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Fast Hopping Frequency Generation in Digital CMOS

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**Mohammad Farazian, Lawrence E.
Larson, Prasad S. Gudem**



Fast Hopping Frequency Generation In Digital Cmos:

Fast Hopping Frequency Generation in Digital CMOS Springer,2012-10-13 **Fast Hopping Frequency Generation in Digital CMOS** Mohammad Farazian, Lawrence E. Larson, Prasad S. Gudem,2012-10-12 Overcoming the agility limitations of conventional frequency synthesizers in multi band OFDM ultra wideband is a key research goal in digital technology This volume outlines a frequency plan that can generate all the required frequencies from a single fixed frequency able to implement center frequencies with no more than two levels of SSB mixing It recognizes the need for future synthesizers to bypass on chip inductors and operate at low voltages to enable the increased integration and efficiency of networked appliances The author examines in depth the architecture of the dividers that generate the necessary frequencies from a single base frequency and are capable of establishing a fractional division ratio Presenting the first CMOS inductorless single PLL 14 band frequency synthesizer for MB OFDMUWB makes this volume a key addition to the literature and with the synthesizer capable of arbitrary band hopping in less than two nanoseconds it operates well within the desired range on a 1.2 volt power supply The author's close analysis of the operation stability and phase noise of injection locked regenerative frequency dividers will provide researchers and technicians with much food for developmental thought

Quadrature Frequency Generation for Wideband Wireless Applications Mohammad Elbadry, Ramesh Harjani,2015-03-10 This book describes design techniques for wideband quadrature LO generation for software defined radio transceivers with frequencies spanning 4GHz to around 80GHz The authors discuss several techniques that can be used to reduce the cost and or power consumption of one of the key component of the RF front end the quadrature local oscillator The discussion includes simple and useful insights into quadrature VCOs along with numerous examples of practical techniques

Millimeter-Wave Digitally Intensive Frequency Generation in CMOS Wanghua Wu, Robert Bogdan Staszewski, John R. Long,2015-09-23 This book describes the digitally intensive time domain architectures and techniques applied to millimeter wave frequency synthesis with the objective of improving performance and reducing the cost of implementation Coverage includes system architecture system level modeling critical building block design and digital calibration techniques making it highly suitable for those who want to learn about mm wave frequency generation for communication and radar applications integrated circuit implementation and time domain circuit and system techniques Highlights the challenges of frequency synthesis at mm wave band using CMOS technology Compares the various approaches for mm wave frequency generation pros and cons Introduces the digitally intensive synthesizer approach and its advantages Discusses the proper partitioning of the digitally intensive mm wave frequency synthesizer into mm wave RF analog digital and software components Provides detailed design techniques from system level to circuit level Addresses system modeling simulation techniques design for test and layout issues Demonstrates the use of time domain techniques for high performance mm wave frequency synthesis *Direct Digital Synthesizers* Jouko Vankka, Kari A.I. Halonen,2013-04-17 A major advantage of a direct

digital synthesizer DDS is that its output frequency phase and amplitude can be precisely and rapidly manipulated under digital processor control Other inherent DDS attributes include the ability to tune with extremely fine frequency and phase resolution and to rapidly hop between frequencies These combined characteristics have made the technology popular in military radar and communications systems In fact DDS technology was previously applied almost exclusively to high end and military applications it was costly power hungry difficult to implement and required a discrete high speed D A converter Due to improved integrated circuit IC technologies they now present a viable alternative to analog based phase locked loop PLL technology for generating agile analog output frequency in consumer synthesizer applications It is easy to include different modulation capabilities in the DDS by using digital signal processing DSP methods because the signal is in digital form By programming the DDS adaptive channel bandwidths modulation formats frequency hopping and data rates are easily achieved The flexibility of the DDS makes it ideal for signal generator for software radio The digital circuits used to implement signal processing functions do not suffer the effects of thermal drift aging and component variations associated with their analog counterparts The implementation of digital functional blocks makes it possible to achieve a high degree of system integration Recent advances in IC fabrication technology particularly CMOS coupled with advanced DSP algorithms and architectures are providing possible single chip DDS solutions to complex communication and signal processing subsystems as modulators demodulators local oscillators programmable clock generators and chirp generators The DDS addresses a variety of applications including cable modems measurement equipments arbitrary waveform generators cellular base stations and wireless local loop base stations Direct Digital Synthesizers was written to find possible applications for radio communication systems It will have appeal for wireless and wireline communication engineers teachers and students

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 **All-Digital Frequency Synthesizer in Deep-Submicron CMOS** Robert Bogdan Staszewski, Poras T. Balsara, 2006-10-25 A new and innovative paradigm for RF frequency synthesis and wireless transmitter design Learn the techniques for designing and

implementing an all digital RF frequency synthesizer In contrast to traditional RF techniques this innovative book sets forth digitally intensive design techniques that lead the way to the development of low cost low power and highly integrated circuits for RF functions in deep submicron CMOS processes Furthermore the authors demonstrate how the architecture enables readers to integrate an RF front end with the digital back end onto a single silicon die using standard ASIC design flow Taking a bottom up approach that progressively builds skills and knowledge the book begins with an introduction to basic concepts of frequency synthesis and then guides the reader through an all digital RF frequency synthesizer design Chapter 2 presents a digitally controlled oscillator DCO which is the foundation of a novel architecture and introduces a time domain model used for analysis and VHDL simulation Chapter 3 adds a hierarchical layer of arithmetic abstraction to the DCO that makes it easier to operate algorithmically Chapter 4 builds a phase correction mechanism around the DCO such that the system's frequency drift or wander performance matches that of the stable external frequency reference Chapter 5 presents an application of the all digital RF synthesizer Chapter 6 describes the behavioral modeling and simulation methodology used in design The final chapter presents the implementation of a full transmitter and experimental results The novel ideas presented here have been implemented and proven in two high volume commercial single chip radios developed at Texas Instruments Bluetooth and GSM While the focus of the book is on RF frequency synthesizer design the techniques can be applied to the design of other digitally assisted analog circuits as well This book is a must read for students and engineers who want to learn a new paradigm for RF frequency synthesis and wireless transmitter design using digitally intensive design techniques

Fast Hopping High-frequency Carrier Generation in Digital CMOS Technology

Mohammad Farazian, 2009 One of the challenges in implementing a frequency synthesizer for Multi band OFDM Ultra Wideband MB OFDM UWB is overcoming the agility limitations of conventional synthesizers The MB OFDM proposal for UWB divides the spectrum from 3.1 GHz to 10.6 GHz into 14 different bands and frequency hops at the rate of 3.2 MHz between them with a specified frequency settling time of only 9.5 nS Design techniques that eliminate the use of on chip inductors and which are compatible with low voltage operation are critical for increasing the level of integration for future implementations An inductor less design methodology may have several advantages over traditional design techniques 1 While the area required to implement an on chip inductor does not scale down in the finer technology nodes inductor less designs benefit from technology scaling 2 On the other hand the quality factor of the on chip inductors may worsen in finer technology nodes which can lead to an increase in the required current consumption to generate a given voltage swing 3 It is more straightforward to port an inductor less design into a new technology node The penalty for an inductor less design methodology is a slightly increase in the current consumption to achieve the necessary gain and voltage swing in the absence of inductors In this work a frequency plan is proposed that can generate all the required frequencies from a single fixed frequency and can implement any center frequency with a maximum of two levels of SSB mixing In order to generate all the

required frequencies for the operation of this frequency synthesizer out of a single frequency fractional frequency dividers are needed Therefore a study is performed on the architectures that can obtain a fractional division ratio This study involves an analysis of the operation stability and phase noise of injection locked regenerative frequency dividers In addition the operation stability locking range and phase noise of two stage ring oscillators which are compact ways to generate quadrature output phases and can be used in injection locked regenerative frequency dividers are analyzed This work presents the first CMOS inductor less single PLL 14 band frequency synthesizer for MB OFDM UWB which is capable to perform any arbitrary band switching specified in less than 2 nS Implemented in a 0.13 μ m CMOS process it uses a single 1.2 V supply voltage and dissipates 135 mW The mixing sideband level is better than 31 dBc and the phase noise is better than 110 dBc/Hz at 1 MHz offset

CMOS Fractional-N Synthesizers Bram De Muer, Michiel Steyaert, 2005-12-29 CMOS Fractional N Synthesizers starts with a comprehensive introduction to general frequency synthesis Different architectures and synthesizer building blocks are discussed with their relative importance on synthesizer specifications The process of synthesizer specification derivation is illustrated with the DCS 1800 standard as a general test case The book tackles the design of fractional N synthesizers in CMOS on circuit level as well as system level The circuit level focuses on high speed prescaler design up to 12 GHz in CMOS and on fully integrated low phase noise LC VCO design High Q inductor integration and simulation in CMOS is elaborated and flicker noise minimization techniques are presented ranging from bias point choice to noise filtering techniques On a higher level a systematic design strategy has been developed that trades off all noise contributions and fast dynamics for integrated capacitance area Moreover a theoretical DeltaSigma phase noise analysis is presented extended with a fast non linear analysis method to accurately predict the influence of PLL non linearities on the spectral purity of the DeltaSigma fractional N frequency synthesizers

Microwave and Wireless Synthesizers Ulrich L. Rohde, Enrico Rubiola, Jerry C. Whitaker, 2021-04-27 The new edition of the leading resource on designing digital frequency synthesizers from microwave and wireless applications fully updated to reflect the most modern integrated circuits and semiconductors Microwave and Wireless Synthesizers Theory and Design Second Edition remains the standard text on the subject by providing complete and up to date coverage of both practical and theoretical aspects of modern frequency synthesizers and their components Featuring contributions from leading experts in the field this classic volume describes loop fundamentals noise and spurious responses special loops loop components multiloop synthesizers and more Practical synthesizer examples illustrate the design of a high performance hybrid synthesizer and performance measurement techniques offering readers clear instruction on the various design steps and design rules The second edition includes extensively revised content throughout including a modern approach to dealing with the noise and spurious response of loops and updated material on digital signal processing and architectures Reflecting today's technology new practical and validated examples cover a combination of analog and digital synthesizers and hybrid systems Enhanced and expanded

chapters discuss implementations of direct digital synthesis DDS architectures the voltage controlled oscillator VCO crystal and other high Q based oscillators arbitrary waveform generation vector signal generation and other current tools and techniques Now requiring no additional literature to be useful this comprehensive one stop resource Provides a fully reviewed updated and enhanced presentation of microwave and wireless synthesizers Presents a clear mathematical method for designing oscillators for best noise performance at both RF and microwave frequencies Contains new illustrations figures diagrams and examples Includes extensive appendices to aid in calculating phase noise in free running oscillators designing VHF and UHF oscillators with CAD software using state of the art synthesizer chips and generating millimeter wave frequencies using the delay line principle Containing numerous designs of proven circuits and more than 500 relevant citations from scientific journal and papers Microwave and Wireless Synthesizers Theory and Design Second Edition is a must have reference for engineers working in the field of radio communication and the perfect textbook for advanced electrical engineering students

Fast Hopping Frequency Generation In Digital Cmos Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Fast Hopping Frequency Generation In Digital Cmos**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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