acm

SIGDA NEWSLETTER

SPECIAL INTEREST GROUP ON DESIGN AUTOMATION

VOLUME 4 NUMBER 1 JANUARY 1974

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MEMBERSHIP

SIGDA dues are $3.00 for ACM members and $5.00 for non-ACM members. Checks should be made payable to the ACM and may be mailed to the SIGDA Secretary/ Treasurer listed above, or to SIGDA, ACM Headquarters, 1133 Avenue of Americas, New York, N. Y. 10036. Please enclose your preferred mailing address and ACM Number (if ACM member).

SIG/SIC FUNCTIONS

Information processing comprises many fields, and continually evolves new subsectors. Within ACM these receive appropriate attention through Special Interest Groups (SIGs) and Special Interest Committees (SICs) that function as centralizing bodies for those of like technical interests ... arranging meetings, issuing bulletins, and acting as both repositories and clearing houses. The SIGs and SICs operate cohesively for the development and advancement of the group purposes, and optimal coordination with other activities. ACM members may, of course, join more than one special interest body. The existence of SIGs and SICs offers the individual member all the advantages of a homogeneous narrower-purpose group within a large cross-field society.

ACTIVITIES

1) Informal technical meetings at SJSS and FJCC.
2) Formal meeting during National ACM meeting + DA Workshop.
3) Joint sponsorship of annual Design Automation Workshop.
4) Quarterly newsletter.
5) Panel and/or technical sessions at other National meetings.

FIELD OF INTEREST OF SIGDA MEMBERS

Theoretic, analytic, and heuristic methods for:

1) performing design tasks,
2) assisting in design tasks,
3) optimizing designs through

the use of computer techniques, algorithms and programs to:

1) facilitate communications between designers and design tasks,
2) provide design documentation,
3) evaluate design through simulation,
4) control manufacturing processes.

CHAIRMAN'S MESSAGE

Role of SIGDA

On Monday evening, June 25th at the 10th DA Workshop in Portland, Oregon, a joint meeting of the DA Technical Committee (IEEE) and SIGDA (ACM) was held. The theme of the meeting was "the role of professional societies in the design automation areas. Some thoughts which I presented during the meeting might be of value to all of the membership:

ROLES

- Develop design automation as a discipline
- Provide direct and timely exchange of information on DA
- Provide a thriving organization which can serve as a focal point for those of similar interests
- Provide an environment for lively interaction with fellow DA professionals (not just other members)
- Provide interfaces with professional groups which relate to the DA interest
- Provide members with awareness of related activities in DA

The employer gains through advancement of the individual in the profession. Further, the industrial community can gain through activities involving standards and educational programs.

There are certain constraints placed in each role. For example:

- Develop DA as a discipline -- because of resource limitations, we must act as a catalyst. One could not expect to have the organization or resources to do otherwise.

- Direct exchange of information. Companies treat DA as highly proprietary and, hence, there are often severe restrictions placed on what the members can and cannot publish, especially as concerns the timeliness of the information. We do have the direct exchange and should within these constraints strive to improve the timeliness of the exchange.

One must remember that most professional groups depend strongly upon volunteers. These groups must operate in a catlyst mode.

The roles of "focal point and environment for lively interaction" are further restricted by a geographical barrier, as is the interfacing with other professional groups. Within ACM, one can organize local special interest groups. For example, in the Washington, D. C. area, there is a very active SIG on Graphics. However, today DA members do not appear to be distributed in terms of large clusters.

Finally, a very strong controlling factor must be added - that is, the level of interest and level of dedication of the members to have the organization play their roles.

What is the future direction with DA as a discipline and with a separate professional subgroup, in our case, SIGDA?

An array is often used to describe DA. Along one axis are the functions such as simulation, analysis, testing, data base, etc., and along the other axis are the applications areas, e. g., computer design, mechanical design, architecture, aerospace, etc. We find our backgrounds quite diverse. It might be Engineering in a particular field, programming or computer science, mathematics, architects, etc.

Today we see application areas. We do not have a distinct and separable discipline. I feel we must work toward developing DA as a discipline or we have no professional society. I predict this will come to pass. The differences in DA systems independent of application modules will continue to disappear.

My crystal ball is a little cloudy, however, if primitives which are used in in design are sufficiently reduced, the programs themsevles and even design languages can merge. We have seen this in the merging of Engineering disciplines and in DA systems to handle flow type problems. However, we certainly are bounded by the fact that the application areas are so prominent.

Because of this boundary, industrial users treat their DA activity as a very proprietary area. Therefore, the degree to which communication can take place is restricted. I feel this present restriction is being relieved somewhat by several factors:

- The increase in the number of manufacturers of hardware which fit into a design center, e. g., graphic tablets, vector oriented terminals, raster displays, raster plotters, plotters, and digitizers. Attempts will be made to sell them as a system with programming support.

- The increase in the number of areas (applications) utilizing terminals, computers, and program in their design process. Hence, the number of individuals in the DA area will increase.

- The tendency to integrate specific functions into a total system and, hence, make the application more general. There will then be less reflection on the specific application.

- The tendency to include more function in the system, including an output to manufacturing. Hence, a broader distribution of the system takes place.

- Finally, certain manufacturers will want to publicize a job, DA system, well done.

I claim, therefore, that the boundaries which now separate the applications will decrease and are, in fact, somewhat artificial. They exist because we have been too narrow and not general enough. Universities have not developed appropriate generalizations. Also, we have not felt that we could gain enough by cross communications with other application groups.

Within DA, regardless of application, the objectives are the same: "to reduce the time from product specification to delivery to the builder of the product at a reduced cost with assured performance".

Finally, I am convinced that the professional organization, at least SIGDA, will grow and the relationship of SIGDA with other groups of common or overlapping interest will be strengthened.

Briefly, again the six roles are:

- Develop discipline of DA

- Direct and timely exchange of information

- Provide a thriving organization to serve as focal point

- Provide an environment for lively interaction

- Provide interfaces with other professional groups

- Provide members with awareness of related activities

The members gain directly if the professional organization is able to fulfill its roles. "One gets out of the organization what one puts into it" is valid.

Although the three dollars to SIGDA constitutes an initial effort, the real effort required is your personal involvement.

Dr. Harlow Freitag, Chairman of the DA Technical Committee of IEEE, also presented his views on the topic. A lively discussion followed with a large percentage of the almost eighty people participating. If I may generalize, I netted out three major points raised in the discussions:

1) Why are there two (or more) DA groups and computer groups in general? How can they work together better and closer? What are their differences?

2) Definitely there is a need for a professional society or sub-group in the area of design automation or if you prefer, computer applications in the area of Engineering design.

3) We should include various disciplines in the SIGDA Newsletter and workshops, not just computer design. Further, the newsletter should be published on a set schedule and all should be encouraged to make it the focal point for communications in the DA area.

Your comments and inputs would be appreciated.

C. E. Radke
Chairman, SIGDA

CER/ca

SPECIAL NOTICE:

INFORMAL MEETING AT NCC (NATIONAL COMPUTER CONFERENCE) MAY 6 - 10, 1974

Subject for discussion; providing flexibility in DA systems to allow for changing technologies.

For more information; check in the ACM Communications of the ACM, check ACM Meeting Schedules at the NCC, or contact Dave Hightower (see inside cover for address).

STANDARDS

During the 1973 DA Workshop, the subject of standards was brought up several times in relationship to DA. Bob Dunn, present Chairman of SIGGRAPH, was also in attendance at the workshop and indicated the needs for standards in the area of graphics (e. g., hardware interfaces, data formats, and application/command language). Sergio Bernstein, at the software session, stressed the need for portability of application modules. Others expressed concern about information provided for input to logic delay simulations and for delay calculations. Concern was also expressed concerning standardized design languages and package terminology.

Within ACM, there is a standing committee on standards:

J. A. N. Lee
University of Massachusetts
Department of Computer Sciences
Amherst, Massachusetts 01002
(413) 545-2744

ACM representatives on the American National Standards Group of interest to SIGDA are as follows:

X-3, Computers and Information Processing
J. A. N. Lee (principal)

Y-32, Graphic Symbols and Designations
P. G. Skelly (principal)
Honeywell Information Systems, Inc.
13430 North Black Canyon
Phoenix, Arizona 85029
(602) 993-3000

I have put one person in contact with one of the committees. SIGGRAPH has appointed several members to assist ACM and review those standards which affect graphics (one person hardware interface, one person software).

Unless I receive additional input concerning standards relative to DA, I don't intend at this time to take further action. I do request that if you do have standard concerns, that you let me know.

C. E. Radke

CER/ca

OBJECTIVES OF THE SIGDA TECHNICAL COMMITTEE

One of the current objectives of the SIGDA Technical Committee is to increase the activity of SIGDA in all areas of Design Automation. We would like to act as a platform for the exchange of ideas on Design Automation in any field where a computer program is used as a design tool. For example, in such fields as ship and highway design.

To meet that objective we presently are planning technical sessions at the 1974 ACM conference to cover broad areas of interest. One of these will be devoted to DA at the university, and the other will be on the Total Data Base concept. We hope these topics will serve the objective of widening the traditional meaning of design automation which, heretofore has meant design of circuits.

We would also like to have a technical session at the next National Computer Conference. A possible topic would be "New Applications of Design Automation."

Another goal of the Technical Committee is to develop a comprehensive bibliography of DA literature. To that end, starting with the next issue of the SIGDA Newsletter, we will begin a series of bibliographies of articles and books related to Design Automation. The bibliography to appear in the next issue is entitled "Algorithms for Shortest Path, Shortest Spanning Tree, and Related Circuit Routing Problems (1957-1973)" and was prepared by A. R. Pierce at Bell Labs. Other bibliographies will follow. To keep our bibliographies current we strongly suggest that if you run across an interesting article related to Design Automation, please drop Steve Krosner a card with the necessary information on it. If you have ever needed to know if an idea has been published, you know the value of a complete bibliography. If the members if SIGDA will help we can develop a complete bibliography that will be of great value to anyone working in the field.

Another goal of the Technical Committee is to strengthen the technical content of the SIGDA Newsletter. In addition to bibliographies, the newsletter needs current technical papers. We understand the problems of having papers cleared by your company. The feeling seems to be that if an author goes to the trouble of getting a paper cleared, then he might as well send it to a major publication. However, the author's ideas may be sound but either not fully

developed or too narrow in scope to warrant appearing in a major publication. In this case he should send the paper to Steve Krosner, and when it is printed he will find out if the ideas are sound when he hears from SIGDA Newsletter readers.

Besides being a medium for publishing papers, the SIGDA Newsletter can serve as a sounding board for ideas that the author would like reactions to. Just a note or abstract could be enough to provoke substantive discussions with people in other companies interested in similar problems. We understand the proprietary nature of the work done in Design Automation and are not advising you to violate company proprietary policies but we are suggesting that if you can clear up any proprietary problems, then you will benefit from the exchange of ideas that is certain to result from an informal presentation of ideas.

In summary, the Technical Committee would like to broaden the sphere of activity of the SIGDA and would like to encourage more participation on the part of the members by asking them to submit papers or ideas for publication, and to submit names of papers that should go into our bibliography.

I believe that with the cooperation of the SIGDA membership we can continue to improve the utility of SIGDA and can make the Newsletter into an important publication.

DAVID W. HIGHTOWER
Chairman
SIGDA Technical Committee

AUTOMATING THE DESIGN PROCESS

I highly recommend for reading a paper by Richard R. Heldenfels, NASA Langley Research Center (AIAA Paper No. 73-410) presented at the AIAA/ASME/SAE 14th Structures, Structural Dynamics, and Materials Conference, Williamsburg, Virginia, March 20-22, 1973. Note: AIAA (American Institute of Aeronautics and Astronautics), ASME (American Society of Mechanical Engineers), SAE (Society of Automotive Engineers). Abstract:

> The design process of large aerospace vehicles is discussed, with particular emphasis on structural design. Problems with current procedures are identified. Then, the contributions possible from automating the design process (defined as the best combination of men and computers) are considered. Progress toward automated design in the aerospace and other communities is reviewed, including NASA studies of the potential development of Integrated Programs for Aerospace-Vehicle Design (IPAD). The need for and suggested directions of future research on the design process, both technical and social, are discussed. Although much progress has been made to exploit the computer in design, it is concluded that technology is available to begin using the computer to speed communications and management as well as calculations in the design process and thus build man-computer teams that can design better, faster and cheaper.

Consider for the thought for the quarter, one of Mr. Heldenfel's statements: "Providing greater depth of analysis sooner is one of the important potential contributions of automation".

C. E. Radke

CER/ca

11th annual
DESIGN AUTOMATION
WORKSHOP

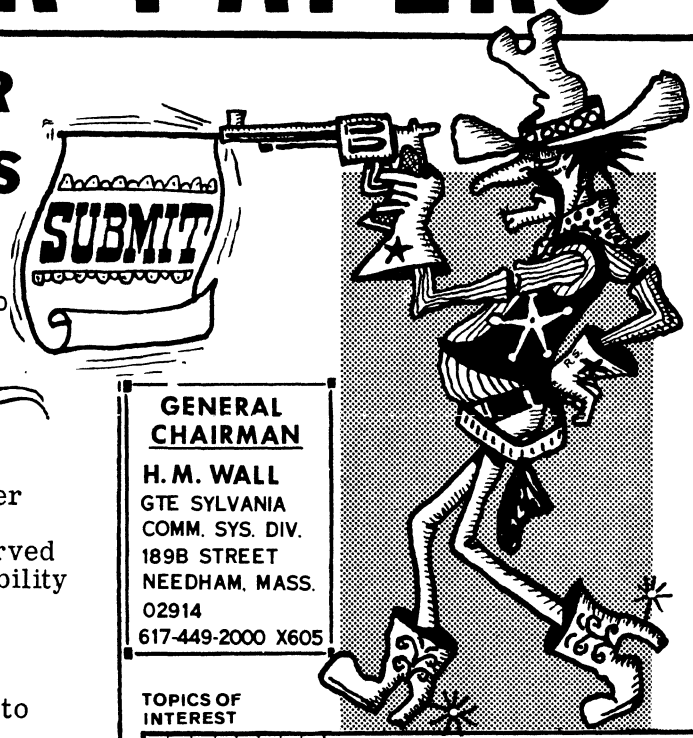
DENVER, COLORADO ★★★★★★★ EXTRA ★★★★★★★ VOLUME 1, NUMBER 1

CALL FOR PAPERS

REQUIREMENTS FOR SUBMITTING PAPERS

IF YOU PLAN TO SUBMIT A PAPER, YOU SHOULD SEND THREE COPIES OF THE PAPER, OR A 1,000 WORD ABSTRACT TO THE PROGRAM CHAIRMAN NO LATER THAN JANUARY 2, 1974. (ROUGH DRAFTS ARE ACCEPTABLE) ALSO INCLUDE A 25 WORD ABSTRACT FOR PROGRAM PLANNING

Accompanying the draft should be the full name, address and telephone number of the principal author, with whom all further direct communication will be conducted.



Notification of acceptance will be sent to you during the first week of February, 1974. After notification of acceptance, you will receive detailed instructions on the format to be observed in typing the final copy. To insure the availability of Proceedings at the Workshop, your final manuscript will be due April 19, 1974.

Final papers should be no longer than 5000 words, and the presentation should be limited to 20 minutes. Projection equipment for 35mm slides and vuegraph (overhead projector) foils will be available for every talk. Please indicate what, if any, additional audio-visual aids you require.

GENERAL CHAIRMAN

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02914
617-449-2000 X605

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ACM (Association for Computing Machinery) Special Interest Group on Design Automation
IEEE (Institute of Electrical and Electronics Engineers) Computer Society

DENVER HOLIDAY INN
chosen for site of 11th D.A.W.
JUNE 17, 18, 19, 1974

TOPICS OF INTEREST

DESIGN AREAS	FUNCTIONS
Manufacturing Process	Partitioning, Placement, Wiring (Packaging)
Architecture	Analysis
Mechanical	Simulation
LSI	Design Verification
Electronic	Testing/Quality Control
Firmware	Interactive System
Software	Design Language
Total Systems	Change Control
	Theory

DESIGN AUTOMATION

Design Automation is taken to mean the use of computers as tools which aid the design process and is often extended to include areas such as testing, simulation and certain portions of manufacturing. Typical examples of Design Automation involve the application of one or more functions to a given design area.

Rough Drafts are to be sent to the Program Chairman:

S. P. Krosner
IBM Corporation
P.O. Box 1328
Boca Raton, Florida 33432
305-391-0500

acm 74 in san diego

NOVEMBER 11-13, 1974 • COMMUNITY CONCOURSE

ASSOCIATION FOR COMPUTING MACHINERY

P.O. BOX 9366 • SAN DIEGO, CALIFORNIA 92109

Next year's annual conference takes place November 11 through 13 in beautiful San Diego, "The Unconventional City". Plans are being made right now to integrate a strong, balanced technical program with the many attractions of San Diego's recreational facilities and historical points of interest. An outstanding convention complex coupled with some of the best weather in Southern California (almost legendary) should contribute immeasurably to the success of the conference and comfort of the attendees.

Be sure to be on the lookout for the Call For Papers announcement which will appear in ACM Communications and other publications later this year. In the meantime, contact Dave Bulman, Technical Program Chairman, ACM '74, P. O. Box 9366, San Diego, California 92109 for further information about submitting papers.

San Diego abounds with excellent restaurants, serving food ranging from seafood and steaks to the mexican variety (ole!), and also offers a wide selection of entertainment. Located in the immediate vicinity are numerous computer centers, such as the Navy Electronics Laboratory, U. S. Customs, University of California at San Diego, General Dynamics/Convair, and Rohr, which offer the latest in technological advances.

Convention Headquarters will be located at the Sheraton-Airport, situated on Harbor Island on San Diego Bay.

So, why not enjoy yourself, relax a little, renew old acquaintances, meet some new friends, and participate in some stimulating technical sessions.

See you in San Diego for ACM '74!!

CALL FOR PAPERS - For SIGDA Session of ACM '74 (November 11-13, 1974), San Diego, California

SIGDA is planning to have two sessions at the ACM '74.

1) Data Based Systems for Design Support

Types of papers desired:

- Data Based Systems used for Computer-Aided Design Support
- Design Automation Systems

Organizer: C. E. Radke

2) Computer-Aided Design Development in the University

Types of papers desired:

- Computer-Aided Design Activity in the University
- Design Automation as a discipline in the University

Organizer: D. W. Hightower

Consult official call for papers or contact session organizers for information. Addresses for the session organizers may be found at the front of the Newsletter.

ON TIME SHARING SYSTEMS' PERFORMANCE...

Premise: "Evaluating the performance of a time sharing system is difficult."

Harry jumped up from his terminal, slammed the receiver back in its cradle after twenty unanswered rings, and stormed out of the office, cursing. Harry had been doing a lot of that recently, Joe thought. Well, a cup of coffee usually puts him back in a better humor...we'll see. Maybe that new time sharing service Harry raved about and started to use also went...no, it couldn't be. Could it really have gone bankrupt, too? And Harry there with that deadline? No wonder he was so angry. Oh well... we'll see...we'll see.

Joe dialed his time sharing company, hoping he could get some work done. "FRIENDLY T/S COMPANY AT YOUR SERVICE...PLEASE LOG IN." Ahhh... happiness is finding that your computer is up! Joe went to work.

Some time later, Harry walked back in, a long sheet of paper in one hand and a cup of coffee in the other. He seemed more pensive than irate now. "I wonder," he said. "I really wonder what in the name of 'down time' does it all mean, Joe. Is any of it MEANINGFUL?"

"What, Harry? That time sharing company gone bankrupt, or has the friendly phone company screwed up again?"

"Never mind <u>that</u>. I was thinking about response time...disk access time...memory cycle time...you know. What does it all mean, Joe? What

does all this stuff really MEAN?"

Joe could feel Harry's despair. He tried to find soothing words, but he knew he couldn't. Life is the way it is, and kind words sometimes do not apply, even if some can be found!

He took the paper from Harry's hand and looked it over. He pulled in a deep breath, sighed, and said, "I don't know, Harry. I really don't know. All I DO know is what these numbers come out to be. No more, no less. What they mean is not for me to say or to judge. I try to stick to the facts. God knows that's hard enough! The pundits and computer experts can come out and try to make a name for themselves, trying to tell us what it MEANS...but not me, buddy, not me. I just stick to the facts, Harry, and there they are. Take 'em or leave 'em. I'm not getting into any messy arguments with anybody! You wanted a quick evaluation of some time sharing systems, something quick and dirty which we could try while the salesman wasn't looking...some simple FORTRAN test which was sure to run on every machine. So here it is, Harry. It's a test. Just a simple test...so don't give me any of that 'meaningful' stuff!

"Really, Harry, could YOU come up with something MEANINGFUL in ten lines of code? Or even a hundred lines, for that matter? If the results depend on the time of day or how many users are on the system, I really can't help it. After all, it's REASONABLE to assume that we have to work during the day sometimes, and not only after six p.m.!

"So here it is, old buddy...here it is. I'll give it to you straight. Just the facts, the way I got them from every time sharing system I could

lay my hands on. You tell ME what it means...what it REALLY means."

MORAL: "It is better to run a single test than to curse all time sharing systems."

###

EPILOGUE:

The results presented may be strongly dependent on the choice of program, since each machine may use a different exponentiation algorithm.

Exponentiation was chosen since it was the easiest function to program in order to have a test which was "compute bound".

Thus, irate voices will be heard (hopefully...we shall get some feedback!) objecting to the validity of this "test" .

WE hope so! We want to encourage commentary on this, and other subjects. If we can find, determine, design, standardize, or otherwise come up with a simple test to check price/performance of a Time Sharing System, then our goal in writing this little note will have been reached--- let us hear from you, please.

Sergio Bernstein

Berne Electronics
28 Havilands Lane
White Plains, NY.
10605

Tel: 914 946-7950

MACHINE TYPE :	WORD SIZE	CPU secs. Singl.Pr.	CPU secs. Doubl.Pr.	ELAPSED Minutes	Num.of Users:	COST for CPU Only	C O M M E N T S :
PDP-10	36	21.5	280.0	2.1/5.5	4/4	2.15/28.00	CPU Charges: 10¢ for 2K Core 23¢ for 20K Cor
Sigma-7	32	27.0	46.0	1.0/2.25	5/5	2.70/4.60	
CDC-3300	48	39.0	--	0.8	???	4.68	Dual processor configuration
CDC-3500	48	30.0	--	0.6	6	4.50	
CDC-6400	60	33.5	--	2.33	29	6.70	
B - 5500	48	62.0	79.0	3.8/11.0	8	6.00/8.00	
U - 1108	36	17.5	60.0	? /?	???	4.50/16.00	
GE - 635	36	49.5	--	3.0	???	???	
IBM 360/67	32	29.3	44.4	1.0/2.25	30/30	11.00/16.50	

Notes: All 48-Bit machines specified use 24-Bits for integer words, 48-Bits for Real words, and upwards of 70-Bits for double precision real words.

The following FORTRAN Program was used for running time tests, after compilation and loading:

```
C       DOUBLE PRECISION A,B,C
C ABOVE USED FOR DOUBLE PRECISION TIMINGS
C.
        A = 2.
        B = 3.
        READ(5,100) N
100     FORMAT(I6)
C
        DO 200 J = 1, N
        C =(A + J)**B
200     CONTINUE
        WRITE(6,300) C
300     FORMAT(1x,E20.5)
        STOP
        END
```

Note: The FORTRAN Device numbers are changed for each system when required.

A Bibliography For Computer Aided Interconnection And Placement

David C. Wilson and Robert J. Smith, II
Southern Methodist University
Dallas, Texas 75275

Introduction

This list emphasizes the area of digital design automation concerned with geographic placement of elements on or within a specific environment (e.g., flatpacks on a printed circuit board), and, to a certain extent, the routing of conductor paths which interconnect various points in the environment. Although similar problems are found in civil engineering, sociology, operations research and other disciplines, the accumulation of comprehensive bibliographies in these related fields was deemed impractical by the authors.

Since much of the recent routing and placement work has not been described in the open literature, readers are cautioned not to consider this list a reflection of current state-of-the-art in this field.

The list is intended to provide a comprehensive coverage of the routing and placement problems as related to the design of electronic equipment; complete listings for related fields were not accumulated, but an attempt was made to cite representative introductory sources in each of these disciplines.

Content

The bibliography was originally assembled for a research project in computer aided placement techniques. Additional entries were made as new material was discovered. The list of entries below is being maintained at Southern Methodist University in machine-readable form; the authors would appreciate receiving copies of past or future work which should be included in the bibliography, as well as citations which may have been overlooked.

Organization

The first section provides a classification of the works cited based on 12 categories. Each reference was assigned to one major and up to 3 minor areas; classification decisions relect the evaluations made by the authors. Section two of the bibliography lists in numbered alphabetical order all references suitable for inclusion as of September 1973.

DESIGN AUTOMATION SURVEYS

35 36 373 375

DESIGN AUTOMATION SYSTEMS
GENERAL

29 32 37 47 53 83 87
167 170 226 227 243 251 252
254 280 295 302 306 327 334
347 375

PRINTED CIRCUIT

10 87 88 100 131 151 155
170 226 227 295 327

MICROCIRCUIT

7 95 224 251 252 256 264
295

BACKPLANE

110

HISTORICAL

9 44 136 189 196 255

BACKGROUND

GRAPH THEORY

1 8 21 49 82 86 126
129 139 152 167 176 178 242
250 322 384

OPERATIONS RESEARCH TECHNIQUES

15 18 19 28 38 66 67
68 69 70 78 79 85 86
104 107 162 191 210 229 230
244 268 291

WIRE ROUTING

GENERAL

0 1 7 8 29 35 36
37 39 53 72 88 95 100
110 125 131 139 151 152 155
165 167 178 184 195 225 232
239 243 247 252 256 259 264
269 281 283 284 295 298 306
314 319 333 334 337 338 339
344 347 368

ORDERING OF WIRES

0 1 162 167

LAYERING

1 125 167 339

MAZE RUNNING

0 5 10 72 110 125 165
171 232 258 259 269 276 284
314 368

HEURISTICS

10 153 171 225 258 268

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15 79 104 195 242

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262 338

ASSIGNMENT

GENERAL

2 7 28 29 32 35 36
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92 95 100 111 128 129 141
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358 360 365

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ABEL, L.C.
ON THE ORDERING OF CONNECTIONS FOR AUTOMATIC WIRE ROUTING
IEEE TRANSACTIONS ON COMPUTERS, VOLUME C-21 (NOVEMBER 1972), PGS. 1227-1233
ALSO COORDINATED SCIENCE LABORATORY REPORT R-537, UNIVERSITY OF ILLINOIS, URBANA, 1971

1 ABEL, L.C.
ON THE AUTOMATED LAYOUT OF MULTILAYER PLANAR WIRING AND A RELATED GRAPH COLORING PROBLEM
ILLINOIS UNIVERSITY, AD 737151, JANUARY 1972, 159 PAGES
COORDINATED SCIENCE LABORATORY REPORT R-546, UNIVERSITY OF ILLINOIS, JANUARY 1972

2 ADAMOWICZ, M. AND ALBANO, A.
A TWO-STAGE SOLUTION OF THE CUTTING-STOCK PROBLEM
PROCEEDINGS OF THE IFIPS, 1971, PGS. 1086-1091

3 ADSHEAD, H.G.
OPTIMIZING AUTOMATIC TRACKING OF MULTILAYER BOARDS
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THE CURRENT STATUS AND FUTURE WORK OF DESIGN AUTOMATION IN JAPAN

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The Japanese computer industry is very active and has done a great deal of work in the Design Automation area. The author has had the opportunity to talk to some of the people working for the leading Japanese computer manufacturers.

The purpose of this article is to provide the readers with information about the recent Design Automation activities and future trend of work in this area in Japan.

I. PRESENT STATUS

(1) Design Language:

As of July, 1973 there existed no design language for automated logic and system design in the Japanese computer industry. Professor T. Mottooka of the University of Tokyo has initiated some research in the design language area.

(2) Design Language Translator (hardware compiler)

As of July, 1973 there was no working hardware compiler in Japan.

(3) System and Logic Level Simulator

As far as can be determined, there is no working System Simulator in Japan. Most of the companies have logic level simulators capable of performing parallel simulation.

(4) Logic design automation system

To my knowledge, no program exists for automated logic synthesis using multiple-level NAND networks with fan-in, fan-out constraints (1) or a library of IC chips (2).

(5) Test generation

Most of the manufacturers have computer programs for generating tests for detecting and locating single stuck-type (stuck-at-1 and stuck-at-0) failure in a combinational or a sequential network. The tests for the last few percentages of faults are being done by hand in most of the companies. No program for detecting multiple faults has been reported. D-algorithm is being used by some companies.

(6) Card Design

a. Partitioning, for the most part, is still being done manually.

b. Packaging is being done automatically by most of computer manufacturers. It consists of the placement of IC modules, the assignment of IC pins and the assignment of package terminal.

c. Routing and artwork generation are being done automatically.

II. APPLICATION OF DESIGN AUTOMATION SYSTEMS IN JAPAN

a) As a result of a high speed and high density requirement of the logic equipments, there is a growing trend to increase the phases of the design cycle where computer aided design techniques can make the most significant impact in the computer design area.

b) Experience has dictated the following requirements for a Design Automation System:

(1) Automation of the logic and system design aspects of computer design.

(2) D.A. System should follow technical innovations in hardware design.

(3) Simplicity of usage of D.A. Systems is a must.

(4) The design engineer must be able to devote his efforts to the creative work in the systems design area leaving the tedious calculations and routine design efforts to the computer.

(5) Minimization of quantity of documents produced by a D.A. System is a necessity; however, the documents should be self explanatory.

(6) Maximum utilization of man-machine interfaces by the D.A. System should be encouraged.

(7) Adaptability of the design automation system to allow for changes in the physical design techniques.

III. FUTURE WORK - Design Automation areas in which the Japanese computer industry is expected to concentrate its efforts are:

1. Computer-aided logic and system design

This is one of the most popular subjects of common interest among Japan computer manufacturers and universities. This work includes investigation of design languages and hardware compilers for the design languages.

2. Microprogramming D.A.

3. Automated Partitioning

4. MSI and LSI oriented packaging techniques

5. (a) General purpose data base optimal host language
(b) PL/1 has not been but will be used

6. Interactive design via graphical terminals and teletypes

7. Efficient System Simulation and evaluation techniques

8. New, efficient logic synthesis algorithm

9. Data base: data structure and data description language

IV. COMMENTS

The current trend is toward the automation of high level design (system and logic design). In other words, the goal is to generate the system and logic diagrams with minimum amounts of human intervention. Such observation is obtained mainly from two sources: (1) After the author of this paper presented the paper, "An Interactive Design Automation System" (A system for computer-aided analysis and logic design of digital networks) at the 10th Annual Design Automation Workshop on June 27, 1973, many people from various countries expressed their interests in this area and requested more detailed information and (2) It was pointed out in the final Panel Discussion

Session (consisting of all Session Chairmen and the D.A. Workshop Committee) that computer-aided logic and system design is an important goal to achieve. Clearly, it is a gap to be bridged in order to obtain a total design automation system.

One of the biggest problems in computer design is the mismatch between software and hardware. Therefore, future design automation systems should emphasize integrated hardware, software and firmware design. Our goal is to have a design automation system which is capable of modeling and generating not only hardware but also software and firmware. A multi-level modeling philosophy and design language has been presented in (3). A system is considered to have a control part and a structure part. The designer can specify his design in any level of detail he wants. The language is relatively simple and is suitable for an interactive environment. The language, in its present form, is for logic and system hardware design. Future work includes using basically the same modeling philosophy for modeling and generation of firmware and software.

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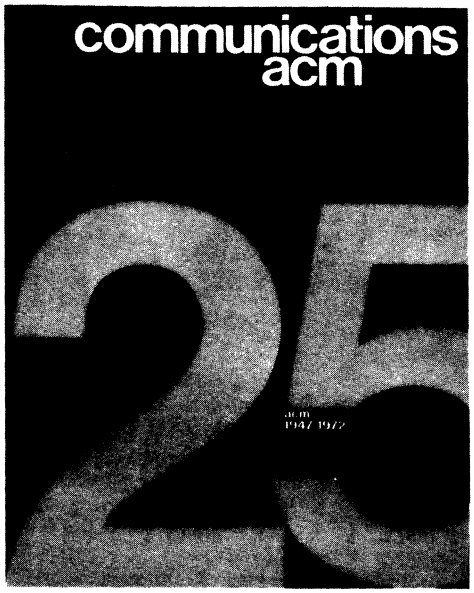

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