



IEEE Symposium on FPGAs for Custom Computing Machines

10-NOV-1997 BSDS BOSTON SPA
LS23 780
IEEE SYMPOSIUM ON FPGAs FOR CUSTOM COMPUTING
MACHINES



4363.086450 YEAR 1997
AC⁸²

1/2

April 16-18, 1997 Napa Valley, California

Edited by Kenneth L. Pocek and Jeffrey Arnold

Sponsored by the IEEE Computer Society Technical Committee on Computer Architecture



PROCEEDINGS

The 5th Annual IEEE Symposium on Field-Programmable Custom Computing Machines

April 16 – 18, 1997

Napa Valley, California

Sponsored by

IEEE Computer Society

IEEE Computer Society Technical Committee on Computer Architecture



Los Alamitos, California

Washington • Brussels • Tokyo



Copyright © 1997 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries may photocopy beyond the limits of US copyright law, for private use of patrons, those articles in this volume that carry a code at the bottom of the first page, provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

Other copying, reprint, or republication requests should be addressed to: IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, P.O. Box 133, Piscataway, NJ 08855-1331.

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

IEEE Computer Society Order Number PR08159
ISBN 0-8186-8159-4
ISBN 0-8186-8160-8 (case)
ISBN 0-8186-8161-6 (microfiche)
IEEE Order Plan Catalog Number 97TB100186
ISSN 1082-3409

Additional copies may be ordered from:

IEEE Computer Society
Customer Service Center
10662 Los Vaqueros Circle
P.O. Box 3014
Los Alamitos, CA 90720-1314
Tel: + 1-714-821-8380
Fax: + 1-714-821-4641
E-mail: cs.books@computer.org

IEEE Service Center
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
Tel: + 1-908-981-1393
Fax: + 1-908-981-9667
mis.custserv@computer.org

IEEE Computer Society
13, Avenue de l'Aquilon
B-1200 Brussels
BELGIUM
Tel: + 32-2-770-2198
Fax: + 32-2-770-8505
euro.ofc@computer.org

IEEE Computer Society
Ooshima Building
2-19-1 Minami-Aoyama
Minato-ku, Tokyo 107
JAPAN
Tel: + 81-3-3408-3118
Fax: + 81-3-3408-3553
tokyo.ofc@computer.org

Editorial production by Bob Werner

Cover art production Joe Daigle/Studio Productions

Printed in the United States of America by Technical Communication Services


IEEE

COMPUTER
SOCIETY



Table of Contents

Symposium on Field-Programmable Custom Computing Machines — FCCM'97

Introduction	ix
Program Committee	x
Session 1: Device Architecture	
An FPGA Architecture for DRAM-based Systolic Computations..... <i>N. Margolus</i>	2
Garp: A MIPS Processor with a Reconfigurable Coprocessor..... <i>J. Hauser, J. Wawrzynek</i>	12
A Time-Multiplexed FPGA..... <i>S. Trimberger, D. Carberry, A. Johnson, J. Wong</i>	22
Session 2: Communication Applications	
An FPGA-Based Coprocessor for ATM Firewalls..... <i>J. McHenry, P. Dowd, T. Carrozzi, F. Pellegrino, W. Cocks</i>	30
A Wireless LAN Demodulator in a Pamette: Design and Experience..... <i>T. McDermott, P. Ryan, M. Shand, D. Skellern, T. Percival, N. Weste</i>	40
Session 3: Run Time Reconfiguration	
Incremental Reconfiguration for Pipelined Applications..... <i>H. Schmit</i>	47
Compilation Tools for Run-Time Reconfigurable Designs..... <i>W. Luk, N. Shirazi, P. Cheung</i>	56
A Dynamic Reconfiguration Run-Time System..... <i>J. Burns, A. Donlin, J. Hogg, S. Singh, M. de Wit</i>	66
Session 4: Architectures for Run Time Reconfiguration	
The Swappable Logic Unit: A Paradigm for Virtual Hardware..... <i>G. Brebner</i>	77

The Chimaera Reconfigurable Functional Unit.....	87
<i>S. Hauck, T. Fry, M. Hosler, J. Kao</i>	
Session 5: Architecture	
Computing Kernels Implemented with a Wormhole RTR CCM	98
<i>R. Bittner Jr., P. Athanas</i>	
Mapping Applications to the RaPiD Configurable Architecture	106
<i>C. Ebeling, D. Cronquist, P. Franklin, J. Secosky, S. Berg</i>	
Defect Tolerance on the Teramac Custom Computer	116
<i>B. Culbertson, R. Amerson, R. Carter, P. Kuekes, G. Snider</i>	
Session 6: Performance	
Systems Performance Measurement on PCI Pamette.....	125
<i>L. Moll, M. Shand</i>	
The RAW Benchmark Suite: Computation Structures for General Purpose Computing.....	134
<i>J. Babb, M. Frank, V. Lee, E. Waingold, R. Barua, M. Taylor, J. Kim, S. Devabhaktuni, A. Agarwal</i>	
Session 7: Software Tools	
Automated Field-Programmable Compute Accelerator Design using Partial Evaluation.....	145
<i>Q. Wang, D. Lewis</i>	
FPGA Synthesis on the XC6200 using IRIS and Trianus/Hades (Or, from Heaven to Hell and back again)	155
<i>R. Woods, S. Ludwig, J. Heron, D. Trainor, S. Gehring</i>	
High Level Compilation for Fine Grained FPGAs	165
<i>M. Gokhale, E. Gomersall</i>	
Session 8: CAD Applications	
Acceleration of an FPGA Router	175
<i>P. Chan, M. Schlag</i>	
Fault Simulation on Reconfigurable Hardware	182
<i>M. Abramovici, P. Menon</i>	

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.