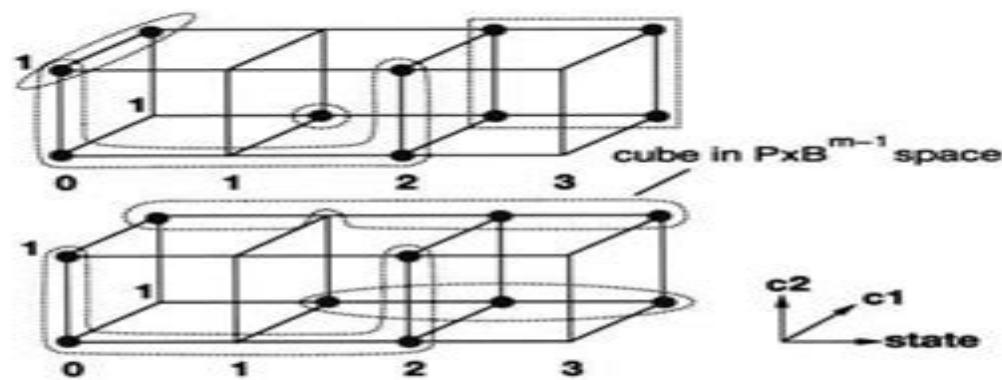


SYNTHESIS OF FINITE STATE MACHINES: Logic Optimization

Tiziano Villa
Timothy Kam
Robert K. Brayton
Alberto Sangiovanni-Vincentelli



Synthesis Of Finite State Machines Logic Optimization

**Timothy Kam, Tiziano Villa, Robert K.
Brayton, Alberto Sangiovanni-
Vincentelli**

Synthesis Of Finite State Machines Logic Optimization:

Synthesis of Finite State Machines Timothy Kam,Tiziano Villa,Robert K. Brayton,Alberto

Sangiovanni-Vincentelli,1996-12-31 Synthesis of Finite State Machines Functional Optimization is one of two monographs devoted to the synthesis of Finite State Machines FSMs This volume addresses functional optimization whereas the second addresses logic optimization By functional optimization here we mean the body of techniques that compute all permissible sequential functions for a given topology of interconnected FSMs and select a best sequential function out of the permissible ones The result is a symbolic description of the FSM representing the chosen sequential function By logic optimization here we mean the steps that convert a symbolic description of an FSM into a hardware implementation with the goal to optimize objectives like area testability performance and so on Synthesis of Finite State Machines Functional Optimization is divided into three parts The first part presents some preliminary definitions theories and techniques related to the exploration of behaviors of FSMs The second part presents an implicit algorithm for exact state minimization of incompletely specified finite state machines ISFSMs and an exhaustive presentation of explicit and implicit algorithms for the binate covering problem The third part addresses the computation of permissible behaviors at a node of a network of FSMs and the related minimization problems of non deterministic finite state machines NDFSMs Key themes running through the book are the exploration of behaviors contained in a non deterministic FSM NDFSM and the representation of combinatorial problems arising in FSM synthesis by means of Binary Decision Diagrams BDDs Synthesis of Finite State Machines Functional Optimization will be of interest to researchers and designers in logic synthesis CAD and design automation

[Synthesis of Finite State Machines](#) Tiziano Villa,Timothy Kam,Robert K. Brayton,Alberto L. Sangiovanni-Vincentelli,2012-12-06

Synthesis of Finite State Machines Logic Optimization is the second in a set of two monographs devoted to the synthesis of Finite State Machines FSMs The first volume Synthesis of Finite State Machines Functional Optimization addresses functional optimization whereas this one addresses logic optimization The result of functional optimization is a symbolic description of an FSM which represents a sequential function chosen from a collection of permissible candidates Logic optimization is the body of techniques for converting a symbolic description of an FSM into a hardware implementation The mapping of a given symbolic representation into a two valued logic implementation is called state encoding or state assignment and it impacts heavily area speed testability and power consumption of the realized circuit The first part of the book introduces the relevant background presents results previously scattered in the literature on the computational complexity of encoding problems and surveys in depth old and new approaches to encoding in logic synthesis The second part of the book presents two main results about symbolic minimization a new procedure to find minimal two level symbolic covers under face dominance and disjunctive constraints and a unified frame to check encodability of encoding constraints and find codes of minimum length that satisfy them The third part of the book introduces generalized prime implicants GPIS which are the counterpart in

symbolic minimization of two level logic to prime implicants in two valued two level minimization GPIs enable the design of an exact procedure for two level symbolic minimization based on a covering step which is complicated by the need to guarantee encodability of the final cover A new efficient algorithm to verify encodability of a selected cover is presented If a cover is not encodable it is shown how to augment it minimally until an encodable superset of GPIs is determined To handle encodability the authors have extended the frame to satisfy encoding constraints presented in the second part The covering problems generated in the minimization of GPIs tend to be very large Recently large covering problems have been attacked successfully by representing the covering table with binary decision diagrams BDD In the fourth part of the book the authors introduce such techniques and extend them to the case of the implicit minimization of GPIs where the encodability and augmentation steps are also performed implicitly Synthesis of Finite State Machines Logic Optimization will be of interest to researchers and professional engineers who work in the area of computer aided design of integrated circuits

Synthesis of Finite State Machines

Tiziano Villa, Timothy Kam, Robert K Brayton, 1997-04-01 **Synthesis of Finite State Machines** Timothy Kam, Tiziano Villa, Robert K. Brayton, 2014-01-15

Sequential Optimization of Asynchronous and Synchronous Finite-State Machines Robert M. Fuhrer, Steven M. Nowick, 2012-12-06 Asynchronous or unclocked digital systems have several potential advantages over their synchronous counterparts In particular they address a number of challenging problems faced by the designers of large scale synchronous digital systems power consumption worst case timing constraints and engineering and design reuse issues associated with the use of a fixed rate global clock Moreover while for synchronous systems these problems are exacerbated by increasing system size asynchronous systems promise to scale more gracefully Sequential Optimization of Asynchronous and Synchronous Finite State Machines Algorithms and Tools makes three contributions to the field of sequential optimization for finite state machines 1 it introduces several new provably optimal algorithms for the synthesis and optimization of asynchronous finite state machines FSMs 2 it presents practical software implementations of each of these algorithms and 3 it introduces a complete new CAD package called MINIMALIST binding these tools into a state of the art technology independent synthesis path for burst mode asynchronous circuits Throughout this book real world industrial designs are used as benchmark circuits to validate the usefulness of the tools As an additional benefit some of the theory and tools also provide new methods for the optimization of synchronous FSMs

Logic Synthesis for FSM-Based Control Units Alexander Barkalov, Larysa Titarenko, 2009-11-25 This book presents the hardware implementation of control algorithms represented by graph schemes of algorithm It includes new methods of logic synthesis and optimization for logic circuits of Mealy and Moore FSMs oriented on both ASIC and FPLD

Foundations of Embedded Systems Alexander Barkalov, Larysa Titarenko, Małgorzata Mazurkiewicz, 2019-02-04 This book is devoted to embedded systems ESSs which can now be found in practically all fields of human activity Embedded systems are essentially a special class of computing systems designed for monitoring and controlling objects of the physical

world The book begins by discussing the distinctive features of ESs above all their cybernetic physical character and how they can be designed to deliver the required performance with a minimum amount of hardware In turn it presents a range of design methodologies Considerable attention is paid to the hardware implementation of computational algorithms It is shown that different parts of complex ESs could be implemented using models of finite state machines FSMs Also field programmable gate arrays FPGAs are very often used to implement different hardware accelerators in ESs The book pays considerable attention to design methods for FPGA based FSMs before the closing section turns to programmable logic controllers widely used in industry This book will be interesting and useful for students and postgraduates in the area of Computer Science as well as for designers of embedded systems In addition it offers a good point of departure for creating embedded systems for various spheres of human activity

State Minimization of Finite State Machines Using

Implicit Techniques Timothy Yee-kwong Kam,1995 *Concise Encyclopedia of Software Engineering* Derrick Morris,2013-10-22 This Concise Encyclopedia of Software Engineering is intended to provide compact coverage of the knowledge relevant to the practicing software engineer The content has been chosen to provide an introduction to the theory and techniques relevant to the software of a broad class of computer applications It is supported by examples of particular applications and their enabling technologies This Encyclopedia will be of value to new practitioners who need a concise overview and established practitioners who need to read about the penumbra surrounding their own specialities It will also be useful to professionals from other disciplines who need to gain some understanding of the various aspects of software engineering which underpin complex information and control systems and the thinking behind them

Logic Synthesis for

FPGA-Based Mealy Finite State Machines Alexander Barkalov,Larysa Titarenko,Kazimierz Krzywicki,2024-12-04 This book is devoted to the logic synthesis of field programmable gate array FPGA based circuits of Mealy finite state machines FSM Three new methods of state assignment are proposed which allows obtaining FSM circuits required minimum amount of internal chip resources Logic Synthesis for FPGA Based Mealy Finite State Machines Structural Decomposition in Logic Design contains several original synthesis and optimization methods based on the structural decomposition of FPGA based FSM circuits developed by the authors To optimize FSM circuits the authors introduce the use of three methods of state assignment twofold extended and composite These methods allow for the creation of two or three level architectures of FSM circuits The authors also demonstrate how the proposed methods FSM architectures and synthesis methods can replace known solutions based on either functional decomposition or classical methods of structural decomposition The authors also show how these architectures have regular systems of interconnections and demonstrate positive features compared to methods based on functional decomposition including producing circuits with fewer elements that are faster and consume less power than their counterparts The book includes experimental results proving the efficiency of the proposed solutions and compares the numbers in Look up Tables LUTs showing the performance maximum operating frequency and power

consumption for various methods of state assignment The audience for this book is students researchers and engineers specializing in computer science engineering electronics and telecommunications It will be especially useful for engineers working within the scope of algorithms hardware based software accelerators and control units and systems based on the use of FPGAs *Sequential Logic Synthesis* Pranav Ashar,S. Devadas,A. Richard Newton,1992 Computer aided design CAD of very large scale integrated VLSI circuits is concerned with the development of computer programs for the automated design and manufacture of ICs Automated VLSI design is referred to as VLSI synthesis Synthesis of VLSI circuits involves transforming a specification of circuit behavior into a mask level layout which can be fabricated using VLSI manufacturing processes Optimization strategies are vital in VLSI synthesis in order to meet desired specifications However the optimization problems encountered in VLSI synthesis are typically nondeterministic polynomial time NP complete or NP hard Therefore solutions to the optimization problems incorporate heuristic strategies the development of which requires a thorough understanding of the problem at hand Thus optimization based VLSI synthesis has evolved into a rich and exciting area of research Automata theory forms a cornerstone of digital VLSI system design Sequential Logic Synthesis deals exclusively with finite automata theory and practice The extensive use of finite state automata finite state machines FSMs or simple sequential logic *Design and Synthesis of On-line Testable Sequential Circuits* Chia-Shun Lai,1993 *Hawaii International Conference on System Sciences*, 23rd IEEE Computer Society Press,1990 This annual meeting held in Kailua Kona Hawaii in January 1990 provides a forum for the interchange of ideas advances and applications among academics and practitioners in the information computing and system sciences and an opportunity to get a winter suntan Papers deal with architecture

Finite State Machine Logic Synthesis for Complex Programmable Logic Devices Robert Czerwinski,Dariusz Kania,2013-01-12 This book is a monograph devoted to logic synthesis and optimization for CPLDs CPLDs macrocell can also be interpreted as programmable AND fixed OR structure well known as PAL based structure The question is what should be done when the number of implicants representing function exceeds the number of product terms available in a logic block The answer is in the book Logic synthesis and optimization methods dedicated for PAL based structures are proposed The methods strive to find the optimum fit for the combinational logic and finite state machines to the structure of the logic device and aim at area and speed optimization The theoretical background and complete strategies are richly illustrated with examples and figures *EDN* ,1992 **Euro ASIC** ,1991 **Synthesis for Control Dominated Circuits** Gabrièle Saucier,Jacques Trilhe,1993 Explores the investigation of efficient synthesis methods for complex control dominated ASICs using library resources including data path generators Topics addressed include the synthesis of complex controllers data path generation and synthesis and synthesis methods of ASICs *Digest of Technical Papers* ,1988 *Introduction to Multichip Modules* Naveed A. Sherwani,Qiong Yu,Sandeep Badida,1995-11-23 Advantages of MCMs over traditional packaging methods for electronic based applications in computers aviation and the military Introduction to Multichip

Modules discusses both custom built MCMs and programmable MCMs and their role in reducing cost and improving turnaround time An invaluable resource for students and professionals in electrical engineering who design MCMs and MCM based systems and for those in computer science who develop CAD tools for MCMs this **IETE Journal of Research**,2003

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