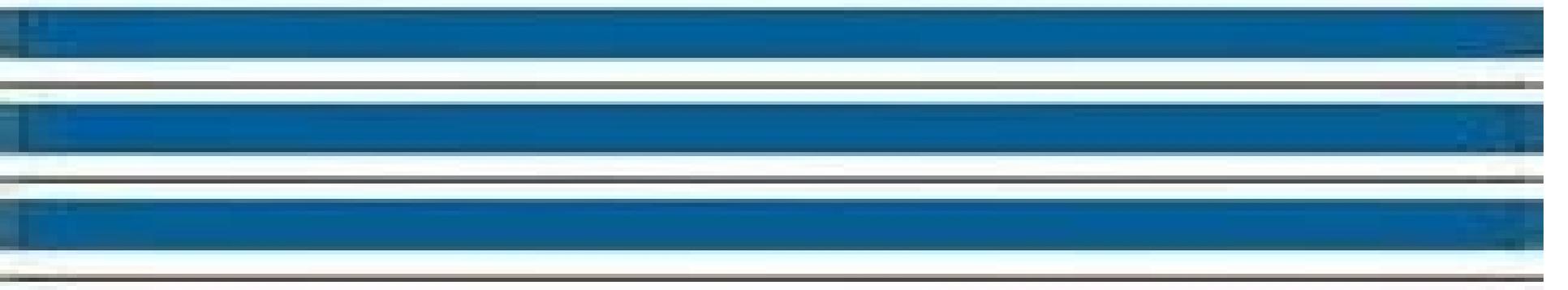


# **ANALOG DEVICE-LEVEL LAYOUT AUTOMATION**

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**John M. Cohn  
David J. Garrod  
Rob A. Rutenbar  
L. Richard Carley**

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# Analog Device Level Layout Automation

**Hongjiang Song**



## **Analog Device Level Layout Automation:**

**Analog Device-Level Layout Automation** John M. Cohn, David J. Garrod, Rob A. Rutenbar, Rick Carley, 2012-12-06 This book presents a detailed summary of research on automatic layout of device level analog circuits that was undertaken in the late 1980s and early 1990s at Carnegie Mellon University We focus on the work behind the creation of the tools called KOAN and ANAGRAM II which form part of the core of the CMU ACACIA analog CAD system KOAN is a device placer for custom analog cells ANAGRAM II a detailed area router for these analog cells We strive to present the motivations behind the architecture of these tools including detailed discussion of the subtle technology and circuit concerns that must be addressed in any successful analog or mixed signal layout tool Our approach in organizing the chapters of the book has been to present our algorithms as a series of responses to these very real and very difficult analog layout problems Finally we present numerous examples of results generated by our algorithms This research was supported in part by the Semiconductor Research Corporation by the National Science Foundation by Harris Semiconductor and by the International Business Machines Corporation Resident Study Program Finally just for the record John Cohn was the designer of the KOAN placer David Garrod was the designer of the ANAGRAM II router and its predecessor ANAGRAM I This book was architected by all four authors edited by John Cohn and Rob Rutenbar and produced in finished form by John Cohn *The Arts of VLSI Circuit Design - Symmetry Approaches toward Zero PVT Sensitivity* Hongjiang Song, 2018-02-26 This is one of a book in a VLSI circuit design book series Dr Hongjiang Song published under the VLSI signal processing circuit techniques This text covers various state of the arts circuit design techniques based on VLSI symmetry principles These methods offer inherently low PVT sensitivity for VLSI analog circuit design with superior scalability and performance **Principles of VLSI Design - Symmetry, Structures and Methods** Hongjiang Song, 2016-06-03 This is the textbook for Dr Hongjiang Song's EEE598 VLSI Analog Circuit Design Based Symmetry class in Ira A Fulton Schools of Engineering at Arizona State University The course introduces structural VLSI analog circuit design concepts and techniques for analog circuit blocks and systems such as the operational amplifiers PLL DLL bandgap reference A/D D/A converters Symmetry principles and associated circuit constraints structures and methods are adopted to mitigate VLSI PVT and other variations for better circuit performance functionality and design productivity across multiple VLSI process nodes **The Arts of VLSI Circuit Design** Hongjiang Song, 2011-03-02 This text is based on the class notes of a VLSI signal processing circuit course series EEE598 the author developed for the EE department at Arizona State University The materials are organized into nineteen special topics covering various state of the arts symmetry based VLSI circuit design techniques for basic VLSI circuit elements circuit modules and systems where the symmetry principle and methods with inherently low PVT sensitivity are used to design VLSI circuits with superior scalability and performance for various VLSI SOC applications *EDA for IC Implementation, Circuit Design, and Process Technology* Luciano Lavagno, Louis Scheffer, Grant Martin, 2018-10-03 Presenting a comprehensive

overview of the design automation algorithms tools and methodologies used to design integrated circuits the Electronic Design Automation for Integrated Circuits Handbook is available in two volumes The second volume EDA for IC Implementation Circuit Design and Process Technology thoroughly examines real time logic to GDSII a file format used to transfer data of semiconductor physical layout analog mixed signal design physical verification and technology CAD TCAD Chapters contributed by leading experts authoritatively discuss design for manufacturability at the nanoscale power supply network design and analysis design modeling and much more Save on the complete set

**VLSI: Integrated Systems on Silicon** Ricardo A. Reis, Luc Claesen, 2013-06-05 This book contains the papers that have been presented at the ninth Very Large Scale Integrated Systems conference VLSI 97 that is organized biannually by IFIP Working Group 10.5 It took place at Hotel Serra Azul in Gramado Brazil from 26-30 August 1997 Previous conferences have taken place in Edinburgh Trondheim Vancouver Munich Grenoble and Tokyo The papers in this book report on all aspects of importance to the design of the current and future integrated systems The current trend towards the realization of versatile Systems on a Chip require attention of embedded hardware software systems dedicated ASIC hardware sensors and actuators mixed analog digital design video and image processing low power battery operation and wireless communication The papers as presented in this book have been organized in two tracks where one is dealing with VLSI System Design and Applications and the other presents VLSI Design Methods and CAD The following topics are addressed VLSI System Design and Applications Track VLSI for Video and Image Processing Microsystem and Mixed mode design Communication And Memory System Design Core voltage Low power Analog Circuits High Speed Circuit Techniques Application Specific DSP Architectures VLSI Design Methods and CAD Track Specification and Simulation at System Level Synthesis and Technology Mapping CAD Techniques for Low Power Design Physical Design Issues in Sub micron Technologies Architectural Design and Synthesis Testing in Complex Mixed Analog and Digital Systems

**APCCAS ...**, 1996 **Proceedings of the ... Midwest Symposium on Circuits and Systems**, 2000 **Analog Layout Generation for Performance and Manufacturability** Koen Lampaert, Georges Gielen, Willy M.C. Sansen, 2013-04-18 Analog integrated circuits are very important as interfaces between the digital parts of integrated electronic systems and the outside world A large portion of the effort involved in designing these circuits is spent in the layout phase Whereas the physical design of digital circuits is automated to a large extent the layout of analog circuits is still a manual time consuming and error prone task This is mainly due to the continuous nature of analog signals which causes analog circuit performance to be very sensitive to layout parasitics The parasitic elements associated with interconnect wires cause loading and coupling effects that degrade the frequency behaviour and the noise performance of analog circuits Device mismatch and thermal effects put a fundamental limit on the achievable accuracy of circuits For successful automation of analog layout advanced place and route tools that can handle these critical parasitics are required In the past automatic analog layout tools tried to optimize the layout without quantifying the performance

degradation introduced by layout parasitics Therefore it was not guaranteed that the resulting layout met the specifications and one or more layout iterations could be needed In Analog Layout Generation for Performance and Manufacturability the authors propose a performance driven layout strategy to overcome this problem In this methodology the layout tools are driven by performance constraints such that the final layout with parasitic effects still satisfies the specifications of the circuit The performance degradation associated with an intermediate layout solution is evaluated at runtime using predetermined sensitivities In contrast with other performance driven layout methodologies the tools proposed in this book operate directly on the performance constraints without an intermediate parasitic constraint generation step This approach makes a complete and sensible trade off between the different layout alternatives possible at runtime and therefore eliminates the possible feedback route between constraint derivation placement and layout extraction Besides its influence on the performance layout also has a profound impact on the yield and testability of an analog circuit In Analog Layout Generation for Performance and Manufacturability the authors outline a new criterion to quantify the detectability of a fault and combine this with a yield model to evaluate the testability of an integrated circuit layout They then integrate this technique with their performance driven routing algorithm to produce layouts that have optimal manufacturability while still meeting their performance specifications Analog Layout Generation for Performance and Manufacturability will be of interest to analog engineers researchers and students

Aslib Book Guide, 1994

**High-Performance Digital VLSI Circuit Design** Richard X. Gu, Khaled M. Sharaf, Mohamed I. Elmasry, 1996 High Performance Digital VLSI Circuit Design is devoted to the analysis and design of digital VLSI CMOS bipolar and BiCMOS circuits which are optimized for high performance applications The book starts by reviewing important background information in the area of MOS and bipolar device design and modeling Detailed analysis and design of high performance CMOS CML ECL NTL and BiCMOS circuits is given Achieving high speed while maintaining low power dissipation in digital circuits is addressed in depth in separate chapters The book ends with a sample application area of high performance design namely the design of phase locked loops The book can be used as a reference for practicing IC designers and as a text for graduate and senior undergraduate students in the area of digital IC design

**Cad Frameworks** Pieter van der Wolf, 1994 Since the early 1980s CAD frameworks have received a great deal of attention both in the research community and in the commercial arena It is generally agreed that CAD framework technology promises much advanced CAD frameworks can turn collections of individual tools into effective and user friendly design environments But how can this promise be fulfilled CAD Frameworks Principles and Architecture describes the design and construction of CAD frameworks It presents principles for building integrated design environments and shows how a CAD framework can be based on these principles It derives the architecture of a CAD framework in a systematic way using well defined primitives for representation This architecture defines how the many different framework sub topics ranging from concurrency control to design flow management relate to each other and come together into an

overall system The origin of this work is the research and development performed in the context of the Nelsis CAD Framework which has been a working system for well over eight years gaining functionality while evolving from one release to the next The principles and concepts presented in this book have been field tested in the Nelsis CAD Framework CAD Frameworks Principles and Architecture is primarily intended for EDA professionals both in industry and in academia but is also valuable outside the domain of electronic design Many of the principles and concepts presented are also applicable to other design oriented application domains such as mechanical design or computer aided software engineering CASE It is thus a valuable reference for all those involved in computer aided design

**Mixed-Signal Systems** Andrzej Handkiewicz, 2002-08-08 A practical guide to the successful integration of digital and analog circuits Mixed signal processing the integration of digital and analog circuitry within computer systems enables systems to take signals from the analog world and process them within a digital system In fact recent advances in VLSI technology performance now allow for the integration of digital and analog circuits on a single chip a process that requires the use of analog pre and post processing systems such as converters filters sensors drivers buffers and actuators However the lack of universal CAD tools for the synthesis simulation and layout of the analog part of the chip represents a design bottleneck of today's VLSI circuits

**Mixed Signal Systems A Guide to CMOS Circuit Design** presents a comprehensive general overview of the latest CMOS technology and covers the various computer systems that may be used for designing integrated circuits Taking an original approach to one and two dimensional filter design the author explores the many digital oriented design systems or silicon compilers currently being used and presents the basic methods procedures and tools used by each In a thorough and systematic manner the text Presents common features of digital oriented design systems Describes methods and tools that are not yet being applied in any compiler Illustrates image processing systems that can be implemented on a single chip Demonstrates the path from synthesis methods to the actual silicon assembly Essential reading for integrated circuit designers and developers of related computer programs as well as advanced students of system design this book represents an invaluable resource for anyone involved in the development of mixed signal systems

**Digital Timing Macromodeling for VLSI Design Verification** Jeong-Taek Kong, David V. Overhauser, 1995-05-31 Digital Timing Macromodeling for VLSI Design Verification first of all provides an extensive history of the development of simulation techniques It presents detailed discussion of the various techniques implemented in circuit timing fast timing switch level timing switch level and gate level simulation It also discusses mixed mode simulation and interconnection analysis methods The review in Chapter 2 gives an understanding of the advantages and disadvantages of the many techniques applied in modern digital macromodels The book also presents a wide variety of techniques for performing nonlinear macromodeling of digital MOS subcircuits which address a large number of shortcomings in existing digital MOS macromodels Specifically the techniques address the device model detail transistor coupling capacitance effective channel length modulation series transistor reduction effective transconductance input

terminal dependence gate parasitic capacitance the body effect the impact of parasitic RC interconnects and the effect of transmission gates The techniques address major sources of errors in existing macromodeling techniques which must be addressed if macromodeling is to be accepted in commercial CAD tools by chip designers The techniques presented in Chapters 4 6 can be implemented in other macromodels and are demonstrated using the macromodel presented in Chapter 3 The new techniques are validated over an extremely wide range of operating conditions much wider than has been presented for previous macromodels thus demonstrating the wide range of applicability of these techniques

**Formal Semantics for VHDL** Carlos Delgado Kloos,P. Breuer,1995-02-28 Research papers from a January 1994 workshop put forth a cohesive set of semantics for the VHDL language and describe semantics based on Petri nets as target language higher order logic functional concepts and evolving algebras Quotes from Lewis Carroll s Alice Through the Looking Glass introduce each paper For researchers in formal methods and advanced students No index Annotation copyright by Book News Inc Portland OR

**Proceedings** ,2005 **Evaluation of Computer Aided Software as a Space Analysis Tool for Outfit Unit Design and Planning** Patrick D. Cahill,1995 **Journal of VLSI Signal Processing Systems for Signal, Image, and Video Technology** ,1999 **Tsinghua Science and Technology** ,2003 **Generating Analog IC Layouts with LAYGEN II** Ricardo M. F. Martins,Nuno C. C. Lourenço,Nuno C.G. Horta,2012-12-16 This book presents an innovative methodology for the automatic generation of analog integrated circuits ICs layout based on template descriptions and on evolutionary computational techniques A design automation tool LAYGEN II was implemented to validate the proposed approach giving special emphasis to reusability of expert design knowledge and to efficiency on retargeting operations

The book delves into Analog Device Level Layout Automation. Analog Device Level Layout Automation is a crucial topic that must be grasped by everyone, ranging from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Analog Device Level Layout Automation, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:

- Chapter 1: Introduction to Analog Device Level Layout Automation
- Chapter 2: Essential Elements of Analog Device Level Layout Automation
- Chapter 3: Analog Device Level Layout Automation in Everyday Life
- Chapter 4: Analog Device Level Layout Automation in Specific Contexts
- Chapter 5: Conclusion

2. In chapter 1, the author will provide an overview of Analog Device Level Layout Automation. The first chapter will explore what Analog Device Level Layout Automation is, why Analog Device Level Layout Automation is vital, and how to effectively learn about Analog Device Level Layout Automation.

3. In chapter 2, this book will delve into the foundational concepts of Analog Device Level Layout Automation. This chapter will elucidate the essential principles that need to be understood to grasp Analog Device Level Layout Automation in its entirety.

4. In chapter 3, this book will examine the practical applications of Analog Device Level Layout Automation in daily life. This chapter will showcase real-world examples of how Analog Device Level Layout Automation can be effectively utilized in everyday scenarios.

5. In chapter 4, this book will scrutinize the relevance of Analog Device Level Layout Automation in specific contexts. The fourth chapter will explore how Analog Device Level Layout Automation is applied in specialized fields, such as education, business, and technology.

6. In chapter 5, this book will draw a conclusion about Analog Device Level Layout Automation. This chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Analog Device Level Layout Automation.

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