

**POWER OPTIMIZATION  
AND SYNTHESIS AT  
BEHAVIORAL AND  
SYSTEM LEVELS USING  
FORMAL METHODS**



Jui-Ming Chang  
Massoud Pedram

Kluwer Academic Publishers

# Power Optimization And Synthesis At Behavioral And System Levels Using Formal Methods

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## **Power Optimization And Synthesis At Behavioral And System Levels Using Formal Methods:**

*Power Optimization and Synthesis at Behavioral and System Levels Using Formal Methods* Jui-Ming Chang, Massoud Pedram, 2012-12-06 Integrated circuit densities and operating speeds continue to rise at an exponential rate Chips however cannot get larger and faster without a sharp decrease in power consumption beyond the current levels Minimization of power consumption in VLSI chips has thus become an important design objective In fact with the explosive growth in demand for portable electronics and the usual push toward more complex functionality and higher performance power consumption has in many cases become the limiting factor in satisfying the market demand A new generation of power conscious CAD tools are coming onto the market to help designers estimate optimize and verify power consumption levels at most stages of the IC design process These tools are especially prevalent at the register transfer level and below There is a great need for similar tools and capabilities at the behavioral and system levels of the design process Many researchers and CAD tool developers are working on high level power modeling and estimation as well as power constrained high level synthesis and optimization Techniques and tools alone are however insufficient to optimize VLSI circuit power dissipation a consistent and convergent design methodology is also required

*Power Optimization and Synthesis at Behavioral and System Levels Using Formal Methods* was written to address some of the key problems in power analysis and optimization early in the design process In particular this book focuses on power macro modeling based on regression analysis and power minimization through behavioral transformations scheduling resource assignment and hardware software partitioning and mapping What differentiates this book from other published work on the subject is the mathematical basis and formalism behind the algorithms and the optimality of these algorithms subject to the stated assumptions From the Foreword This book makes an important contribution to the field of system design technologies by presenting a set of algorithms with guaranteed optimality properties that can be readily applied to system level design This contribution is timely because it fills the need of new methods for a new design tool generation which supports the design of electronic systems with even more demanding requirements Giovanni De Micheli Professor Stanford University

*Power Optimization and Synthesis at Behavioral and System Levels Using Formal Methods* Jui-Ming Chang, Massoud Pedram, 1999-06-30 Integrated circuit densities and operating speeds continue to rise at an exponential rate Chips however cannot get larger and faster without a sharp decrease in power consumption beyond the current levels Minimization of power consumption in VLSI chips has thus become an important design objective In fact with the explosive growth in demand for portable electronics and the usual push toward more complex functionality and higher performance power consumption has in many cases become the limiting factor in satisfying the market demand A new generation of power conscious CAD tools are coming onto the market to help designers estimate optimize and verify power consumption levels at most stages of the IC design process These tools are especially prevalent at the register transfer level and below There is a great need for similar tools and capabilities at the behavioral and

system levels of the design process Many researchers and CAD tool developers are working on high level power modeling and estimation as well as power constrained high level synthesis and optimization Techniques and tools alone are however insufficient to optimize VLSI circuit power dissipation a consistent and convergent design methodology is also required

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**Low Power Design with High-Level Power Estimation and Power-Aware Synthesis** Sumit Ahuja,Avinash Lakshminarayana,Sandeep Kumar Shukla,2011-10-22 This book presents novel research techniques algorithms methodologies and experimental results for high level power estimation and power aware high level synthesis Readers will learn to apply such techniques to enable design flows resulting in shorter time to market and successful low power ASIC FPGA design

**Low Power Hardware Synthesis from Concurrent Action-Oriented Specifications** Gaurav Singh,Sandeep Kumar Shukla,2010-07-23 Human lives are getting increasingly entangled with technology especially computing and electronics At each step we take especially in a developing world we are dependent on various gadgets such as cell phones handheld PDAs netbooks medical prosthetic devices and medical measurement devices e.g blood pressure monitors glucometers Two important design constraints for such consumer electronics are their form factor and battery life This translates to the requirements of reduction in the die area and reduced power consumption for the semiconductor chips that go inside these gadgets Performance is also important as increasingly sophisticated applications run on these devices and many of them require fast response time The form factor of such electronics goods depends not only on the overall area of the chips inside them but also on the packaging which depends on thermal characteristics Thermal characteristics in turn depend on peak power signature of the chips As a result while the overall energy usage reduction increases battery life peak power reduction influences the form factor One more important aspect of these electronic equipments is that every 6 months or so a newer feature needs to be added to keep ahead of the market competition and hence new designs have to be completed with these new features better form factor battery life and performance every few months This extreme pressure

on the time to market is another force that drives the innovations in design automation of semiconductor chips

Low-Power High-Level Synthesis for Nanoscale CMOS Circuits Saraju P. Mohanty, Nagarajan Ranganathan, Elias Kougianos, Priyadarshan Patra, 2008-05-31 Low Power High Level Synthesis for Nanoscale CMOS Circuits addresses the need for analysis characterization estimation and optimization of the various forms of power dissipation in the presence of process variations of nano CMOS technologies The authors show very large scale integration VLSI researchers and engineers how to minimize the different types of power consumption of digital circuits The material deals primarily with high level architectural or behavioral energy dissipation because the behavioral level is not as highly abstracted as the system level nor is it as complex as the gate transistor level At the behavioral level there is a balanced degree of freedom to explore power reduction mechanisms the power reduction opportunities are greater and it can cost effectively help in investigating lower power design alternatives prior to actual circuit layout or silicon implementation The book is a self contained low power high level synthesis text for Nanoscale VLSI design engineers and researchers Each chapter has simple relevant examples for a better grasp of the principles presented Several algorithms are given to provide a better understanding of the underlying concepts The initial chapters deal with the basics of high level synthesis power dissipation mechanisms and power estimation In subsequent parts of the text a detailed discussion of methodologies for the reduction of different types of power is presented including Power Reduction Fundamentals Energy or Average Power Reduction Peak Power Reduction Transient Power Reduction Leakage Power Reduction Low Power High Level Synthesis for Nanoscale CMOS Circuits provides a valuable resource for the design of low power CMOS circuits *Springer Handbook of Automation* Shimon Y. Nof, 2009-07-16 Automation is undergoing a major transformation in scope and dimension and plays an increasingly important role in the global economy and in our daily lives Engineers combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities This handbook incorporates these new developments and presents a widespread and well structured conglomeration of new emerging application areas of automation Besides manufacturing as a primary application of automation the handbook contains new application areas such as medical systems and health transportation security and maintenance service construction and retail as well as production or logistics This Springer Handbook is not only an ideal resource for automation experts but also for people new to this expanding field such as engineers medical doctors computer scientists designers It is edited by an internationally renowned and experienced expert **DCIS2002** Salvador Bracho del Pino, Mar Martínez, Teresa Riesgo, Miguel Ángel Allende Recio, 2002 Este libro contiene las presentaciones de la XVII Conferencia de Diseño de Circuitos y Sistemas Integrados celebrado en el Palacio de la Magdalena Santander en noviembre de 2002 Esta Conferencia ha alcanzado un alto nivel de calidad como consecuencia de su tradición y madurez que lo convierte en uno de los acontecimientos más importantes para los circuitos de microelectrónica y la comunidad de diseño de sistemas en el sur de

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**Design Automation, Languages, and Simulations** Wai-Kai Chen,2003-03-26 As the complexity of electronic systems continues to increase the micro electronic industry depends upon automation and simulations to adapt quickly to market changes and new technologies Compiled from chapters contributed to CRC's best selling VLSI Handbook this volume of the Principles and Applications in Engineering series covers a broad range

**Semantic Hyper/Multimedia Adaptation** Ioannis E. Anagnostopoulos,Mária Bielíková,Phivos Mylonas,Nicolas Tsapatsoulis,2012-07-28 Nowadays more and more users are witnessing the impact of Hypermedia Multimedia as well as the penetration of social applications in their life Parallel to the evolution of the Internet and Web several Hypermedia Multimedia schemes and technologies bring semantic based intelligent personalized and adaptive services to the end users More and more techniques are applied in media systems in order to be user group centric adapting to different content and context features of a single or a community user In respect to all the above researchers need to explore and study the plethora of challenges that emergent personalisation and adaptation technologies bring to the new era This edited volume aims to increase the awareness of researchers in this area All contributions provide an in depth investigation on research and deployment issues regarding already introduced schemes and applications in Semantic Hyper Multimedia and Social Media Adaptation Moreover the authors provide survey based articles so as potential readers can use it for catching up the recent trends and applications in respect to the relevant literature Finally the authors discuss and present their approach in the respective field or problem addressed

**The Circuits and Filters Handbook** Wai-Kai Chen,2002-12-23 A bestseller in its first edition The Circuits and Filters Handbook has been thoroughly updated to provide the most current most comprehensive information available in both the classical and emerging fields of circuits and filters both analog and digital This edition contains 29 new chapters with significant additions in the areas of computer

**Formal Methods in VLSI System Design** Adnan Aziz,1996

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**Prototyping** Rudy Lauwereins,1995 To help designers and developers of hardware software systems knock together a working model more quickly the 33 papers discuss models for system simulation and emulation in a hierarchical sense software to hardware mapping software prototyping and validation prototyping environments of hardware *Formal Methods for Embedded System Design* Harry Chia Chang Hsieh,2000 **Dissertation Abstracts International** ,2009  
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In some sort of consumed by monitors and the ceaseless chatter of quick connection, the melodic elegance and mental symphony created by the prepared term often disappear into the background, eclipsed by the constant noise and interruptions that permeate our lives. But, set within the pages of **Power Optimization And Synthesis At Behavioral And System Levels Using Formal Methods** a stunning fictional value brimming with fresh thoughts, lies an immersive symphony waiting to be embraced. Crafted by an outstanding composer of language, that charming masterpiece conducts readers on an emotional journey, well unraveling the concealed melodies and profound influence resonating within each carefully crafted phrase. Within the depths with this poignant review, we can investigate the book is central harmonies, analyze its enthralling publishing type, and submit ourselves to the profound resonance that echoes in the depths of readers souls.

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