

Nanometer Frequency Synthesis Beyond the Phase-Locked Loop

Liming Xiu



A NEW FRONTIER IN ELECTRONIC SYSTEM DESIGN

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Sabine Zange

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Nanometer Frequency Synthesis Beyond the Phase-Locked Loop Liming Xiu,2012-08-14 Introducing a new pioneering approach to integrated circuit design Nanometer Frequency Synthesis Beyond Phase Locked Loop introduces an innovative new way of looking at frequency that promises to open new frontiers in modern integrated circuit IC design While most books on frequency synthesis deal with the phase locked loop PLL this book focuses on the clock signal It revisits the concept of frequency solves longstanding problems in on chip clock generation and presents a new time based information processing approach for future chip design Beginning with the basics the book explains how clock signal is used in electronic applications and outlines the shortcomings of conventional frequency synthesis techniques for dealing with clock generation problems It introduces the breakthrough concept of Time Average Frequency presents the Flying Adder circuit architecture for the implementation of this approach and reveals a new circuit device the Digital to Frequency Converter DFC Lastly it builds upon these three key components to explain the use of time rather than level to represent information in signal processing Provocative inspiring and chock full of ideas for future innovations the book features A new way of thinking about the fundamental concept of clock frequency A new circuit architecture for frequency synthesis the Flying Adder direct period synthesis A new electronic component the Digital to Frequency Converter A new information

processing approach time based vs level based Examples demonstrating the power of this technology to build better cheaper and faster systems Written with the intent of showing readers how to think outside the box Nanometer Frequency Synthesis Beyond the Phase Locked Loop is a must have resource for IC design engineers and researchers as well as anyone who would like to be at the forefront of modern circuit design *The Turn of Moore's Law from Space to Time* Liming Xiu,2022-05-24

This book states that a space induced crisis is recognized as the cause of trouble that Moore's Law is currently facing The contemporary practice of this empirical law can be considered as happening within a space dominant paradigm An alternative of exploiting potential in the dimension of time is identified as an emerging paradigm in microelectronics The new practice is termed a time oriented paradigm It is justified as the turn of Moore's Law from space to time The resultant Time Moore strategy is envisioned as the next generation enabler for continuing Moore's Law's pursuit of everhigher information processing power and efficiency It also serves as the perpetuation of the spirit that Moore's law is nothing but a collective storied history of innovations In the first part of this book by following Thomas Kuhn's seminal work around the concepts of paradigm and scientific revolution the argument for the Time Moore strategy Time Moore to use time more and the paradigm shift from space to time is carried out heavily through philosophical persuasion rather than technical proof due to the difficult challenge of change of mindset The second part of the book provides solid technical materials for supporting this transition from the old paradigm to the new one In short the goal of this book is to reevaluate the contemporary practice of microelectronics identify the cause of the current crisis advocate a change of mindset to circumvent the crisis and ultimately point out a new route for advancing After achieving so many unprecedented accomplishments through several decades of relentless endeavor it's time for the big ship of Moore's Law i.e. the art of microelectronic system design to make a turn

Low Power Circuits for Emerging Applications in Communications, Computing, and Sensing Fei

Yuan,2018-12-07 The book addresses the need to investigate new approaches to lower energy requirement in multiple application areas and serves as a guide into emerging circuit technologies It explores revolutionary device concepts sensors and associated circuits and architectures that will greatly extend the practical engineering limits of energy efficient computation The book responds to the need to develop disruptive new system architectures circuit microarchitectures and attendant device and interconnect technology aimed at achieving the highest level of computational energy efficiency for general purpose computing systems Features Discusses unique technologies and material only available in specialized journal and conferences Covers emerging applications areas such as ultra low power communications emerging bio electronics and operation in extreme environments Explores broad circuit operation ex analog RF memory and digital circuits Contains practical applications in the engineering field as well as graduate studies Written by international experts from both academia and industry *Mixed-Signal Circuits* Thomas Noulis,2018-09-03 Mixed Signal Circuits offers a thoroughly modern treatment of integrated circuit design in the context of mixed signal applications Featuring chapters authored by

leading experts from industry and academia this book Discusses signal integrity and large scale simulation verification and testing Demonstrates advanced design techniques that enable digital circuits and sensitive analog circuits to coexist without any compromise Describes the process technology needed to address the performance challenges associated with developing complex mixed signal circuits Deals with modeling topics such as reliability variability and crosstalk that define pre silicon design methodology and trends and are the focus of companies involved in wireless applications Develops methods to move analog into the digital domain quickly minimizing and eliminating common trade offs between performance power consumption simulation time verification size and cost Details approaches for very low power performances high speed interfaces phase locked loops PLLs voltage controlled oscillators VCOs analog to digital converters ADCs and biomedical filters Delineates the respective parts of a full system on chip SoC from the digital parts to the baseband blocks radio frequency RF circuitries electrostatic discharge ESD structures and built in self test BIST architectures Mixed Signal Circuits explores exciting opportunities in wireless communications and beyond The book is a must for anyone involved in mixed signal circuit design for future technologies

Dissertation Abstracts International ,2007 From Frequency to Time-Average-Frequency Liming Xiu,2015-04-20 Written in a simple easy to understand style this book will teach PLL users how to use new clock technology in their work in order to create innovative applications Investigates the clock frequency concept from a different perspective at an application level Teaches engineers to use this new clocking technology to create innovations in chip system level through real examples extracted from commercial products

Proceedings of the Fourteenth Biennial University/Government/Industry Microelectronics Symposium ,2001 **Optics Letters** ,2004

Government Reports Announcements & Index ,1993-05 **Electrical & Electronics Abstracts** ,1997

International Aerospace Abstracts ,1999 *Ceramic Abstracts* American Ceramic Society,1997 **A New Technique for Fractional-N Phase-locked Loop Frequency Synthesis** Jerome Mark Shapiro,1984 Digital Frequency Synthesis Demystified Bar-Giora Goldberg,1999 Preface Introduction to frequency synthesis Frequency synthesizer system analysis Measurement techniques DDS general architecture Phase locked loop synthesizers Accumulators Lockup table and sine rom compression Digital to analog converters Synthesizers in use and reference generators Index **Design of Fractional-N Phase Locked Loops for Frequency Synthesis from 30 to 40 GHz** George Gal,2013 High frequency fractional N PLLs in CMOS technology in the 30 to 40 GHz are very difficult to design when considering power area phase noise requirements and frequency range of operation One of the difficulties is to synthesize the loop filter of the PLL such that it meets the phase noise characteristics using the information available for all the components that make up the PLL At the same time predicting the phase noise output of the PLL using extracted layout results takes a long time to simulate and often the solution does not converge thereby lengthening the design cycle This thesis proposes a new methodology for designing high performance wide band fractional N PLLs in the 30 40 GHz range The method begins by first designing the phase

frequency detector charge pump voltage controlled oscillator and frequency divider circuit for realization in a specific CMOS technology. The method of choice mixes insight deemed from both a theoretical and simulation perspective. Next the loop filter is derived based on the layout extracted behaviour of each component. Once complete all components of the PLL are described using the high level description language of Verilog A available in the Cadence tool set over its full range of operating characteristics. Ideally these components would be fabricated, tested and characterized afterward. The Verilog A description of the PLL enables a fast and efficient simulation of the complete PLL in a closed loop configuration. This latter step allows further optimization of the overall design. Two chips have been fabricated, one in a 0.13 μm CMOS process from IBM and another in a 65 nm CMOS process from TSMC. One chip contains the design of a 28 GHz VCO and another containing the design of a programmable frequency divider circuit. Experimental results for both chip are provided.

Digital Techniques in Frequency Synthesis Bar-Giora Goldberg, 1996 **Science Abstracts**, 1995 **Advanced Frequency Synthesis by Phase Lock** William F. Egan, 2011-10-07

The latest frequency synthesis techniques including sigma delta, Diophantine and all digital Sigma delta is a frequency synthesis technique that has risen in popularity over the past decade due to its intensely digital nature and its ability to promote miniaturization. A continuation of the popular Frequency Synthesis by Phase Lock Second Edition, this timely resource provides a broad introduction to sigma delta bypassing practical simulation results with cutting edge research. Advanced Frequency Synthesis by Phase Lock discusses both sigma delta and fractional-N, the still in use forerunner to sigma delta employing Simulink models and detailed simulations of results to promote a deeper understanding. After a brief introduction, the book shows how spurs are reproduced at the synthesizer output by the basic process and different methods for overcoming them. It investigates how various defects in sigma delta synthesis contribute to spurs or noise in the synthesized signal. Synthesizer configurations are analyzed and it is revealed how to trade off the various noise sources by choosing loop parameters. Other sigma delta synthesis architectures are then reviewed. The Simulink simulation models that provided data for the preceding discussions are described, providing guidance in making use of such models for further exploration. Next, another method for achieving wide loop bandwidth simultaneously with fine resolution, the Diophantine Frequency Synthesizer, is introduced. Operation at extreme bandwidths is also covered, further describing the analysis of synthesizers that push their bandwidths close to the sampling frequency limit. Lastly, the book reviews a newly important technology that is poised to become widely used in high production consumer electronics: all digital frequency synthesis. Detailed appendices provide in-depth discussion on various stages of development and many related resources are available for download, including Simulink models, MATLAB scripts, spreadsheets and executable programs. All these features make this authoritative reference ideal for electrical engineers who want to achieve an understanding of sigma delta frequency synthesis and an awareness of the latest developments in the field.

Frequency Synthesis Using Phase-locked Loop, 2002

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