

The Art Of Analog Layout

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Analog Layout Synthesis
The Art of Analog Layout (Second Edition)
Analog Layout Generation for Performance and Manufacturability
Generating Analog IC Layouts with LAYGEN II
Analog Device-Level Layout Automation
ESD Computer-Aided Design of Analog Integrated Circuits and Systems
Automatic Synthesis of Analog Layout
Analog VLSI Design Automation
Analog Integrated Circuit Design Automation
Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology
IEEE Circuits & Devices
IC Mask Design
Symbolic Analysis for Automated Design of Analog Integrated Circuits
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Alan Hastings Ray Alan Hastings Helmut E. Graeb Alan Hastings Koen Lampaert Ricardo M. F. Martins John M. Cohn Steven H. Voldman Rob A. Rutenbar Mark J. Rentmeesters Sina Balkir Ricardo Martins Luciano Lavagno Christopher Saint Georges Gielen Stanley A. White

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for electrical engineering courses in analog layout or professional layout designers this text covers the issues involved in successfully laying out analog integrated circuits hastings provides clear guidance and does not stress theoretical physics or mathematical analysis of layouts he emphasizes cross sections of devices and carrier based models of device operation as compared to the more common geometric and schematic representation of devices

integrated circuits are fundamental electronic components in biomedical automotive and many other technical systems a small yet

crucial part of a chip consists of analog circuitry this part is still in large part designed by hand and therefore represents not only a bottleneck in the design flow but also a permanent source of design errors responsible for re designs costly in terms of wasted test chips and in terms of lost time to market layout design is the step of the analog design flow with the least support by commercially available computer aided design tools this book provides a survey of promising new approaches to automated analog layout design which have been described recently and are rapidly being adopted in industry

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

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

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.

A comprehensive and in depth review of analog circuit layout, schematic architecture, device power network and ESD design. This book will provide a balanced overview of analog circuit design, layout, analog circuit schematic development, architecture of chips and ESD design. It will start at an introductory level and will bring the reader right up to the state of the art. Two critical design aspects for analog and power integrated circuits are combined. The first design aspect covers analog circuit design techniques to achieve the desired circuit performance. The second and main aspect presents the additional challenges associated with the design of adequate and effective ESD protection elements and schemes. A comprehensive list of practical application examples is used to demonstrate the successful combination of both techniques and any potential design trade offs. Chapter one looks at analog design discipline including layout and analog matching and analog layout design practices. Chapter two discusses analog design with circuits examining single transistor amplifiers, multi transistor amplifiers, active loads and more. The third chapter covers analog design layout also MOSFET layout. Before chapters four and five discuss analog design synthesis. The next chapters introduce the reader to analog digital mixed signal design synthesis, analog signal pin ESD networks and analog ESD power clamps. Chapter nine the last chapter covers ESD design in analog applications. Clearly describes analog design fundamentals, circuit fundamentals as well as outlining the various ESD implications. Covers a large breadth of subjects and technologies such as CMOS, LDMOS, BCD, SOI and thick body SOI. Establishes an ESD analog design discipline that distinguishes itself from the alternative ESD digital design focus. Focuses on circuit and circuit design applications accessible with the artwork and tutorial style of the ESD book series. Powerpoint slides are available for university faculty members even in the world of digital circuits. Analog and power circuits are two very important but under addressed topics especially from the ESD aspect. Dr. Voldman's new book will serve as an essential and practical guide to the greater IC community with high practical and academic values. This book is a bible for professionals, graduate students, device and circuit designers for investigating the physics of ESD and for product designs and testing.

The tools and techniques you need to break the analog design bottleneck. Ten years ago analog seemed to be a dead end technology. Today system on chip, SoC designs are increasingly mixed signal designs with the advent of application specific integrated circuits, ASIC technologies that can integrate both analog and digital functions on a single chip. Analog has become more crucial than ever to the

design process today designers are moving beyond hand crafted one transistor at a time methods they are using new circuit and physical synthesis tools to design practical analog circuits new modeling and analysis tools to allow rapid exploration of system level alternatives and new simulation tools to provide accurate answers for analog circuit behaviors and interactions that were considered impossible to handle only a few years ago to give circuit designers and cad professionals a better understanding of the history and the current state of the art in the field this volume collects in one place the essential set of analog cad papers that form the foundation of today s new analog design automation tools areas covered are analog synthesis symbolic analysis analog layout analog modeling and analysis specialized analog simulation circuit centering and yield optimization circuit testing computer aided design of analog integrated circuits and systems is the cutting edge reference that will be an invaluable resource for every semiconductor circuit designer and cad professional who hopes to break the analog design bottleneck

the explosive growth and development of the integrated circuit market over the last few years have been mostly limited to the digital vlsi domain the difficulty of automating the design process in the analog domain the fact that a general analog design methodology remained undefined and the poor performance of earlier tools have left the analog

this book introduces readers to a variety of tools for analog layout design automation after discussing the placement and routing problem in electronic design automation eda the authors overview a variety of automatic layout generation tools as well as the most recent advances in analog layout aware circuit sizing the discussion includes different methods for automatic placement a template based placer and an optimization based placer a fully automatic router and an empirical based parasitic extractor the concepts and algorithms of all the modules are thoroughly described enabling readers to reproduce the methodologies improve the quality of their designs or use them as starting point for a new tool all the methods described are applied to practical examples for a 130nm design process as well as placement and routing benchmark sets

the second of two volumes in the electronic design automation for integrated circuits handbook second edition electronic design automation for ic implementation circuit design and process technology thoroughly examines real time logic rtl to gdsii a file format used to transfer data of semiconductor physical layout design flow analog mixed signal design physical verification and technology computer aided design tcad chapters contributed by leading experts authoritatively discuss design for manufacturability dfm at the nanoscale power supply network design and analysis design modeling and much more new to this edition major updates appearing in the initial phases of the design flow where the level of abstraction keeps rising to support more functionality with lower non recurring engineering nre costs significant revisions reflected in the final phases of the design flow where the complexity due to smaller and smaller geometries is compounded by the slow progress of shorter wavelength lithography new coverage of cutting edge applications and approaches realized in the decade since publication of the previous edition these are illustrated by new chapters on 3d circuit integration and clock design offering improved depth and modernity electronic design automation for ic implementation circuit design and process technology provides a valuable state of the art reference for electronic design automation eda students researchers and professionals

integrated circuit mask design teaches integrated circuit ic processes mask design techniques and fundamental device concepts in everyday language it develops ideas from the ground up building complex concepts out of simple ones constantly reinforcing what has been taught with examples self tests and sidebars covering the motivation behind the material covered

it is a great honor to provide a few words of introduction for dr georges gielen s and prof willy sansen s book symbolic analysis for automated design of analog integrated circuits the symbolic analysis method presented in this book represents a significant step forward in the area of analog circuit design as demonstrated in this book symbolic analysis opens up new possibilities for the development of computer aided design cad tools that can analyze an analog circuit topology and automatically size the components for a given set of specifications symbolic analysis even has the potential to improve the training of young analog circuit designers and to guide more experienced designers through second order phenomena such as distortion this book can also serve as an excellent reference for researchers in the analog circuit design area and creators of cad tools as it provides a comprehensive overview and comparison of various approaches for analog circuit design automation and an extensive bibliography the world is essentially analog in nature hence most electronic systems involve both analog and digital circuitry as the number of transistors that can be integrated on a single integrated circuit ic substrate steadily increases over time an ever increasing number of systems will be implemented with one or a few very complex ics because of their lower production costs

iscas 98 provides the latest results on many important subjects in computer aided design modeling and simulation testing signal processing neural and fuzzy systems multimedia image and video processing linear and nonlinear circuits and systems and many more exciting fields

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Introduction

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