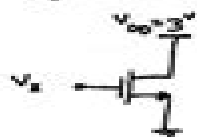


Chapter 2

2.1) a) NMOS :

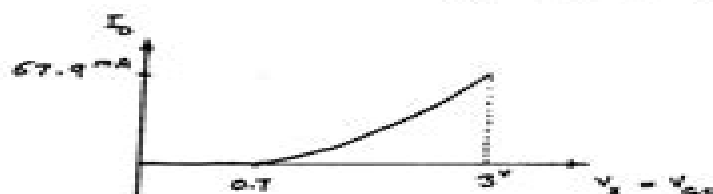


for $V_x < V_{th} (= 0.7)$ device is off, $I_D \approx 0$

for $V_x \geq 0.7$

$$I_D = \frac{1}{2} \mu_n C_{ox} \frac{W}{L_{eff}} (V_x - 0.7)^2 (1 + \lambda \cdot 3V) \quad (L_{eff} = 0.5^{\mu m} - 2L_D)$$

$$I_D = 12.8 \left(\frac{nA}{V^2} \right) \cdot (V_x - 0.7)^2$$



b) PMOS :

Solution is the same

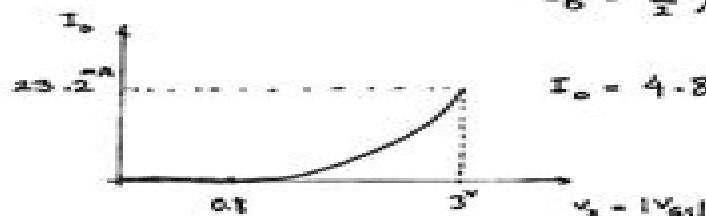


for $|V_{GS}| < V_{th} (= 0.8)$ $I_D = 0$

for $|V_{GS}| \geq 0.8$

$$I_D = \frac{1}{2} \mu_p C_{ox} \frac{W}{L_{eff}} (V_x - 0.8)^2 (1 + \lambda \cdot 3V)$$

$$I_D = 4.8 \left(\frac{nA}{V^2} \right) \cdot (V_x - 0.8)^2$$



Design Of Analog Cmos Integrated Circuits Solution Manual

Phillip E. Allen, Douglas R. Holberg



Design Of Analog Cmos Integrated Circuits Solution Manual:

Computer-Aided Design of Analog Integrated Circuits and Systems Rob A. Rutenbar, Georges G. E.

Gielen, 2002-05-06 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 **CMOS Analog**

Circuit Design Phillip E. Allen, Douglas R. Holberg, 2011 A textbook for 4th year undergraduate first year graduate electrical engineering students [A Computer-Aided Design and Synthesis Environment for Analog Integrated Circuits](#) Geert Van der Plas, Georges Gielen, Willy M.C. Sansen, 2005-12-27 This text addresses the design methodologies and CAD tools available for the systematic design and design automation of analogue integrated circuits Two complementary approaches discussed increase analogue design productivity demonstrated throughout using design times of the different design experiments undertaken **Advances in Analog Circuits** Esteban Tlelo-Cuautle, 2011-02-02 This book highlights key design issues and challenges to guarantee the development of successful applications of analog circuits Researchers around the world share acquired experience and insights to develop advances in analog circuit design modeling and simulation The key contributions of the sixteen chapters focus on recent advances in analog circuits to accomplish academic or industrial target specifications

Simulation and Optimization of Digital Circuits Vazgen Melikyan, 2018-04-12 This book describes new fuzzy logic based mathematical apparatus which enable readers to work with continuous variables while implementing whole circuit simulations with speed similar to gate level simulators and accuracy similar to circuit level simulators The author demonstrates newly developed principles of digital integrated circuit simulation and optimization that take into consideration various external and internal destabilizing factors influencing the operation of digital ICs The discussion includes factors including radiation ambient temperature electromagnetic fields and climatic conditions as well as non ideality of

interconnects and power rails Automatic Analog IC Sizing and Optimization Constrained with PVT Corners and Layout Effects Nuno Lourenço,Ricardo Martins,Nuno Horta,2016-07-29 This book introduces readers to a variety of tools for automatic analog integrated circuit IC sizing and optimization The authors provide a historical perspective on the early methods proposed to tackle automatic analog circuit sizing with emphasis on the methodologies to size and optimize the circuit and on the methodologies to estimate the circuit's performance The discussion also includes robust circuit design and optimization and the most recent advances in layout aware analog sizing approaches The authors describe a methodology for an automatic flow for analog IC design including details of the inputs and interfaces multi objective optimization techniques and the enhancements made in the base implementation by using machine learning techniques The Gradient model is discussed in detail along with the methods to include layout effects in the circuit sizing 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 An extensive set of application examples is included to demonstrate the capabilities and features of the methodologies described *Life System Modeling and Intelligent Computing* Minrui Fei,Li Jia,George W. Irwin,2010-09 This book is part II of a two volume work that contains the refereed proceedings of the International Conference on Life System Modeling and Simulation LSMS 2010 and the International Conference on Intelligent Computing for Sustainable Energy and Environment ICSEE 2010 held in Wuxi China in September 2010 The 194 revised full papers presented were carefully reviewed and selected from over 880 submissions and recommended for publication by Springer in two volumes of Lecture Notes in Computer Science LNCS and one volume of Lecture Notes in Bioinformatics LNBI This particular volume of Lecture Notes in Computer Science LNCS includes 55 papers covering 7 relevant topics The 56 papers in this volume are organized in topical sections on advanced evolutionary computing theory and algorithms advanced neural network and fuzzy system theory and algorithms modeling and simulation of societies and collective behavior biomedical signal processing imaging and visualization intelligent computing and control in distributed power generation systems intelligent methods in power and energy infrastructure development intelligent modeling monitoring and control of complex nonlinear systems **Design of Very High-Frequency Multirate Switched-Capacitor Circuits** Seng-Pan U,Rui Paulo Martins,José Epifânio da Franca,2006 Design of Very High Frequency Multirate Switched Capacitor Circuits presents the theory and the corresponding CMOS implementation of the novel multirate sampled data analog interpolation technique which has its great potential on very high frequency analog front end filtering due to its inherent dual advantage of reducing the speed of data converters and DSP core together with the specification relaxation of the post continuous time filtering This technique completely eliminates the traditional phenomenon of sampled and hold frequency shaping at the lower input sampling rate Also in order to tackle physical IC imperfections at very high frequency the state of the art circuit design and layout techniques for high speed Switched Capacitor SC circuits are comprehensively discussed Optimum circuit architecture

tradeoff analysis Simple speed and power trade off analysis of active elements High order filtering response accuracy with respect to capacitor ratio mismatches Time interleaved effect with respect to gain and offset mismatch Time interleaved effect with respect to timing skew and random jitter with non uniformly holding Stage noise analysis and allocation scheme Substrate and supply noise reduction Gain and offset compensation techniques High bandwidth low power amplifier design and layout Very low timing skew multiphase generation Two tailor made optimum design examples in CMOS are presented The first one achieves a 3 stage 8 fold SC interpolating filter with 5 5MHz bandwidth and 108MHz output sampling rate for a NTSC PAL CCIR 601 digital video at 3 V Another is a 15 tap 57MHz SC FIR bandpass interpolating filter with 4 fold sampling rate increase to 320MHz and the first time embedded frequency band up translation for DDFS system at 2 5V The corresponding chip prototype achieves so far the highest operating frequency highest filter order and highest center frequency with highest dynamic range under the lowest supply voltage when compared to the previously reported high frequency SC filters in CMOS

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