



ASP-DAC
Asia and South Pacific
Design Automation Conference 2000

January 25 - 28, 2000
Pacifico Yokohama,
Yokohama, Japan

Click on the text below to go to:

Cover Page
Front Matter
Table of Contents
Session Index

Author Index

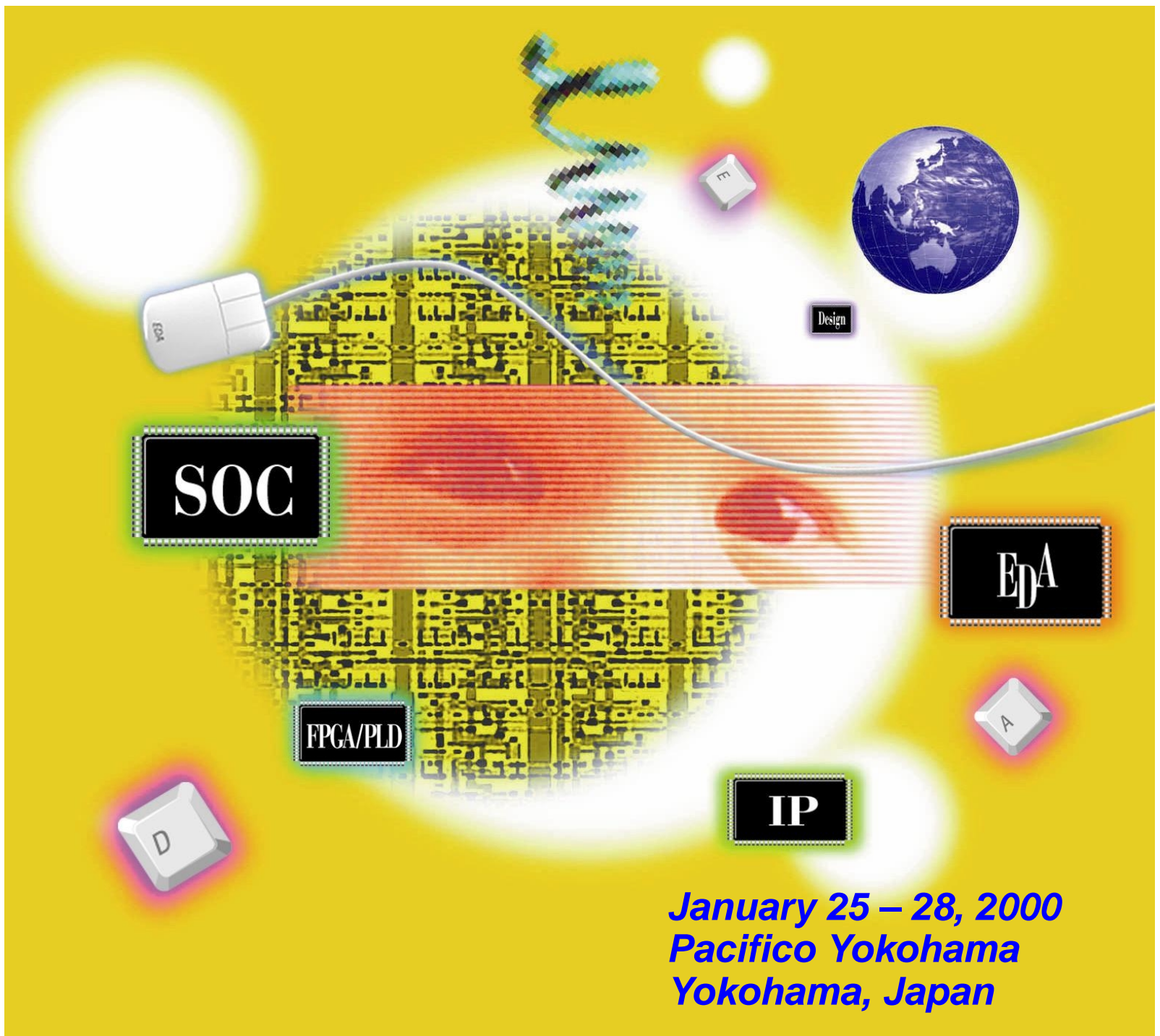
PROCEEDINGS

ASP-DAC 2000

Asia and South Pacific Design Automation Conference 2000

with

EDA TechnoFair 2000



January 25 – 28, 2000
Pacifico Yokohama
Yokohama, Japan

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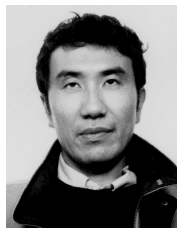


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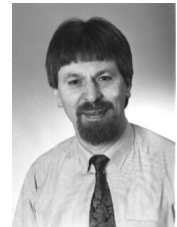
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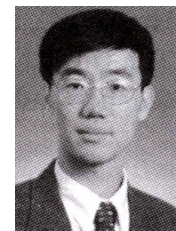


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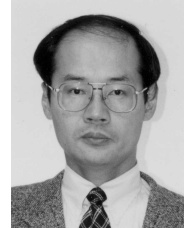
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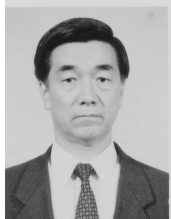
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ASP-DAC 2000 General Chair's Message

Welcome to ASP-DAC 2000

On behalf of the Organizing Committee, I would like to welcome you to the Asia and South Pacific Design Automation Conference 2000 (ASP-DAC 2000). This year's ASP-DAC will be held again in the Pacifico Yokohama, Japan, jointly with EDA TechnoFair 2000, premier Japanese EDA exhibition. The goal of the ASP-DAC is to provide an international forum for researchers and engineers in academia and industry, in the area of electronic system/VLSI design, and DA/CAD. ASP-DAC is a sister conference of DAC in the USA and DATE in Europe.



Three keynote speakers will talk about future directions of VLSI design technologies from different points of view. Dr. Shojiro Asai, Corporate Officer & President of Hitachi R & D Group will talk about the impact of communications convergence on VLSI. Prof. C. L. Liu, President of National Tsing Hua University, Taiwan, will talk about education, design and fabrication technologies. And, finally, Mr. Willam Herrick, Director of Compaq Alpha Development Group, USA, will talk about challenges in multi-GHz processor designs.

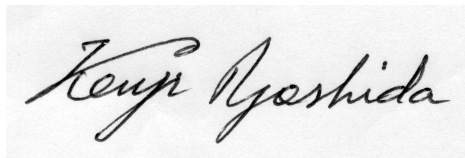
An excellent technical program has been organized by the committee co-chaired by Prof. H. Kunieda and Prof. C.M. Kyung, and with voluntary work of numerous experts from worldwide. This year we have an increased number of paper submissions in a wide spectrum of technical areas, and also from variety of geographical regions. 90 papers selected have been organized into five tracks; LSI Design, System DA, Logic and Test, Physical DA, and Circuit and Device CAD. Each of them also includes special sessions, panels, embedded tutorials or invited talks by distinguished speakers. Among panels, a panel by EDA vendor executive is planned just after the opening session on Wednesday. They will talk on their strategies to solve the next generation design challenges.

A unique feature of ASP-DAC is the University LSI Design Contest, which focuses a real chip design in academia. 18 designs have been selected for poster presentation, from which 3 or 4 award winners will be selected at the conference.

On Tuesday, full day tutorials are scheduled to give complete introductions of five state-of-the-art design/CAD topics; (1) Embedded Microprocessor Design, (2) Power Reduction Techniques, (3) Test Techniques, (4) Front-End Optimization and Verification, and (5) Ultra Deep Submicron Design and Analysis.

Our community is now facing tremendous challenges caused by accelerated scaling down and ever increasing complexity of System-on-a-Chip. I believe the ASP-DAC 2000 will be a precious opportunity for you to find many hints for your solution by meeting, talking and exchanging ideas with many leading edge researchers, or friends of yours, in the same, or different, technical areas.

I hope you will have a valuable and enjoyable experience at Yokohama, Japan, in next January.

A handwritten signature in black ink that reads "Kenji Yoshida". The signature is written in a cursive, flowing style.

Kenji Yoshida
General Chair, ASP-DAC 2000

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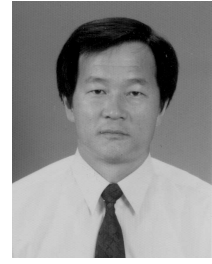
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Technical Program Co-Chairs' Message

On behalf of the Technical Program Committee of ASP-DAC 2000, I would like to welcome all of you to ASP-DAC in the memorial year of 2000. Following the past successful conferences in Tokyo (1995, 1997, 1998) and in Hong Kong (1999), the Committee has invited contributions for 2000 conference in the area of Design Automation of various design stages and LSI design methodologies.



Hiroaki Kunieda



Chong-Min Kyung

This year, our committee specifically introduced LSI Development into the area of interest for the ASP-DAC 2000 Technical Program. The number of gates on a chip is rapidly approaching 10 million gates. System-On-A-Chip is now in our hands. As the roles of CAD tools in these highly complex system designs become more and more important, CAD tool designers have to pay particularly close attention to the latest system design examples and methodologies. In this context, we believe that our ASP-DAC needs to increase presentations of LSI developments, to provide a place where system designers and CAD designers can exchange ideas and establish an intensive and mutual understandings of the important problems we are currently facing.

Also, reflecting the current trend of System-On-A-Chip, there is a great increase in paper submissions related to system-level design automation which includes software/hardware codesign, a variety of system-level optimization issues, system description languages, etc. Physical layout CAD continues to provide challenging new topics and maintains to be one of the major contributors to this conference. Especially, continuous efforts on conquering various layout problems in deep submicron process have been undertaken by many researchers.

For this conference, 144 technical papers were submitted from 14 countries. The technical program committee have reviewed all the submitted papers and accepted 80 regular papers and 10 short papers for presentation at the conference. We have organized the session tracks based on the field categories, each of which runs in the same room. They are 1) LSI Design Track, 2) System DA track, 3) Logic DA track including testing, 4) Physical DA track, 5) Device CAD track including Analog DA. They are designed so that the participants can easily follow the session tracks related to their own fields.

There are also 8 special sessions and panel sessions included in our technical program, inviting a number of distinguished researchers from around the world. These sessions address a wide variety of important issues such as CAD for embedded systems, System-In-Packaging (SIP), timing closure between logic and physical designs, issues on industry-academia cooperation, and system level design languages. Also, there are a number of embedded tutorials and invited talks within the regular sessions. We would like to express our appreciations for the efforts of organizers, chairs, panelists and invited speakers, which add special values to our program.

Best paper awards are presented to the authors whose papers are of exceptionally high quality among all the presented papers. 7 best paper award candidates were first nominated by the Technical Program Committee, where they were further subjected to intensive evaluation by the Committee.

As co-chair of ASP-DAC 2000 Technical Program Committee, I am really grateful for all of the members of our committee, organizers of special sessions and panel sessions, chairs and speakers of special sessions and regular sessions for their continuing efforts. Among them, I really appreciate TPC secretaries, Dr. Kazuhito Ito, Dr. Kei Suzuki and Dr. Tsuyoshi Isshiki for their dedications. Without them, ASP-DAC 2000 could not be held. At last, I would like to emphasize that the real success depends on how much all of you, the participants of ASP-DAC 2000, show your attention and join the conference activity. In other words, I hope you can enjoy 3 days hot discussions through this conference. Please join us.

A handwritten signature in black ink, appearing to read 'H. Kunieda', written over a light grey background.

A handwritten signature in black ink, appearing to read 'Chong-Min Kyung', written over a light grey background.

Hiroaki Kunieda and Chong-Min Kyung
Co-Chairs, ASP-DAC 2000 Program Committee

ASP-DAC 2000 Best Paper Award Candidates

- E7.1 “A 12b 50 MHz 3.3V CMOS Acquisition Time Minimized A/D Converter”**, Young-Deuk Jeon, Byeong-Lyeol Jeon, Hyoung-Kyu Choi, Seung-Hoon Lee (Sogang Univ., Korea) [LSI Development]
- A6.1 “Optimization of VDD and VTH for Low-Power and High Speed Applications”**, Koichi Nose, Takayasu Sakurai (Univ. of Tokyo, Japan) [Designs]
- B2.1 “A New Method for Constructing IP Level Power Model Based on Power Sensitivity”**, Heng-Liang Huang, Jiing-Yuan Lin, Wen-Zen Shen, Jing-Yang Jou (Nat'l Chaio-Tung Univ., Taiwan) [Design Methods & Environments]
- C5.1 “Performance-Optimal Clustering with Retiming for Sequential Circuits”**, Tzu-Chieh Tien, Youn-Long Lin (Tsing Hua Univ., Taiwan) [Logic Synthesis]
- D3.1 “Delay-Optimal Wiring Plan for the Microprocessor of High Performance Computing Machine”**, Jun Kikuchi, Tetsuo Sasaki, Tohru Hashimoto, Kazuhisa Miyamoto (Hitachi, Japan) [Physical DA]
- D6.1 “A Cell Synthesis Method for Salicide Process”**, Kazuhisa Okada, Takayuki Yamanouchi, Taksahi Kambe (Sharp, Japan) [Physical DA]
- E4.2 “Circuit Performance Oriented Device Optimization using BSIM3 Pre-Silicon Model Parameters”**, Mikako Miyama, Shiro Kamohara, (Hitachi, Japan) [T-CAD]

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University LSI Design Contest Co-Chairs' Message

The University LSI Design Contest was born a unique program of ASP-DAC Conference. The purpose of the Contest is to encourage education and research on LSI design and its implementation into chips at universities, and other educational organizations, by providing the opportunities to present and discuss their latest designs at the conference.

Application areas and types of circuits include (1) Analog and Mixed-Signal Circuits, (2) Digital Signal Processing, (3) Microprocessors, and (4) Custom Application Specific Circuits. Methods, or technology used for implementation include (a) Full Custom and Cell-Based LSIs, (b) Gate Arrays, and (c) Field Programmable Devices, including FPGA/PLDs. Actually implemented on real chips is required of all the designs.

This year, eighteen selected designs from four countries will be disclosed in Session A1, with a short aural presentations followed by Q & A, using posters. Three out of the eighteen are with analog and mixed signal, six are with microprocessors, and nine are with custom application specific circuits. Demonstrations on the achievements will also be made for some designs. Opportunities for demonstrations at EDA TechnoFair2000 will be provided for the above designs.

Submitted designs were reviewed by the members of the University Design Contest Committee, based on the following criteria: Reliability of design and implementation, Quality of implementation, Performance of the design, Novelty, and Additional factors. In the selection process, emphasis was placed more on reliability, quality, and performance, rather than on novelty of designs. AS a result, the eighteen designs were selected. And also, a certain number of awards will be given to outstanding designs, selected from those presented at the conference.

It is our great pleasure if the design contest will contribute to the promotion of research and education in LSI design field at academic organizations. It is also our hope that many people not only in academia but in industry will attend the contest and enjoy stimulating discussion.



Ryota Kasai



Anantha Chandrakasan



Hideharu Anamo

Ryota Kasai Anantha Chandrakasan

Ryota Kasai and Anantha Chandrakasan
Co-Chairs, University LSI Design Contest Committee

天野英晴

Hideharu Amano
Vice Chair, University LSI Design Contest Committee

ASP-DAC 2000 University LSI Design Contest Summary

Submission

Nineteen designs were submitted from four countries, Japan, Korea, China and Taiwan. Design area and methodologies are as follows. This year, most of design used full custom or cell based design methodology.

Country	Number of Submission	Application Area			Design Methodology		
		A	M	C	F/C	G/A	F/P
Japan	9	4	4	1	9	0	0
China	5	0	1	4	4	0	1
Korea	3	0	1	2	3	0	0
Taiwan	2	0	0	2	2	0	0

Area

A: Analog or A/D Mixed, M: Microprocessor or DSP, C: Custom or Application Specific

Methodology

G/A: Gate Array, F/P: FPGA/PLD

F/C: Full Custom/ Cell Based, G/A: Gate Array, F/P: FPGA/PLD

Paper Selection

Submitted designs were subjected to the reviewing by committee members who were classified into three groups corresponding areas: Analog or A/D Mixed, Microprocessor or DSP, and Custom or Application Specific. Each committee member was requested to fill in the review sheet, including the following criteria, rank and comments. (1) Reliability of design and implementation, (2) Quality of Implementation, (3) Performance of the Design, (4) Novelty of Application, Algorithm, Architecture, and Circuit configuration, (5) Additional Points, such as new design methodology and testability. Unlike usual reviews of technical papers, our evaluation of submitted placed more importance on how the LSI circuits were designed and implemented than anything else. Design selection was carried out the committee meeting held on September 21. Discussion on the selection rejection of each design was carried out, based on the recommendation points and comments. As a result, 18 designs are selected and are presented in these proceedings. One design was rejected, since it is too specific to interest the conference. A candidate for the Outstanding Design Award, and two candidates for Special Feature Awards were selected.

ASP-DAC 2000 University LSI Design Contest Awards

Outstanding Design Award

A VLSI Implementation of the Blowfish Encryption/Decryption Algorithm

Michael C.-J.Lin and Youn-Long Lin

(Department of Computer Science, National Tsing Hua University)

Outstanding Design Award presented for the implementation of a high performance cryptographic processor utilizing novel critical path reduction techniques at the logic and architecture levels.

Special Feature Award (Microprocessors/DSP)

An Application Specific JAVA Processor with Reconfigurabilities

Shinji Kimura, Hiyoyuki Kida, Kazuyoshi Takagi, Tatsumori Abematsu and
Katsumasa Watanabe

(Graduate School of Information Science, Nara Institute of Science and Technology)

Special Feature Award presented for incorporating reconfigurability into an embedded Java processor to enable instruction set customizations and facilitate access to external computational resources.

Special Feature Award (Analog / A/D Mixed)

A Smart Imager for the Vision Processing Front-END

Noriaki Takeda, Mitsuru Homma, Makoto Nagata, Takashi Morie and Atsushi Iwata
(Advanced Scientific of Matter, Hiroshima University)

Special Feature Award presented for utilizing novel PWM-based signal processing techniques for front-end processing in a CMOS imager for intelligent vision applications.

Keynote Address I

“The Impact of Communications Convergence on Silicon Integrated Circuits”

Shojiro Asai, Ph.D.

Corporate Officer and President,
Research & Development Group, Hitachi, Ltd., Japan



Telephone, wireless, datacom, and broadcasting are quickly converging around the internet, creating an integrated environment for work, education, entertainment, and shopping. You will have access to any service whether you are at home or on the road. In order to ensure the quality of services it is necessary to provide ubiquitous support, high bandwidth, security, and ease of use. A new family of integrated circuits that brings about this brave new world and the design methodology it requires will be described.

Keynote Address II

“Research, Design, and Fabrication - Brain Power, Tool Power, and Electric Power”

Prof. C. L. Liu, Sc.D.

President,
National Tsing Hua University, Hsin-chu, Taiwan



Research and education, design tools, and fabrication technology are key and inter-related ingredients in to-day's vast and rapidly growing micro-electronic economics. We shall examine some of the current issues and future challenges we are facing.

Keynote Address III

“Design Challenges in Multi-GHz Microprocessors”

William Herrick

Director, Alpha Microprocessor Development,
Compaq Computer Corporation, USA



Advances in semiconductor technology will soon enable multi-GHz microprocessors and present designers with opportunities and challenges. Transistors and interconnect will exhibit new behaviors which must be modeled. Logical and circuit complexity will explode making data management critical. Power distribution and clocking methods must be re-thought. A new generation of synthesizers must be developed and new electrical and timing verification tools must be created.

ASP-DAC 2000 EDA Vendor Executive Panel

Can We Rely on EDA Vendors for the Next Generation Design Technologies?

Organizer: Kenji Yoshida – *Toshiba Corp., Japan*

Moderator: Ron Collett – *Collett International, Inc., USA*

Panelists: Aart de Geus – *Synopsys, Inc., USA*

Shane Robison – *Cadence Design Systems, Inc. USA*

Wally Rhinse – *Mentor Graphics Corp., USA*

Jinya Katsube – *Zuken Inc., Japan*

Penny Herscher – *Simplex, Inc., USA*

Guido Arnout – *CoWare, Inc., USA*

Table of Contents

Organizing Committee	iii
Steering Committee	vi
General Chair's Message	x
Technical Program Committee	xi
Technical Program Co-Chair's Message	xv
Best Paper Award Candidates	xvi
University LSI Design Contest Committee	xvii
University LSI Design Contest Co-Chair's Message	xviii
University LSI Design Contest Summary	xix
University LSI Design Contest Awards	xx
Keynote Addresses	xxi
EDA Vendor Executive Panel	xxii

Session A1 (Special Session) University LSI Design Contest

Co-Chairs : *Ryota Kasai – NTT, Japan*
Anantha Chandrakasan – MIT, USA

A1.1	A VLSI Implementation of the Blowfish Encryption/Decryption Algorithm	
	<i>Michael C.-J. Lin, Youn-L. Lin</i>	1
A1.2	VLSI Implementation of Rake Receiver for IS-95 CDMA Testbed using FPGA	
	<i>Oliver Y-h. Leung, Chi-Y.Tsui, Roger S. Cheng</i>	3
A1.3	VLSI Implementation of a Switch Fabric for Mixed ATM and IP Traffic	
	<i>Chi-Y. Tsui, Louis Chung-Y. Kwan, Chin-T. Lea</i>	5
A1.4	Design of Digital Neural Cell Scheduler for Intelligent IB-ATM Switch	
	<i>J.Lee, S. Lee, M.Lee, D.Lee, Y.Kim, S.Jeong</i>	7
A1.5	Genetic Algorithm Accelerator GAA-II	
	<i>Shin'ichi Wakabayashi, Tetsuhi Koide, Nayoshi Toshine, Masataka Yamane, Hajime Ueno</i>	9
A1.6	A Programmable Built-In Self-Test Core for Embedded Memories	
	<i>Chih-T. Huang, Jing-R. Huang, Cheng-W. Wu</i>	11
A1.7	An Algorithm for VLSI Implementation of Highly Efficient Cubic-Polynomial Evaluation	
	<i>Fan Mo, Yiha Zhang, Jun Yu, Qianling Zhang</i>	13

A1.8	Design of Self-timed Asynchronous Booth's multiplier	
	<i>Tin-Y. Tang, Chin-S. Choy, Pui-L. Siu, Cheong-F. Chan</i>	15
A1.9	High Speed and Ultra-Low Power 16x16 MAC Design using TG for Web-based Multimedia System	
	<i>Seung-M. Lee, Jin-H. Chung, Hying-S. Yoon, Mike M-O. Lee</i>	17
A1.10	A Smart Imager for the Vision Processing Front-END	
	<i>Naoki Takeda, Mitsuru Homma, Makoto Nagata, Takashi Morie, Atsushi Iwata</i>	19
A1.11	A Bunary Image Sensor with Flexible Motion Vector Detection using Block Matching Method	
	<i>Tomohiro Nezuka, Takafumi Fujita, Makoto Ikeda, Kunihiro Asada</i>	21
A1.12	An Arbitrary Chaos Generator Core Circuit Using PWM/PPM Signals	
	<i>Kenichi Murakoshi, Takashi Morie, Makoto Nagata, Atushi Iwata</i>	23
A1.13	An Application Specific Java Processor with Reconfigurabilities	
	<i>Shinji Kimura, Hiroyuki Kida, Kazuyoshi Takagi, Tatsumori Abematsu, Katsumasa Watanabe</i>	25
A1.14	Reconfigurable Synchronized Dataflow Processor	
	<i>Hiroshi Sasaki, Hitoshi Maruyama, Hideaki Tsukioka, Nobuyoshi Shoji, Hiroaki Kobayashi, Tadao Nakamura</i>	27
A1.15	Prototype Microprocessor LSI with Scheduling Support Hardware for Operating System on Multiprocessor System	
	<i>Naoki Nishimura, Takahiro Sasaki, Tetsuo Hironaka</i>	29
A1.16	A Floating Point Arithmetic Unit for a Static Scheduling and Compiler Oriented Multiprocessor System ASCA	
	<i>Takahiro Kawaguti, Takayuki Suzuki, Hideharu Amano</i>	31
A1.17	A 16bit redundant binary multiplier using low-power pass-transistor logic SPL	
	<i>Hirofumi Sakamoto, Ken'ichiro Uda, Bu-Y. Lee, Hiroyuki Ochi, Kazuo Taki, Takao Tsuda</i>	33
A1.18	An 8x8 nRERL Serial Multiplier for Ultra-Low-Power Applications	
	<i>Joonho Lim, Dong-G. Kim, Sang-C. Kang, Soo-I. Chae</i>	35

Session B1 IP Reuse and Protection Methods

Co-Chairs : *Graham R. Hellestrand – VaST Systems Technology Corp., USA*
Minoru Yamamoto – Fujitsu Ltd., Japan

B1.1	Embedded Tutorial: Essential Issues for IP Reuse	
	<i>Daniel D. Gajski, Viraphol Chaiyakul, Allen C.-H. Wu, Shojiro Mori, Tom Nukiyama, Larry Rosenberg</i>	37
B1.2	Usage-Based Characterization of Complex Functional Blocks for Reuse in Behavioral Synthesis	
	<i>Nong Fan, Viraphol Chaiyakul, Daniel D. Gajski</i>	43
B1.3	Reuse and Protection of Intellectual Property in the SpecC System	
	<i>Rainer Doemer, Daniel D. Gajski</i>	49
B1.4	Fair Watermarking Techniques	
	<i>Gang Qu, Jennifer L. Wong, Miodrag Potkonjak</i>	55

Session C1 Decision Diagrams and Verification Methods

Co-Chairs : *Yirng-An Chen – National Chiao Tung Univ., Taiwan*
Kiyoharu Hamaguchi – Osaka Univ., Japan

C1.1	An Efficient Heuristic for State Encoding Minimizing the BDD Representations of the Transition Relations of Finite State Machines	
	<i>Riccardo Forth, Paul Molitor</i>	61
C1.2	Automatic Partitioning for Efficient Combinational Verification	
	<i>Rajarshi Mukherjee, Jawahar Jain, Koichiro Takayama, Masahiro Fujita</i>	67
C1.3	A Hardware Simulation Engine Based on Decision Diagrams (Short Paper)	
	<i>Yukihiro Iguchi, Tsutomu Sasao, Munehiro Matsuura, Atsumu Iseno</i>	73
C1.4	Formal Verification based on Assume and Guarantee Approach - A Case Study (Short Paper)	
	<i>Subir K. Roy, Hiroaki Iwashita, Tsuneo Nakata</i>	77
C1.5	Multi-Clock Path Analysis Using Propositional Satisfiability	
	<i>Kazuhiro Nakamura, Shinji Maruoka, Shinji Kimura, Katsumasa Watanabe</i>	81

Session D1 Routing in Deep-Submicron

Co-Chairs : *Jason Cong – Univ. of California, Los Angeles, USA*
Takumi Okamoto – NEC Corp., Japan

D1.1	Self-Reforming Routing for Stochastic Search in VLSI Interconnection Layout	
	<i>Yukiko Kubo, Yasuhiro Takashima, Shigetoshi Nakatake, Yoji Kajitani</i>	87
D1.2	An Interconnect Topology Optimization by a Tree Transformation	
	<i>Naofumi Tsujii, Katsutoshi Baba, Shuji Tsukiyama</i>	93
D1.3	Timing-Driven Hierarchical Global Routing with Wire-Sizing and Buffer-Insertion for VLSI with Multi-Routing-Layer	
	<i>Takahiro Deguchi, Tetsushi Koide, Shin'ichi Wakabayashi</i>	99
D1.4	Area Routing Oriented Hierarchical Corner Stitching with Partial Bin	
	<i>Zhang Yan, Wang Baohua, Cai Yici, Hong Xianlong</i>	105

Session A2 (Special Session) CAD for Embedded Systems

Chair : *Miodrag Potkonjak – Univ. of California, Los Angeles, USA*

A2.1	Offline Program Re-mapping to Improve Branch Prediction Efficiency in Embedded Systems	
	<i>Stephen S. Brown, Jeet Asher, William H. Mangione-Smith</i>	111
A2.2	Timing Driven Co-design of Networked Embedded Systems	
	<i>Dinesh Ramanathan, Ravindra Jejurikar, Rajesh K. Gupta</i>	117
A2.3	Low-power Design Methodology and Applications utilizing Dual Supply Voltages	
	<i>Kimiyoshi Usami, Mutsunori Igarashi</i>	123
A2.4	Co-Synthesis with custom ASICs	
	<i>Yuan Xie, Wayne Wolf</i>	129

Session B2 System-Level Power Optimization & Estimation

Co-Chairs : Akira Matsuzawa – Matsushita Electrical Industrial, Co. Ltd., Japan
Masato Edahiro – NEC Corp., Japan

B2.1	A New Method for Constructing IP Level Power Model Based on Power Sensitivity	
	<i>Heng-Liang Huang, Jiing-Yuan Lin, Wen-Zen Shen, Jing-Yang Jou</i>	135
B2.2	A hybrid approach for core-based system-level power modeling	
	<i>Tony Givargis, Frank Vahid, Joerg Henkel</i>	141
B2.3	Voltage Reduction of Application-Specific Heterogeneous Multiprocessor Systems for Power Minimisation	
	<i>Allan Rae, Sri Parameswaran</i>	147
B2.4	Withdrawn	
B2.5	Synthesis of Low Power Folded Programmable Coefficient FIR Digital Filters (Short Paper)	
	<i>Vijay Sundararajan, Keshab K. Parhi</i>	153

Session C2 Design Environment for FPGA

Co-Chairs : Shinji Kimura – Nara Inst. of Science and Technology, Japan
Kazutoshi Wakabayashi – NEC Corp., Japan

C2.1	Invited Talk : Synthesis Challenges for Next-Generation High-Performance and High-Density PLDs	
	<i>Jason Cong, Songjie Xu</i>	157
C2.2	KressArray Xplorer: A New CAD Environment to Optimize Reconfigurable Datapath Array Architectures	
	<i>Reiner Hartenstein, Michael Herz, Thomas Hoffmann, Ulrich Nageldinger</i>	163
C2.3	Hardware-Software Cosynthesis for Run-time Incrementally Reconfigurable FPGAs	
	<i>Byungil Jeong, Sungjoo Yoo, Sunghyun Lee, Kiyoun Choi</i>	169

Session D2 Placement Consistent with Routing

Co-Chairs : Yu-Liang Wu – Chinese University of Hong Kong, China
Hiroshi Murata – Microark, Japan

D2.1	A New Encoding Scheme for Rectangle Packing Problem	
	<i>Toshihiko Takahashi</i>	175
D2.2	Analytical Minimization of Half-Perimeter Wirelength	
	<i>Andrew A. Kennings, Igor L. Markov</i>	179
D2.3	Modeling and Minimization of Routing Congestion	
	<i>Maogang Wang, Majid Sarrafzadeh</i>	185

**Session E2 (Special Session)
System-In-Package (SIP)**

Chair : *Wayne W.-M. Dai – Univ. of California, Santa Cruz, USA*

E2.1	System-In-Package (SIP): Challenges and Opportunities	
	<i>King L. Tai</i>	191
E2.2	Taiwan Foundry for System-In-Package (SIP)	
	<i>Albert Lin</i>	197
E2.3	Integration of Large-Scale FPGA and DRAM in a Package Using Chip-On-Chip Technology	
	<i>Michael X. Wang, Katsuharu Suzuki, Wayne W.-M. Dai, Yee L. Low, Kevin J. O'conner, King L. Tai</i>	205
E2.4	Modeling and Analysis of Integrated Spiral Inductors for RF System-In-Package	
	<i>Minqing Liu, Wayne W.-M. Dai</i>	211

**Session A3
Low Power Design : Implementation**

Co-Chairs : *Shoji Kawahito – Toyohashi Univ. of Technology, Japan*
Jan M. Rabaey – Univ. of California, Berkeley, USA

A3.1	Narrow Bus Encoding for Low Power Systems	
	<i>Youngsoo Shin, Kiyoungh Choi</i>	217
A3.2	Data Transmission over a Bus with Peak-Limited Transition Activity	
	<i>Vijay Sundararajan, Keshab K. Parhi</i>	221
A3.3	Power Analysis and Implementation of a Low-Power 300 MHz 8-b x 8-b Pipelined Multiplier	
	<i>Jinn-Shyan Wang, Po-Hui Yang</i>	225

**Session B3
Embedded Software**

Co-Chairs : *Peter Marwedel – Univ. of Dortmund, Germany*
Hiroaki Takada – Toyohashi University of Technology, Japan

B3.1	A New Approach to Assembly Software Retargeting for Microcontrollers	
	<i>Ing-Jer Huang, Dao-Zhen Chen</i>	229
B3.2	Register Allocation for Common Subexpressions in DSP Data Paths	
	<i>Rainer Leupers</i>	235
B3.3	A Technique for QoS-based System Partitioning	
	<i>Johnson S. Kin, Chunho Lee, William H. Mangione-Smith, Miodrag Potkonjak</i>	241

Session C3 Implementation of Boolean Functions

Co-Chairs : *Yusuke Matsunaga – Fujitsu Laboratories, Ltd., Japan*
Hiroyuki Ochi – Hiroshima City Univ., Japan

C3.1	Exact minimization of fixed polarity Reed-Muller expressions for incompletely specified functions	
	<i>Debatosh Debnath, Tsutomu Sasao</i>	247
C3.2	An Efficient Framework of Using Various Decomposition Methods to Synthesize LUT Networks and Its Evaluation	
	<i>Shigeru Yamashita, Hiroshi Sawada, Akira Nagoya</i>	253
C3.3	Three Parameters to Find Functional Decompositions	
	<i>Tsutomu Sasao, Ken-ichi Kurimoto</i>	259

Session D3 Physical Design Planning

Co-Chairs : *Wayne W.-M. Dai – Univ. of California, Santa Cruz, USA*
Shuji Tsukiyama – Chuo Univ., Japan

D3.1	Delay-Optimal Wiring Plan for the Microprocessor of High Performance Computing Machines	
	<i>Jun Kikuchi, Tetsuo Sasaki, Tohru Hashimoto, Kazuhisa Miyamoto</i>	265
D3.2	MMP : A Novel Placement Algorithm for Combined Macro Block and Standard Cell Layout Design	
	<i>Hong Yu, Xianlong Hong, Yici Cai</i>	271
D3.3	Dynamic Weighting Monte Carlo for Constrained Floorplan Designs in Mixed Signal Application	
	<i>Jason Cong, Tianming Kong, Dongmin Xu, Faming Liang, Jun S. Liu, Wing Hung Wong</i>	277

Session E3 Methodologies for Reliable Design

Co-Chairs : *Mitiko Miura-Mattausch – Hiroshima Univ., Japan*
Andrzej J. Strojwas – Carnegie Mellon Univ., USA

E3.1	Symbolic Circuit-Noise Analysis and Modeling with Determinant Decision Diagrams	
	<i>XiangDong Tan, C.-J. Richard Shi</i>	283
E3.2	Gate-Level Aged Timing Simulation Methodology for Hot-Carrier Reliability Assurance	
	<i>Yoshiyuki Kawakami, Jingkun Fang, Hirokazu Yonezawa, Nobufusa Iwanishi, Lifeng Wu, Alvin I-Hsien Chen, Norio Koike, Ping Chen, Chune-Sin Yeh, Zhihong Liu</i>	289
E3.3	Embedded Tutorial : Subwavelength Lithography Technologies (PSM, OPC)	
	<i>Tsuneo Terasawa</i>	295

Session A4 Synthesis for System-On-A-Chip

Co-Chairs : *Rolf Ernst – Technical Univ. Braunschweig, Germany*
Ahmed A. Jerraya – TIMA Laboratory, France

A4.1	Embedded Tutorial : IC Design Technology for Building System-On-A-Chip	
	<i>Rajesh Gupta</i>	301
A4.2	Thread Partitioning Method for Hardware Compiler Bach	
	<i>Mizuki Takahashi, Nagisa Ishiura, Akihisa Yamada, Takashi Kambe</i>	303
A4.3	An Area/Time Optimizing Algorithm in High-Level Synthesis for Control-Based Hardwares (Short Paper)	
	<i>Nozomu Togawa, Masayuki Ienaga, Masao Yanagisawa, Tatsuo Ohtsuki</i>	309
A4.4	A Timing-Driven Synthesis of Arithmetic Circuits using Carry-Save-Adders (Short Paper)	
	<i>Taewhan Kim, Junhyung Um</i>	313

Session B4 Reconfigurable Computation

Co-Chairs : *Toshiaki Miyazaki – NTT Network Innovation Laboratories, Japan*
Tetsuo Hironaka – Hiroshima City Univ., Japan

B4.1	Communicating Logic : An Alternative Embedded Stream Processing Paradigm	
	<i>Norbert Imlig, Ryusuke Konishi, Tsunemichi Shiozawa, Kiyoshi Oguri, Kouichi Nagami, Hideyuki Ito, Minoru Inamori, Hiroshi Nakada</i>	317
B4.2	A Scheduling and Allocation Method to Reduce Data Transfer Time by Dynamic Re-configuration	
	<i>Kazuhito Ito</i>	323
B4.3	Invited Talk : Reconfigurable Computing: Its Concept and a Practical Embodiment using Newly Developed Dynamically Reconfigurable Logic (DRL) LSI	
	<i>Masakazu Yamashina, Masato Motomura</i>	329

Session C4 Synthesis for Low Power

Co-Chairs : *Akira Nagoya – NTT Communication Science Laboratories, Japan*
Manish Pandey – Cadence Design Systems, Inc., USA

C4.1	Power Reduction by Simultaneous Voltage Scaling and Gate Sizing	
	<i>Chunhong Chen, Majid Sarrafzadeh</i>	333
C4.2	Analysis of Power-Clocked CMOS with Application to the Design of Energy-Recovery Circuits	
	<i>Massoud Pedram, Xunwei Wu</i>	339
C4.3	Low-Power Design of Sequential Circuits Using a Quasi-Synchronous Derived Clock	
	<i>Xunwei Wu, Jian Wei, Massoud Pedram, Qing Wu</i>	345
C4.4	FSM Decomposition by Direct Circuit Manipulation Applied to Low Power Design	
	<i>Jose C. Monteiro, Arlindo L. Oliveira</i>	351

Session D4 (Panel Discussion)
Timing Closure : The Solution and Its Problems

Organizer: *Ralph H.J.M. Otten – Delft University of Technology, The Netherlands*
Moderator: *Ralph H.J.M. Otten – Delft University of Technology, The Netherlands*
Panelists: *Raul Camposano (Synopsys, Inc., USA), Oliver Coudert (Monterey Design Systems, Inc., USA), Patrick Groeneveld (Magma Design Automation, USA), Leon Stok (Thomas J. Watson Research Center, IBM, USA) 359*

Session E4
MOSFET Device Optimization

Co-Chairs : *Naoyuki Shigyo – Toshiba Corp., Japan*
C.-J. Richard Shi – Univ. of Washington, USA

E4.1	High Performance of Short-Channel MOSFETs due to an Elevated Central-Channel Doping	
	<i>M. Tanaka, N. Tokida, T. Okagaki, M. Miura-Mattausch, W. Hansch, H. J. Mattausch</i>	<i>365</i>
E4.2	Circuit Performance Oriented Device Optimization using BSIM3 Pre-Silicon Model Parameters	
	<i>Mikako Miyama, Shiro Kamohara</i>	<i>371</i>
E4.3	Embedded Tutorial : Design for Manufacturability	
	<i>Andrzej J. Strojwas</i>	<i>375</i>

Session A5
Low Power Design : System Approach

Co-Chairs : *Keshab K. Parhi – Univ. of Minnesota, USA*
Koji Kotani – Tohoku Univ., Japan

A5.1	Embedded Tutorial : Low-Power Silicon Architectures for Wireless Communications	
	<i>Jan Rabaey</i>	<i>377</i>
A5.2	Run-time Power Control Scheme using Software Feedback Loop for Low-power Real-time Application	
	<i>Seongsoo Lee, Takayasu Sakurai</i>	<i>381</i>
A5.3	An Interleaved Dual-Battery Power Supply for Battery-Operated Electronics	
	<i>Qing Wu, Qinru Qiu, Massoud Pedram</i>	<i>387</i>

Session B5 System Design and Debugging

Co-Chairs : *Rajesh Gupta – Univ. of California, Irvine, USA*
Takashi Kambe – Sharp Corp., Japan

B5.1	Embedded Tutorial : Multilanguage System Design	
	<i>Rolf Ernst, Ahmed A. Jerraya</i>	391
B5.2	Symbolic Debugging of Globally Behavioral Specifications	
	<i>Darko Kirovski, Inki Hong, Miodrag Potkonjak, Marios C. Papaefthymiou</i>	397
B5.3	Fast Development of Source-level Debugging System Using Hardware Emulation (Short Paper)	
	<i>Sang-Joon Nam, Jun-Hee Lee, Byoung-Woon Kim, Yeon-Ho Im, Young-Su Kwon, Kyong-Gu Kang, Chong-Min Kyung</i>	401
B5.4	Methodology for Hardware/Software Co-verification in C/C++ (Short Paper)	
	<i>Luc Semeria, Abhijit Ghosh</i>	405

Session C5 Optimization Issues in Logic Synthesis

Co-Chairs : *Tsutomu Sasao – Kyushu Inst. of Technology, Japan*
Shin'ichi Minato – NTT Network Innovation Laboratories, Japan

C5.1	Performance-Optimal Clustering with Retiming for Sequential Circuits	
	<i>Tzu-Chieh Tien, Youn-Long Lin</i>	409
C5.2	IBAW: An Implication-Tree Based Alternative-Wiring Logic Transformation Algorithm	
	<i>Wangning Long, Yu-Liang Wu, Jinian Bian</i>	415
C5.3	On Mixture Density and Maximum Likelihood Power Estimation via Expectation-Maximization	
	<i>R. Chandramouli, Vamsi K. Srikantam</i>	423

Session D5 Novel Techniques in Advanced Partitioning

Co-Chairs : *Shin'ichi Wakabayashi – Hiroshima Univ., Japan*
Tetsushi Koide – Univ. of Tokyo, Japan

D5.1	Edge Separability Based Circuit Clustering with Application to Circuit Partitioning	
	<i>Jason Cong, Sung Kyu Lim</i>	429
D5.2	Feasible Two-Way Circuit Partitioning with Complex Resource Constraints	
	<i>Hsun-Cheng Lee, Ting-Chi Wang</i>	435
D5.3	Performance Driven Multiway Partitioning	
	<i>Jason Cong, Sung Kyu Lim</i>	441

Session E5 Efficient Estimation for Interconnection

Co-Chairs : *Hiroshi Matsumoto – NEC Corp., Japan*
Xianlong Hong – Tsinghua Univ., China

E5.1	Hierarchical Computation of 3-D Interconnect Capacitance using Direct Boundary Element Method	
	<i>Jiangchun Gu, Zeyi Wang, Xianlong Hong</i>	447
E5.2	A Simplified Hybrid Method for Calculating the Frequency-dependent Inductances of Transmission Lines with Rectangular Cross Section	
	<i>Shuzhou Fang, Xiaobo Tang, Zeyi Wang, Xianlong Hong</i>	453
E5.3	An Analytic Calculation Method for Delay Time of RC-class Interconnects	
	<i>W. K. Kal, S. Y. Kim</i>	457
E5.4	A New Efficient Waveform Simulation Method for RLC Interconnect via Amplitude and Phase Approximation	
	<i>Xiaodong Yang, Walter H. Ku, Chung-Kuan Cheng</i>	463

Session A6 Optimized LSI Design

Co-Chairs : *Chong-Min Kyung – Korea Advanced Inst. of Science and Technology, Korea*
Takashi Morie – Hiroshima Univ., Japan

A6.1	Optimization of VDD and VTH for Low-Power and High Speed Applications	
	<i>Koichi Nose, Takayasu Sakurai</i>	469
A6.2	Compact yet High Performance (CyHP) Library for Short Time-to-Market with New Technologies	
	<i>Nguyen Minh Duc, Takayasu Sakurai</i>	475
A6.3	A New CMAC Neural Network Architecture and Its ASIC Realization	
	<i>Yuan-Bao Hsu, Kao-Shing Hwang, Chien-Yuan Pao, Jinn-Shyan Wang</i>	481

Session B6 DSP and Memory Architecture

Co-Chairs : *Ichiro Kuroda – NEC Corp., Japan*
Keshab K. Parhi – Univ. of Minnesota, USA

B6.1	Retargetable Estimation Scheme for DSP Architecture Selection	
	<i>Naji Ghazal, Richard Newton, Jan Rabaey</i>	485
B6.2	Data Memory Minimization by Sharing Large Size Buffers	
	<i>Hyunok Oh, Soonhoi Ha</i>	491
B6.3	Array Allocation Taking into Account SDRAM Characteristics	
	<i>Hong-Kai Chang, Youn-Long Lin</i>	497

Session C6 Validation and Test

Co-Chairs : *Cheng-Wen Wu – Univ. of California, Santa Barbara, USA*
Tomoo Inoue – Hiroshima City Univ., Japan

C6.1	Causality Based Generation Of Directed Test Cases	
	<i>Nina Saxena, Jacob Abraham, Avijit Saha</i>	503
C6.2	Embedded Tutorial : Fault models and test generation for IDDQ Testing	
	<i>Yoshinobu Higami, Kewal K. Saluja, Yuzo Takamatsu, Kozo Kinoshita</i>	509
C6.3	Embedded Tutorial : Issues on SOC Testing in DSM Era	
	<i>Takashi Aikyo</i>	515

Session D6 Cell Generation & Process Dependent Issues

Co-Chairs : *Jun-Dong Cho – Sungkyunkwan Univ., Korea*
Yoichi Shiraishi – Gunma Univ., Japan

D6.1	A Cell Synthesis Method for Salicide Process	
	<i>Kazuhisa Okada, Takayuki Yamanouchi, Takashi Kambe</i>	517
D6.2	Monte-Carlo Algorithms for Layout Density Control	
	<i>Yu Chen, Andrew B. Kahng, Gabriel Robins, Alex Zelikovsky</i>	523
D6.3	Layout Generation of Array Cell for NMOS 4-phase Dynamic Logic (Short Paper)	
	<i>Makoto Furuie, Bao-Yu Song, Yukihiro Yoshida, Takao Onoye, Isao Shirakawa</i>	529
D6.4	A New Efficient Method for Substrate-Aware Device-Level Placement (Short Paper)	
	<i>C. Lin, D. M. W. Leenaerts</i>	533

Session E6 Analysis Techniques for Analog Circuits

Co-Chairs : *Mineo Kaneko – Japan Advanced Inst. of Science and Technology, Japan*
Peter M. Lee – Hitachi Ltd., Japan

E6.1	The Enhancing of Efficiency of the Harmonic Balance Analysis by Adaptation of Pre-conditioner to Circuit Nonlinearity	
	<i>M. M. Gourary, S. G. Rusakov, S. L. Ulyanov, M. M. Zharov, K. K. Gullapalli, B. J. Mulvaney</i>	537
E6.2	Analog-Testability Analysis by Determinant-Decision-Diagrams based Symbolic Analysis	
	<i>Tao Pi, C.-J. Richard Shi</i>	541
E6.3	A Method for Linking Process-level Variability to System Performances	
	<i>Tomohiro Fujita, Ken-ichi Okada, Hiroaki Fujita, Hidetoshi Onodera, Keikichi Tamaru</i>	547

Session A7 Advanced Design Techniques for Deep-Submicron System-On-A-Chip

Co-Chairs : *Kazuo Yano – Hitachi, Ltd., Japan*
Takao Onoye – Kyoto Univ., Japan

A7.1	Embedded Tutorial : Design Challenges for 0.1um and Beyond	
	<i>Takayasu Sakurai</i>	553
A7.2	A Hardware Accelerator for the Specular Intensity of Phong Illumination Model in 3-Dimensional Graphics	
	<i>Young-Su Kwon, In-Cheol Park, Chong-Min Kyung</i>	559
A7.3	Radix-4 Modular Multiplication and Exponentiation Algorithms for the RSA Public-Key Cryptosystem	
	<i>Jin-Hua Hong, Cheng-Wen Wu</i>	565

Session B7 (Special Session) Future of System Level Design Languages

Chair : *Masaharu Imai – Osaka Univ., Japan*

B7.1	SLDL and Rosetta	
	<i>Steven Schulz – Texas Instruments, Inc., USA</i>	571
B7.2	SystemC Standard	
	<i>Guido Arnout</i>	573
B7.3	Java based object oriented hardware specification and synthesis,	
	<i>Tommy Kuhn, Wolfgang Rosenstiel</i>	579
B7.4	Superlog, A Unified Design Language for System-on-chip	
	<i>Peter Flake, Simon J. Davidmann</i>	583

Session C7 Delay Testing and Design-For-Testability

Co-Chairs : *Yukiya Miura – Tokyo Metropolitan Univ., Japan*
Hiroshi Date – Inst. of Systems & Information Technologies Kyushu, Japan

C7.1	Performance Sensitivity Analysis Using Statistical Method and Its Applications to Delay Testing	
	<i>Jing-Jia Liou, Angela Krstic, Kwang-Ting Cheng, Deb Aditya Mukherjee, Sandip Kundu</i>	587
C7.2	A Testability Metric for Path Delay Faults and Its Application	
	<i>Huan-Chih Tsai, Kwang-Ting Cheng, Vishwani D. Agrawal</i>	593
C7.3	A Non-Scan DFT Method at Register-Transfer Level to Achieve Complete Fault Efficiency	
	<i>Satoshi Ohtake, Hiroki Wada, Toshimitsu Masuzawa, Hideo Fujiwara</i>	599
C7.4	A Sigma-Delta Modulation Based BIST Scheme for Mixed-Signal Circuits	
	<i>Jiun-Lang Huang, Kwang-Ting Cheng</i>	605

Session D7 (Panel Discussion)
Industry-Academia Cooperation

Organizer: *Tokenori Kozawa – STARC, Japan*
Moderator: *Hiroto Yasuura – Kyushu Univ., Japan*
Panelists: *Bill Joyner (SRC, USA), Jan Rabaey (Univ. of California, Berkeley, USA), Ivo Bolson (IMEC, Belgium), Yoshiaki Masuhara (Hitachi Ltd., Japan) 611*

Session E7
Signal Integrity / Noise Issues in Deep-Submicron

Co-Chairs : *Hidetoshi Onodera – Kyoto Univ., Japan*
Nobuo Fujii – Tokyo Inst. of Technology, Japan

E7.1	A 12b 50 MHz 3.3V CMOS Acquisition Time Minimized A/D Converter <i>Young-Deuk Jeon, Byeong-Lyeol Jeon, Seung-Chul Lee, Sang-Min Yoo, Seung-Hoon Lee</i>	613
E7.2	A Benchmark Suite for Substrate Analysis <i>Edoardo Charbon, Luis Miguel Silveira, Paolo Miliozzi</i>	617
E7.3	Embedded Tutorial : Substrate Crosstalk Analysis in Mixed Signal CMOS Integrated Circuits <i>Makoto Nagata, Atsushi Iwata</i>	623

Session A8
High Speed LSI Design for Entertainment Application

Co-Chairs : *Takayasu Sakurai – Univ. of Tokyo, Japan*
Makoto Ikeda – Univ. of Tokyo, Japan

A8.1	Invited Talk : Importance of CAD Tools and Methodology in High Speed CPU Design <i>Haruyuki Tago, Kazuhiro Hashimoto, Nobuyuki Ikumi, Masato Nagamatsu, Yasuyuki Yamamoto, Masakazu Suzuoki</i>	631
A8.2	300MHz design methodology of VU for Emotion Synthesis <i>Takayuki Kamei, Hideki Takeda, Yukio Ootaguro, Takayoshi Shimazawa, Kazuhiko Tachibana, Shin'ichi Kawakami, Seiji Norimatsu, Fujio Ishihara, Toshinori Sato, Hiroaki Murakami, Nobuhiro Ide, Yukio Endo, Akira Aono, Atsushi Kunimatsu</i>	635
A8.3	Repeater Insertion Method and its application to a 300MHz 128-bit 2-way Superscalar Microprocessor <i>Norman Kojima, Yukiko Parameswar, Christian Klingner, Yukio Ohtaguro, Masataka Matsui, Shigeaki Iwasa, Tatsuo Teruyama, Takayoshi Shimazawa, Hideki Takeda, Kouji Hashizume, Haruyuki Tago, Masaaki Yamada</i>	641
A8.4	Clock Design of 300MHz 128-bit 2-way Superscalar Microprocessor <i>Fujio Ishihara, Christian Klingner, Ken-ichi Agawa</i>	647

Session B8 (Panel Discussion)

One Language or More? (How Can We Design an SoC at a System Level?)

Organizer: *Masaharu Imai – Osaka Univ., Japan*

Moderator: *Gary Smith – Dataquest, USA*

Panelists: *Steven Schulz [SLDL] (Texas Instruments, Inc., USA), Karen Bartleson [SystemC] (Synopsys, Inc., USA), Daniel D. Gajski [SpecC] (Univ. of California, Irvine, USA), Peter Flake [Superlog] (Co-Design Automation, Inc., USA), Wolfgang Rosenstiel [Java] (Univ. of Tuebingen, Germany), Hiroto Yasuura [C/C++] (Kyushu Univ., Japan), Masaharu Imai [VHDL] (Osaka Univ., Japan)*

653

Session D8 High Performance Partitioning

Co-Chairs : *Chung-Kuan Cheng – Univ. of California, San Diego, USA*
Toshiyuki Shibuya – Fujitsu Laboratories, Ltd., Japan

D8.1 Circuit Partitioning with Coupled Logic Restructuring Techniques

Yu-Liang Wu, Xiao-Long Yuan, David Ihsin Cheng 655

D8.2 Improved Algorithms for Hypergraph Bipartitioning

Andrew E. Caldwell, Andrew B. Kahng, Igor L. Markov 661

D8.3 Multi-way Partitioning Using Bi-partition Heuristics

Maogang Wang, Sung Lim, Jason Cong, Majid Sarrafzadeh 667

Author Index

A

Abematsu, Tatsumori(A1.13)(25)
Abraham, Jacob(C6.1)(503)
Agawa, Ken-ichi(A8.4)(647)
Agrawal, Vishwani D.(C7.2)(593)
Aikyo, Takashi(C6.3)(515)
Amano, Hideharu(A1.16)(31)
Aono, Akira(A8.2)(635)
Arnout, Guido(B7.2)(573)
Asada, Kunihiro(A1.11)(21)
Asher, Jeet(A2.1)(111)

B

Baba, Katsutoshi(D1.2)(93)
Baohua, Wang(D1.4)(105)
Bian, Jinian(C5.2)(415)
Brown, Stephen S.(A2.1)(111)

C

Cai, Yici(D3.2)(271)
Caldwell, Andrew E.(D8.2)(661)
Chae, Soo-I.(A1.18)(35)
Chaiyakul, Viraphol(B1.1)(37)
.....(B1.2)(43)
Chan, Cheong-F.(A1.8)(15)
Chandramouli, R.(C5.3)(423)
Chang, Hong-Kai(B6.3)(497)
Charbon, Edoardo(E7.2)(617)
Chen, Alvin I-Hsien(E3.2)(289)
Chen, Chunhong(C4.1)(333)
Chen, Dao-Zhen(B3.1)(229)
Chen, Ping(E3.2)(289)
Chen, Yu(D6.2)(523)
Cheng, Chung-Kuan(E5.4)(463)
Cheng, David Ihsin(D8.1)(655)
Cheng, Kwang-Ting(C7.1)(587)
.....(C7.2)(593)
.....(C7.4)(605)
Cheng, Roger S.(A1.2)(3)

Choi, Kiyoung(A3.1)(217)
.....(C2.3)(169)
Choy, Chin-S.(A1.8)(15)
Chung, Jin-H.(A1.9)(17)
Cong, Jason(C2.1)(157)
.....(D3.3)(277)
.....(D5.1)(429)
.....(D5.3)(441)
.....(D8.3)(667)

D

Dai, Wayne W.-M.(E2.3)(205)
.....(E2.4)(211)
Davidmann, Simon J.(B7.4)(583)
Debnath, Debatosh(C3.1)(247)
Deguchi, Takahiro(D1.3)(99)
Doemer, Rainer(B1.3)(49)
Duc, Nguyen Minh(A6.2)(475)

E

Endo, Yukio(A8.2)(635)
Ernst, Rolf(B5.1)(391)

F

Fan, Nong(B1.2)(43)
Fang, Jingkun(E3.2)(289)
Fang, Shuzhou(E5.2)(453)
Flake, Peter(B7.4)(583)
Forth, Riccardo(C1.1)(61)
Fujita, Hiroaki(E6.3)(547)
Fujita, Masahiro(C1.2)(67)
Fujita, Takafumi(A1.11)(21)
Fujita, Tomohiro(E6.3)(547)
Fujiwara, Hideo(C7.3)(599)
Furuie, Makoto(D6.3)(529)

G

Gajski, Daniel D.(B1.1)(37)
.....(B1.2)(43)
.....(B1.3)(49)

Ghazal, Naji	(B6.1)(485)
Ghosh, Abhijit	(B5.4)(405)
Givargis, Tony	(B2.2)(141)
Gourary, M. M.	(E6.1)(537)
Gu, Jiangchun	(E5.1)(447)
Gullapalli, K. K.	(E6.1)(537)
Gupta, Rajesh K.	(A2.2)(117)
	(A4.1)(301)

H

Ha, Soonhoi	(B6.2)(491)
Hansch, W.	(E4.1)(365)
Hartenstein, Reiner	(C2.2)(163)
Hashimoto, Kazuhiro	(A8.1)(631)
Hashimoto, Tohru	(D3.1)(265)
Hashizume, Kouji	(A8.3)(641)
Henkel, Joerg	(B2.2)(141)
Herz, Michael	(C2.2)(163)
Higami, Yoshinobu	(C6.2)(509)
Hironaka, Tetsuo	(A1.15)(29)
Hoffmann, Thomas	(C2.2)(163)
Homma, Mitsuru	(A1.10)(19)
Hong, Inki	(B5.2)(397)
Hong, Jin-Hua	(A7.3)(565)
Hong, Xianlong	(D3.2)(271)
	(E5.1)(447)
	(E5.2)(453)
Hsu, Yuan-Bao	(A6.3)(481)
Huang, Chih-T.	(A1.6)(11)
Huang, Heng-Liang	(B2.1)(135)
Huang, Ing-Jer	(B3.1)(229)
Huang, Jing-R.	(A1.6)(11)
Huang, Jiun-Lang	(C7.4)(605)
Hwang, Kao-Shing	(A6.3)(481)

I

Ide, Nobuhiro	(A8.2)(635)
Ienaga, Masayuki	(A4.3)(309)
Igarashi, Mutsunori	(A2.3)(123)
Iguchi, Yukihiro	(C1.3)(73)
Ikeda, Makoto	(A1.11)(21)
Ikumi, Nobuyuki	(A8.1)(631)
Im, Yeon-Ho	(B5.3)(401)
Imlig, Norbert	(B4.1)(317)

Inamori, Minoru	(B4.1)(317)
Isono, Atsumu	(C1.3)(73)
Ishihara, Fujio	(A8.2)(635)
	(A8.4)(647)
Ishiura, Nagisa	(A4.2)(303)
Ito, Hideyuki	(B4.1)(317)
Ito, Kazuhito	(B4.2)(323)
Iwanishi, Nobufusa	(E3.2)(289)
Iwasa, Shigeaki	(A8.3)(641)
Iwashita, Hiroaki	(C1.4)(77)
Iwata, Atsushi	(A1.10)(19)
	(E7.3)(623)
	(A1.12)(23)

J

Jain, Jawahar	(C1.2)(67)
Jejurikar, Ravindra	(A2.2)(117)
Jeon, Byeong-Lyeol	(E7.1)(613)
Jeon, Young-Deuk	(E7.1)(613)
Jeong, Byungil	(C2.3)(169)
Jeong, S.	(A1.4)(7)
Jerraya, Ahmed A.	(B5.1)(391)
Jou, Jing-Yang	(B2.1)(135)

K

Kahng, Andrew B.	(D6.2)(523)
	(D8.2)(661)
Kajitani, Yoji	(D1.1)(87)
Kal, W. K.	(E5.3)(457)
Kambe, Takashi	(A4.2)(303)
	(D6.1)(517)
Kamei, Takayuki	(A8.2)(635)
Kamohara, Shiro	(E4.2)(371)
Kang, Kyong-Gu	(B5.3)(401)
Kang, Sang-C.	(A1.18)(35)
Kawaguti, Takahiro	(A1.16)(31)
Kawakami, Shin'ichi	(A8.2)(635)
Kawakami, Yoshiyuki	(E3.2)(289)
Kennings, Andrew A.	(D2.2)(179)
Kida, Hiroyuki	(A1.13)(25)
Kikuchi, Jun	(D3.1)(265)
Kim, Byoung-Woon	(B5.3)(401)
Kim, Dong-G.	(A1.18)(35)
Kim, S. Y.	(E5.3)(457)

Motomura, Masato (B4.3)(329)
Mukherjee, Deb Aditya (C7.1)(587)
Mukherjee, Rajarshi (C1.2)(67)
Mulvaney, B. J. (E6.1)(537)
Murakami, Hiroaki (A8.2)(635)
Murakoshi, Kenichi (A1.12)(23)

N

Nagamatsu, Masato (A8.1)(631)
Nagami, Kouichi (B4.1)(317)
Nagata, Makoto (A1.10)(19)
..... (A1.12)(23)
..... (E7.3)(623)
Nageldinger, Ulrich (C2.2)(163)
Nagoya, Akira (C3.2)(253)
Nakada, Hiroshi (B4.1)(317)
Nakamura, Kazuhiro (C1.5)(81)
Nakamura, Tadao (A1.14)(27)
Nakata, Tsuneo (C1.4)(77)
Nakatake, Shigetoshi (D1.1)(87)
Nam, Sang-Joon (B5.3)(401)
Newton, Richard (B6.1)(485)
Nezuka, Tomohiro (A1.11)(21)
Nishimura, Naoki (A1.15)(29)
Norimatsu, Seiji (A8.2)(635)
Nose, Koichi (A6.1)(469)
Nukiyama, Tom (B1.1)(37)

O

O'conner, Kevin J. (E2.3)(205)
Ochi, Hiroyuki (A1.17)(33)
Oguri, Kiyoshi (B4.1)(317)
Oh, Hyunok (B6.2)(491)
Ohtaguro, Yukio (A8.3)(641)
Ohtake, Satoshi (C7.3)(599)
Ohtsuki, Tatsuo (A4.3)(309)
Okada, Kazuhisa (D6.1)(517)
Okada, Ken-ichi (E6.3)(547)
Okagaki, T. (E4.1)(365)
Oliveira, Arlindo L. (C4.4)(351)
Onodera, Hidetoshi (E6.3)(547)
Onoye, Takao (D6.3)(529)
Ootaguro, Yukio (A8.2)(635)

P

Pao, Chien-Yuan (A6.3)(481)
Papaefthymiou, Marios C. (B5.2)(397)
Parameswar, Yukiko (A8.3)(641)
Parameswaran, Sri (B2.3)(147)
Parhi, Keshab K. (A3.2)(221)
..... (B2.5)(153)
Park, In-Cheol (A7.2)(559)
Pedram, Massoud (A5.3)(387)
..... (C4.2)(339)
..... (C4.3)(345)
Pi, Tao (E6.2)(541)
Potkonjak, Miodrag (B1.4)(55)
..... (B3.3)(241)
..... (B5.2)(397)

Q

Qiu, Qinru (A5.3)(387)
Qu, Gang (B1.4)(55)

R

Rabaey, Jan (A5.1)(377)
..... (B6.1)(485)
Rae, Allan (B2.3)(147)
Ramanathan, Dinesh (A2.2)(117)
Robins, Gabriel (D6.2)(523)
Rosenberg, Larry (B1.1)(37)
Rosenstiel, Wolfgang (B7.3)(579)
Roy, Subir K. (C1.4)(77)
Rusakov, S. G. (E6.1)(537)

S

Saha, Avijit (C6.1)(503)
Sakamoto, Hirofumi (A1.17)(33)
Sakurai, Takayasu (A5.2)(381)
..... (A6.1)(469)
..... (A6.2)(475)
..... (A7.1)(553)
Saluja, Kewal K. (C6.2)(509)
Sarrafzadeh, Majid (C4.1)(333)
..... (D2.3)(185)
..... (D8.3)(667)
Sasaki, Hiroshi (A1.14)(27)

Watanabe, Katsumasa (A1.13)(25)
 (C1.5)(81)
 Wei, Jian (C4.3)(345)
 Wolf, Wayne (A2.4)(129)
 Wong, Jennifer L. (B1.4)(55)
 Wong, Wing Hung (D3.3)(277)
 Wu, Allen C.-H. (B1.1)(37)
 Wu, Cheng-W. (A1.6)(11)
 Wu, Cheng-Wen (A7.3)(565)
 Wu, Lifeng (E3.2)(289)
 Wu, Qing (A5.3)(387)
 (C4.3)(345)
 Wu, Xunwei (C4.2)(339)
 (C4.3)(345)
 Wu, Yu-Liang (C5.2)(415)
 (D8.1)(655)

X

Xianlong, Hong (D1.4)(105)
 Xie, Yuan (A2.4)(129)
 Xu, Dongmin (D3.3)(277)
 Xu, Songjie (C2.1)(157)

Y

Yamada, Akihisa (A4.2)(303)
 Yamada, Masaaki (A8.3)(641)
 Yamamoto, Yasuyuki (A8.1)(631)
 Yamane, Masataka (A1.5)(9)
 Yamanouchi, Takayuki (D6.1)(517)
 Yamashina, Masakazu (B4.3)(329)
 Yamashita, Shigeru (C3.2)(253)
 Yan, Zhang (D1.4)(105)

Yanagisawa, Masao (A4.3)(309)
 Yang, Po-Hui (A3.3)(225)
 Yang, Xiaodong (E5.4)(463)
 Yeh, Chune-Sin (E3.2)(289)
 Yici, Cai (D1.4)(105)
 Yonezawa, Hirokazu (E3.2)(289)
 Yoo, Sang-Min (E7.1)(613)
 Yoo, Sungjoo (C2.3)(169)
 Yoon, Hying-S. (A1.9)(17)
 Yoshida, Yukihiro (D6.3)(529)
 Yu, Hong (D3.2)(271)
 Yu, Jun (A1.7)(13)
 Yuan, Xiao-Long (D8.1)(655)

Z

Zelikovsky, Alex (D6.2)(523)
 Zhang, Qianling (A1.7)(13)
 Zhang, Yiha (A1.7)(13)
 Zharov, M. M. (E6.1)(537)

Session Index

- Session A1 (Special Session) University LSI Design Contest
- Session B1 IP Reuse and Protection Methods
- Session C1 Decision Diagrams and Verification Methods
- Session D1 Routing in Deep-Submicron
- Session A2 (Special Session) CAD for Embedded Systems
- Session B2 System-Level Power Optimization & Estimation
- Session C2 Design Environment for FPGA
- Session D2 Placement Consistent with Routing
- Session E2 (Special Session) System-In-Package (SIP)
- Session A3 Low Power Design Implementation
- Session B3 Embedded Software
- Session C3 Implementation of Boolean Functions
- Session D3 Physical Design Planning
- Session E3 Methodologies for Reliable Design
- Session A4 Synthesis for System-On-A-Chip
- Session B4 Reconfigurable Computation
- Session C4 Synthesis for Low Power
- Session D4 (Panel Discussion) Timing Closure--The Solution and Its Problems
- Session E4 MOSFET Device Optimization
- Session A5 Low Power Design System Approach
- Session B5 System Design and Debugging
- Session C5 Optimization Issues in Logic Synthesis
- Session D5 Novel Techniques in Advanced Partitioning
- Session E5 Efficient Estimation for Interconnection
- Session A6 Optimized LSI Design
- Session B6 DSP and Memory Architecture
- Session C6 Validation and Test
- Session D6 Cell Generation & Process Dependent Issues
- Session E6 Analysis Techniques for Analog Circuits
- Session A7 Advanced Design Techniques for Deep-Submicron
System-On-A-Chip
- Session B7 (Special Session) Future of System Level Design Languages
- Session C7 Delay Testing and Design-For-Testability
- Session D7 (Panel Discussion) Industry-Academia Cooperation
- Session E7 Signal Integrity / Noise Issues in Deep-Submicron
- Session A8 High Speed LSI Design for Entertainment Application
- Session B8 (Panel Discussion) One Language or More? (How Can We Design
an SoC at a System Level?)
- Session D8 High Performance Partitioning