, Y. "A simpler parallel algorithm for graph connectivity" J. Algorithms, 16, 2, 190-217, 1994.

Iwama, K., "ASPACE(o(log log n)) Is Regular" SIAM J. Computing, 22, 1, pp. 136-146, Feb. 1993.

Iwama, K., "CNF Satisfiability Test by Counting and Polynomial Average Time," SIAM J. Computing, 18, 2, 385-391, Apr. 1989.

Iwama, K., "Unique Decomposability of Shuffled Strings: A Formal Treatment of Asynchronous Time-Multiplexed Communication," Proc. 15th ACM Conference on Theory of Computing, pp. 374-381, Boston, Apr. 1983.

Iwama, K., "The Universe Problem for Unrestricted Flow Languages," Acta Informatica, 19, 1, pp. 85-96, Mar. 1983.

Iwama, K., "On Equation Including String Variables," Proc. 23rd IEEE Symposium on Foundations of Computer Science, pp. 226-235, Chicago, Nov. 1982.

Yajima, S.; Kambayashi, Y.; Yoshida, S.; Iwama, K., "Labolink: An Optically Linked Laboratory Computer Network," IEEE Computer, 10, 11, pp. 52-59, Nov. 1977.