

SCIENTIFIC PAPER ON DATA ENGINEERING

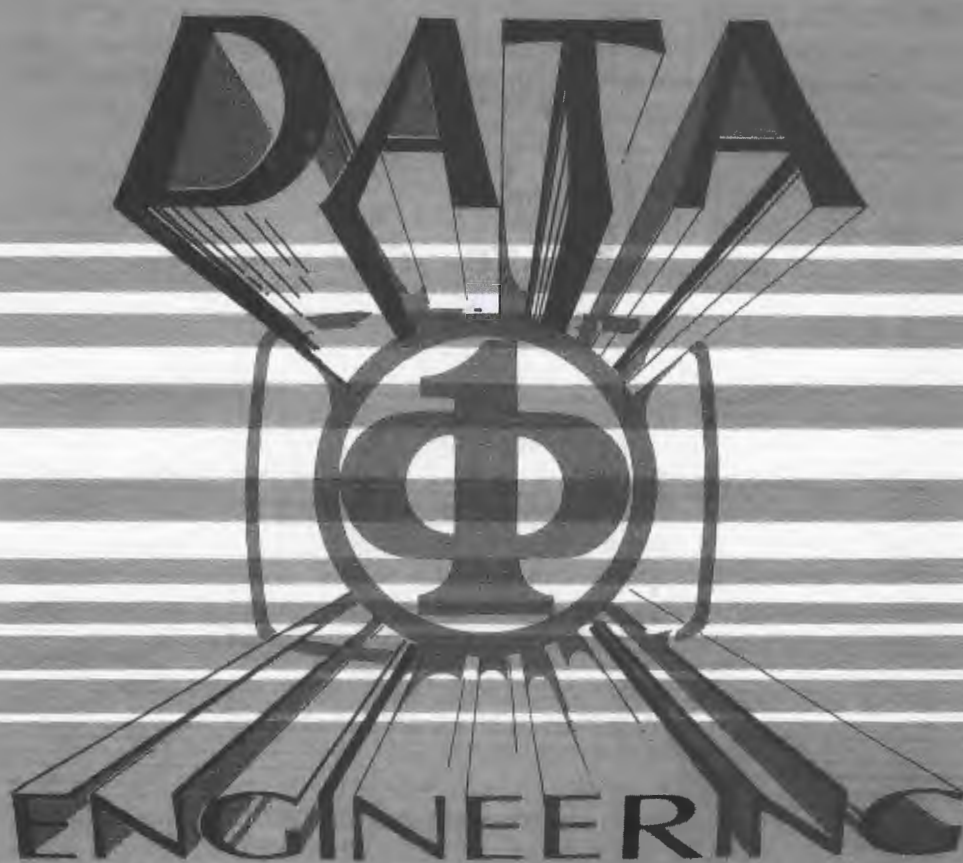


한국과학기술원



1101250

International Conference on DATA ENGINEERING



April 24-27, 1984
Bonaventure Hotel
Los Angeles, California, USA

ISBN 0-8186-0533-2
IEEE CATALOG NO. 84CH2031-3
LIBRARY OF CONGRESS NO. 84-80546
IEEE COMPUTER SOCIETY ORDER NO. 533

THE COMPUTER
SOCIETY
PRESS



THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

IEEE COMPUTER SOCIETY



101250



1101250

The papers appearing in this book comprise the proceedings of the meeting mentioned on the cover and title page. They reflect the authors' opinions and are published as presented and without change, in the interests of timely dissemination. Their inclusion in this publication does not necessarily constitute endorsement by the editors, IEEE Computer Society Press, or the Institute of Electrical and Electronics Engineers, Inc.

Published by IEEE Computer Society Press
1109 Spring Street
Suite 300
Silver Spring, MD 20910



Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 29 Congress Street, Salem, MA 01970. Instructors are permitted to photocopy isolated articles for noncommercial classroom use without fee. For other copying, reprint or republication permission, write to Director, Publishing Services, IEEE, 345 E. 47 St., New York, NY 10017. All rights reserved. Copyright © 1984 by The Institute of Electrical and Electronics Engineers, Inc.

ISBN 0-8186-0533-2 (paper)
ISBN 0-8186-4533-4 (microfiche)
ISBN 0-8186-8533-6 (casebound)
IEEE Catalog Number 84CH2031-3
Library of Congress Number 84-80546
IEEE Computer Society Order Number 533

Order from: IEEE Computer Society
Post Office Box 80452
Worldway Postal Center
Los Angeles, CA 90080

IEEE Service Center
445 Hoes Lane
Piscataway, NJ 08854



The Institute of Electrical and Electronics Engineers, Inc.

Foreword

This year (1984) marks the First International Computer Data Engineering Conference (COMPDEC). Our purpose is to provide a forum for the discussion of experience, practice and theory of automated data and knowledge management from an engineering point of view. We have an outstanding technical program, for which we extend our gratitude and congratulations to the Program Chairmen, Bruce Berra, Barry Boehm, Wesley Chu, Peter Wang, and Gio Wiederhold, and to their excellent Program Committee.

The topics in our program include logical and physical database design; data management methodologies; computer architectures for knowledge bases; technology, implementation and operation for data management; and specialized tools; as well as an excellent tutorial program organized and chaired by Dr. Robert Yacobellis and Dr. Peter Ng.

We owe a deep debt of gratitude to the many people who have contributed their efforts to this Conference: Professors Aldo Castillo and Mas Tsuchiya, for its organization; Drs. John Scanlon and Charles Bachman, for its Keynote Addresses; and Professor Benjamin Wah, for editing its Proceedings. Our sincere thanks to all of our dedicated and hardworking friends who made this Conference possible. We extend our hearty welcome to all of you.

C.V. Ramamoorthy
General Chairman

Program Chairman's Message

This is the first International Conference on Data Engineering. We view the field as being concerned with the role of data in the design, development and use of comprehensive information systems. It encompasses the more traditional aspects of databases, knowledge bases and general uses of data. The purpose of the conference is to provide a forum for the discussion of experience, practice and theory of automated data and knowledge management from an engineering point of view. We have tried to create an environment conducive to free interchange of ideas among the various subcomponents of data engineering.

The conference is composed of contributed papers, invited papers, invited sessions, plenary speakers and plenary panels. We are indeed fortunate to have Dr. John Scanlon and Dr. Charles Bachman as plenary speakers on the morning of the first day. They will address various aspects of Data Engineering. Following this we have a distinguished panel chaired by Dr. Barry Boehm that will address challenges in data engineering. Panelists include Dr. Charles Bachman, Mr. Ed Brennan, General Alan Salisbury, Dr. Gio Wiederhold and Dr. Stephen Yau. These plenary sessions will set the stage for the conference.

On the morning of the second day we are pleased to have Mr. M. Eddie Heironimus of the Internal Revenue Service to speak on information resources management within the IRS. On the morning of the last day we are pleased to have Dr. Denji Tajima as a plenary speaker on the subject of the Japanese software industry. This will be followed by a panel chaired by Dr. Charles Vick with distinguished panelists Dr. Tajima, Dr. David Opferman and Dr. Raymond Yeh. The topic of this panel will be new directions in software and data engineering. Finally, as the last session of the conference we will have a panel of distinguished persons chosen from the Program Committee consisting of Dr. Nick Cercone, Dr. Wesley Chu, Dr. Richard Shuey and Dr. Peter Wang. I will chair this session and it will be our task to assess what we have learned about data engineering in the process of preparing for and conducting this conference.

It is impossible to individually thank all the persons who contributed to the success of the First International Conference on Data Engineering, but I would like to mention a few. My special thanks go to Dr. C.V. Ramamoorthy for his leadership in preparing for this conference and to Drs. Barry Boehm, Wesley Chu, Peter Wang and Gio Wiederhold for their able contributions as Co-Program Chairmen. My thanks also go to the entire program committee, the authors and the reviewers. I would also like to thank Mike Liu, Robert Yacobellis, Peter Ng, Aldo Castillo, Mas Tsuchiya, Ben Wah, the tutorial presenters, the staff of the IEEE Computer Society, and Cher Grassmann.

Finally, I would like to thank you, the participants, for taking the time to attend this conference. I sincerely hope that it was time well spent.

P. Bruce Berra
Program Chairman

COMPDEC 84 Committee

General Chairman

C.V. Ramamoorthy
University of California, Berkeley

Program Chairman

P. Bruce Berra
Syracuse University

Co-Program Chairmen

Barry Boehm, *TRW*
Wesley Chu, *UCLA*

Peter C.C. Wang, *Naval Postgraduate School*
Gio Wiederhold, *Stanford University*

Program Committee Members

H. Aiso, *Keio University*
Francious Bancilhon, *INRIA*
Carlo Batini, *U. of Degli Studi de Roma*
Bharat Bhargava, *U. Pittsburgh*
Olin Bray, *Control Data Corp.*
Nick Cercone, *Simon Fraser U.*
Peter P. Chen, *Louisiana State U.*
Tim Clement, *Syracuse U.*
Bruce Croft, *U. of Massachusetts*
Lt. Col. John S. Davis, *AIRMICS*
Casper R. DeFiore, *USAF/HQ*
Lorraine M. Duvall, *IIT Research Inst.*
Robert Epstein, *Britton-Lee*
K.S. Fu, *Purdue U.*
Thomas F. Gannon III, *Auerbach*
Sakti Ghosh, *IBM*
Ron Hoelzeman, *U Pittsburgh*
T. Ichikawa, *U of Hiroshima*
Keki Irani, *U. of Michigan*
Iris Kameny, *Systems Development Corp.*
F. Kamijo, *Information Technology
Promotion Agency, Japan*
K.H. Kim, *U. of South Florida*
Robert Korfhage, *SMU*
T. Kunii, *U. of Tokyo*
Jane Liu, *U. of Illinois*
Raymond A. Liuzzi, *USAF/RADC*
Y.W. Ma, *U. of Pennsylvania*
M. Maekawa, *U. of Tokyo*

Gordon McCalla, *U. of Saskatchewan*
Daniel Menasce, *U. of Rio de Janeiro*
Y. Mizuno, *NEC*
Christine Montgomery, *LOGICON*
John Musa, *Bell Laboratories*
Ez Nahouraii, *IBM*
C.W. Nam, *MEI Corp.*
Peter A. Ng, *U. of Missouri-Columbia*
G.M. Nijssen, *U. of Queensland*
Merel Ozsoyoglu, *Case Western Reserve U.*
Raj. Reddy, *Carnegie-Mellon U.*
R. Ruberti, *USAF/RADC*
G. Schlageter, *FernUniversitat*
Richard Shuey, *General Electric*
Edgar Sibley, *Alpha Omega-Group*
P.M. Stocker, *U. of East Anglia*
Stanley Y.W. Su, *U. of Florida*
D. Tajima, *Hitachi*
Robert W. Taylor, *IBM*
Joseph Urban, *U. of Southwestern Louisiana*
R.P. van de Riet, *Virje U.*
Benjamin Wah, *Purdue U.*
Raymond Yeh, *U. of Maryland*
Beatrice Yormark, *Uniform Software Systems*
John Young, *NCR*
Kwang-I Yu, *TRW*
David Yun, *SMU*
Moshe Zloof, *IBM*

Awards

Ming T. (Mike) Liu, *Ohio State U.*

Tutorials

Robert Yacobellis, *Bell Laboratories*
Peter Ng, *U. of Missouri-Columbia*

Arrangements

Aldo Castillo, *TRW*

International Liaison and Publicity

Mas Tsuchiya, *TRW*

Proceedings Editor

Benjamin Wah, *Purdue U.*

Treasurer

Harry Hayman, *IEEE Computer Society*

1984 Reviewers

A. Ashar	Ez Nahouraii
J.L. Baer	C. W. Nam
P. Bruce Berra	M. Nizon
Bharat Bhargava	Peter A. Ng
P. Bineman	L. Otsubo
Barry Boehm	Meral Ozsoyoglu
Ken Bowen	Robert Parks
Olin Bray	Carol Proctor
J. F. Brinkley	M. R. Railey
Gerard Caparao	R. Rathmann
R. Casey	David Reiner
Nick Cercone	Daniel Ries
Peter Chen	Robert Ruberti
Wesley Chu	Sharon Salveter
Bruce Croft	Jake Scherer
John David	J. Short
Casper DeFiore	Richard Shuey
L. Demichel	John M. Smith
Lorraine Duvall	Stanley Su
Tom Gannon	E. Swartzlander
Sakti Ghosh	E. Szwedo
Amrit Goel	T. Takefuj
S. Gruben	Robert Taylor
Lee Hollaar	Mas Tsuchiya
S. Hui	S.E. Uhrig
Keki Irani	Joseph Urban
Iris Kameny	R. P. Van de Riet
K. H. Kim	Benjamin Wah
R. Knablein	A. Walker
Robert Korfhage	M. Walker
E. Lee	Peter Wang
Jane Liu	S. Wartik
Raymond Liuzzi	Gio Wiederhold
Wa Shu Luh	H. Wong
Y. W. Ma	Beatrice Yormark
Gordon McCalla	John Young
Christine Montgomery	Kwang Yu
John Musa	Moshe Zloof

Table of Contents

Foreword	iii
Program Chairman's Message	v
COMPDEC 84 Committee	vii
1984 Reviewers	viii
Session 1A: Engineering Applications (F. Kamijo, Chair)	
An Advanced Database System ADAM—Towards Integrated Management of Engineering Data	3
<i>Y. Udagawa and T. Mizoguchi</i>	
Integrated Environment for Information Management in VLSI Design	12
<i>V. Ashok, W. McKnight, and J. Ramanathan</i>	
CADETT: Computer Aided Design and Engineering Tool for Toyota	20
<i>Y. Kuranaga</i>	
Session 1B: Entity Relationship Approach I (P. Ng, Chair)	
A Role for Data Analysis in Practical Requirements Definition	30
<i>R.P. Zimmerman</i>	
An Algebra for a Directional Binary Entity-Relationship Model	37
<i>P.P. Chen</i>	
Session 1C: Database Architecture I (TBA, Chair)	
SM3: A Dynamically Partitionable Multicomputer System with Switchable Main Memory Modules	42
<i>T. Fei, C.K. Baru, and S.Y.W. Su</i>	
On the Effectiveness of Fault-Tolerance Techniques in Parallel Associative Database Processors	50
<i>A. Avizienis, A.F. Cardenas, and F. Alavian</i>	
A Comparison of Parallel Language Approaches to Data Representation and Data Transferral	60
<i>C. Cline and H.J. Siegel</i>	
Session 1D: User Interface Languages (R.R. Korfhage, Chair)	
A Natural Language Interface for Performing Database Updates	69
<i>J. Davidson</i>	
Cooperative Responses to Boolean Queries	77
<i>F. Corella, S.J. Kaplan, G. Wiederhold, and L. Yesil</i>	
MALPHA: A Relational Multidatabase Manipulation Language	86
<i>W. Litwin</i>	
Session 2A: Statistical Databases (S. Ghosh, Chair)	
An Application of Statistical Databases in Manufacturing Testing	96
<i>S.P. Ghosh</i>	
Micro and Macro Statistical/Scientific Database Management	104
<i>H.K.T. Wong</i>	
Diophantine Inferences from Statistical Aggregates on Few-Valued Attributes	107
<i>N.C. Rowe</i>	

A Theory of Data: Implications for Information Retrieval	111
<i>J.L. Dolby</i>	
Session 2B: Database Models (TBA, Chair)	
Comparison-Criteria for Semantic Data Models	120
<i>M. Schrefl, A.M. Tjoa, and R.R. Wagner</i>	
A Method for Optimization of a Conceptual Model	126
<i>O. Oren</i>	
Representing Roles in Universal Scheme Interfaces	133
<i>D. Maier, D. Rozenshtein, and J. Stein</i>	
Recursive Data Models for Non-Conventional Database Applications	143
<i>W. Lamersdorf</i>	
Session 2C: Database Architecture II (R.A. Liuzzi, Chair)	
A Pipeline and Parallel Architecture for Supporting Database Management Systems	152
<i>Y.-C. Hong</i>	
Architecture and Algorithm for Parallel Execution of a Join Operation	160
<i>T. Nakayama, M. Hirakawa, and T. Ichikawa</i>	
The Fast Data Finder—An Architecture for Very High Speed Data Search and Dissemination	167
<i>K.-I. Yu, S.-P. Hsu, and P. Otsubo</i>	
Dynamic Data Structures on Optical Disks	175
<i>P. Rathmann</i>	
Session 2D: User Interfaces (J.S. Davis, Chair)	
The Forms Pattern Language	183
<i>J.A. Larson</i>	
Summary-Table-By-Example: A Database Query Language for Manipulating Summary Data	193
<i>Z.M. Ozsoyoglu and G. Ozsoyoglu</i>	
A Semantic Approach to Usability in Relational Database Systems	203
<i>K. Sugihara, J. Miyao, T. Kikuno, and N. Yoshida</i>	
Distributed Query Processing Strategies in Mermaid, a Frontend to Data Management Systems	211
<i>D. Brill, M. Templeton, and C. Yu</i>	
Session 3A: Query Optimization (Y.W. Ma, Chair)	
Distributed Query Optimization: An Engineering Approach	220
<i>R. Krishnamurthy and S.P. Morgan</i>	
The File-Assignment and Query-Processing Problems in Logical Multiaccess Networks	228
<i>B.W. Wah and Y.-N. Lien</i>	
Session 3B: Database Design I (J. Liu, Chair)	
Dynamics Analysis in Database Design	238
<i>G. Balbo, G.B. Demo, A. DiLeva, and P. Giolito</i>	
Fixed Length Semiorde r Preserving Code for Field Level Data File Compression	244
<i>M. Toyama and S. Ura</i>	
A Descriptive Model of Physical Database Design Problems and Solutions	253
<i>J.V. Carlis and S.T. March</i>	

Session 3C: Software Quality and Production (M. Tsuchiya, Chair)	
Software and Development Process Quality Metrics	262
<i>R.H. Jacobellis</i>	
Building-In Quality and Productivity to a Large Software System	270
<i>E.M. Prell and A.P. Sheng</i>	
A Programming Environment Framework Based on Reusability	277
<i>R.T. Yeh, R. Mittermeir, N. Rousopoulos, and J. Reed</i>	
Session 3D: Construction of Knowledge Bases (V. Kobler, Chair)	
Overview of Tools for Knowledge Base Construction	282
<i>V.P. Kobler</i>	
Judgmental-Knowledge Bases: Problem Solving and Expert Systems	286
<i>J.D. Johannes</i>	
Issues in Distributed Artificial Intelligence	293
<i>B. McDaniel</i>	
Session 4A: Concurrency Control I (C.W. Nam, Chair)	
Version-Based Access Capabilities for Concurrency Control of a Database System	300
<i>T. Minoura and K. Parsaye</i>	
The Delay/Re-Read Protocol for Concurrency Control in Databases	307
<i>M.D. Mickunas, P. Jalote, and R.H. Campbell</i>	
Locking Policies in Distributed Databases	315
<i>O. Wolfson</i>	
Session 4B: Database Design II (P. Stocker, Chair)	
From Natural Language Requirements to Good Data Base Definitions—A Data Base Design Methodology	324
<i>C.F. Eick</i>	
Approaches for Updating Databases with Incomplete Information and Nulls	332
<i>A. Keller and M.W. Wilkins</i>	
Session 4C: Software Engineering (A. Goel, Chair)	
Flow Sketch Methodology: A Practical Requirements Definition Technique Based on Data Flow Concept	342
<i>Y. Matsumoto, T. Shibata, and M. Tani</i>	
Utilizing an Executable Specification Language for an Information System	348
<i>S.D. Urban, J.E. Urban, and W.D. Dominick</i>	
Data Flow Structures for System Specification and Implementation	356
<i>T. DeMarco and A. Soceneantu</i>	
Session 5A: Data Engineering for Real Time Distributed Operating Systems (A. Van Tilborg, Chair)	
Partitioning Ada Programs for Execution on Distributed Systems	364
<i>D. Cornhill</i>	
Programming Language Support for Real-Time Distributed Systems	371
<i>T.J. LeBlanc</i>	
Guardian: Decentralized Control of an Embedded Multimicroprocessor	377
<i>A.M. van Tilborg</i>	

Session 5B: Database Design Tools (J. Urban, Chair)	
A Tool for the Implementation of Databases	386
<i>D. Farmer, R. King, and D. Myers</i>	
Rapid Software Development in a Database Framework— A Case Study	394
<i>H.J. Komorowski</i>	
Gambit: An Interactive Database Design Tool for Data Structures, Integrity Constraints and Transactions	399
<i>R.P. Brägger, A. Dudler, J. Rebsamen, and C.A. Zehnder</i>	
Practical Application of IDEF1 as a Database Development Tool	408
<i>K.L. Ruoff</i>	
Session 5C: Database Design Theory (R.P Van de Riet, Chair)	
Matching Techniques in Global Schema Design	418
<i>M.V. Mannino and W. Effelsberg</i>	
Object Integration in Logical Database Design	426
<i>R. Elmasri and S. Navathe</i>	
Supporting the Design of Conceptual Schemata by Database Systems	434
<i>H. Wedekind</i>	
Predicate Trees: An Approach to Optimize Relational Query Operations	439
<i>G. Gardarin, P. Valduriez, and Y. Viemont</i>	
Session 5D: Artificial Intelligence Applications (I. Kameny, Chair)	
Towards a Data Model for Artificial Intelligence Applications	446
<i>S. Nirenburg and C. Attiya</i>	
Specification-Based Computing Environments for Information Management	454
<i>R. Balzer, N. Goldman, and B. Neches</i>	
The CMS-HELP Expert System	459
<i>D.Y.Y. Yun and D. Loeb</i>	
The Transition from Data Management to Knowledge Management	467
<i>C. Kellogg</i>	
Session 6A: Concurrency Control II (TBA, Chair)	
An Adaptive Concurrency Control Strategy for Distributed Database Systems	474
<i>A.P. Sheth, A. Singhal, and M.T. Liu</i>	
A Robust Distributed Solution to the Generalized Dining Philosophers Problem	483
<i>D.P. Sidhu and R.H. Pollack</i>	
Session 6B: Entity Relationship Approach II (P. Chen, Chair)	
A Method for Behavior Modeling in Data Oriented Approach to Systems Design	492
<i>H. Sakai and H. Horiuchi</i>	
An Entity-Relationship Algebra	500
<i>C. Parent and S. Spaccapietra</i>	
Session 6C: Local Area Network Environments (R.C.T. Lee, Chair)	
Distributed Query Evaluation in Local Area Networks	510
<i>G.M. Sacco</i>	
Modeling File System Organizations in a Local Area Network Environment	517
<i>D. Ferrari and T.-Y.P. Lee</i>	

Session 6D: Design Tools and Software Metrics	
(C.V. Ramamoorthy, Chair)	
A Friendly Logical Database Design Tool for the Humming-Bird System	526
<i>T.-L. Jiang and Y.H. Chin</i>	
Program Complexity and Programming Style	534
<i>M. Evangelist</i>	
Session 7A: Test Beds for Evaluating Design Methodologies for Distributed Systems (W. McDonald, Chair)	
A Distributed Software Runtime Environment to Support Testbed Experimentation Using ADL/ADS	544
<i>J.T. Ellis</i>	
DCT—A Testbed Approach to Distributed Systems Research	552
<i>W.L. Heimerdinger and D. Bhatt</i>	
Session 7B: Performance Analysis (G. Schlageter, Chair)	
Transaction Workload Evaluation in the Codasyl Database Environment	562
<i>S. Orlando, P. Rullo, and W. Staniszkis</i>	
Performance Modeling of Distributed Database	570
<i>M. Tsuchiya and M.P. Mariani</i>	
Cross-Program Simulator for Any Microprocessors	576
<i>A. Miyagawa, T. Itajima, T. Takagi, and S. Nakano</i>	
Session 7C: Applications of Knowledge Bases (G. McCalla, Chair)	
Feedback Stabilization of Control Policy Selection in Data/Knowledge Based Systems	586
<i>C.F. Stamer</i>	
The Manager's Assistant, an Application of Knowledge Management	592
<i>D. Kogan</i>	
Mutual Consistency Maintenance in a Prototype Data Traffic Management System	596
<i>G.G. Belford, J.W.S. Liu, D. Cho, P. Cotten, S. England, J.D. Goldstein, S.C. Hwung, K.A. Kaufman, C.K. Kim, J. Leo, A.P. Manolas, A. Moon, A.D. Smet, Y.L. Yan, L. Zhang, G.L. Robinson, and R.L. Lapp</i>	
Session 7D: Image Data and Networks (C.V. Ramamoorthy, Chair)	
A Low-Cost Geometry-Preserving Image Database System	604
<i>Y.-K. Yang and K.-S. Fu</i>	
Algebraic Properties of Some Parallel Processor Interconnection Networks	611
<i>S. Yalamanchili and J.K. Aggarwal</i>	
Late Paper	
Evolution of a Virtual Machine Supporting Fault-Tolerant Distributed Processes at a Research Laboratory	620
<i>K.H. Kim</i>	
Author Index	629