

Chapter 3 SOLUTIONS

1) a) $I_D = \frac{V_{in} - 2V_{D0n}}{R_1 + R_2}$
 $= \frac{2.5 - 1.4}{4k\Omega} = \frac{1.1V}{4k\Omega}$

$I_D = 275\mu A$

b) $I_S = 10^{-14} A$, $T = 300K$, $V_{D0n} = 0.7V$

$I_D = I_S (e^{V_D/\phi_T} - 1)$

where $\phi_T = \frac{kT}{q} = 26mV @ 300K$

⊛ $I_D = \frac{V_{in} - 2V_D}{R_1 + R_2} = I_S (e^{V_D/\phi_T} - 1)$
 $\frac{2.5 - 2V_D}{4k\Omega} = 10^{-14} (e^{V_D/0.026} - 1)$

iterating on this expression
 we can obtain.

$V_D = 0.628V$
 $I_D = 311\mu A$

c) SPICE

exercise 3.1

```
vin in 0 dc 2.5
r1 in 2 2k
d1 2 3 D
r2 3 out 2k
d2 out 0 D
```

```
.options post=2
.op
```

```
.model D D level=1 is=1e-14 n=0.5
```

```
.end
```

```
*****
NODE      VOLTAGE
2          1.8750E+00
3          1.2500E+00
OUT        6.2501E-01
```

CURRENT 3.1249E-04

d) $I_S = 10^{-16} A$, $T = 300K$;
 again use ⊛ from b and iterate
 to find:

$V_D = 0.743V$
 $I_D = 253\mu A$

$I_S = 10^{-14} A$, $T = 350K$;

$V_D = 0.728V$
 $I_D = 261\mu A$

```
exercise 3.1d
vin in 0 dc 2.5
r1 in 2 2k
d1 2 3 D
r2 3 out 2k
d2 out 0 D
```

```
.options post=2
.op
```

```
*.temp 27
*.temp 77
*.model D D level=1 is=1e-16 n=0.5
*.model D D level=1 is=1e-14 n=0.5
.end
```

```
*****
t=27C*
NODE      VOLTAGE
2          1.9449E+00
3          1.2500E+00
IN         2.5000E+00
OUT        7.3892E-01
```

```
ID        2.3554E-04
*****
t=77C*
NODE      VOLTAGE
2          1.7844E+00
3          1.2500E+00
IN         2.5000E+00
OUT        5.3436E-01
```

ID 3.5782E-04

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Richardson, Vigyan (Vigs) Chandra, 2023-05-26 Devices and Circuit Fundamentals is Chapter Outline Learning Objectives Key Terms Figure List Chapter Summary Formulas Answers to Examples Self Exams Glossary of Terms defined **Solutions**

Manual to Accompany Analysis and Design of Digital Integrated Circuits David A. Hodges, Yu Chen, Horace G.

Jackson, 1983 **Solution Manual to Accompany Gallium Arsenide Digital Integrated Circuit Design** Stephen I.

Long, Steven E. Butner, 1991 *Solution Manual* James W. Mayer, S. S. Lau, 1990 *Fundamentals Of Solid-state*

Electronics: Solution Manual Chih Tang Sah, 1996-09-30 This Solution Manual a companion volume of the book Fundamentals of Solid State Electronics provides the solutions to selected problems listed in the book Most of the solutions are for the selected problems that had been assigned to the engineering undergraduate students who were taking an introductory device core course using this book This Solution Manual also contains an extensive appendix which illustrates the application of the fundamentals to solutions of state of the art transistor reliability problems which have been taught to advanced undergraduate and graduate students This book is also available as a set with Fundamentals of Solid State Electronics and Fundamentals of Solid State Electronics Study Guide Digital Integrated Circuit Design Hubert Kaeslin, 2008-04-28 This practical tool independent guide to designing digital circuits takes a unique top down approach reflecting the nature of the design process in industry Starting with architecture design the book comprehensively explains the why and how of digital circuit design using the physics designers need to know and no more Digital Integrated Circuits Evgeni

Perelroyzen, 2018-10-03 A current trend in digital design the integration of the MATLAB components Simulink and Stateflow for model building simulations system testing and fault detection allows for better control over the design flow process and ultimately for better system results Digital Integrated Circuits Design for Test Using Simulink and Stateflow illustrates the construction of Simulink models for digital project test benches in certain design for test fields The first two chapters of the book describe the major tools used for design for test The author explains the process of Simulink model building presents the main library blocks of Simulink and examines the development of finite state machine modeling using Stateflow diagrams Subsequent chapters provide examples of Simulink modeling and simulation for the latest design for test fields including combinational and sequential circuits controllability and observability deterministic algorithms digital circuit dynamics timing verification built in self test BIST architecture scan cell operations and functional and diagnostic testing The book also discusses the automatic test pattern generation ATPG process the logical determinant theory and joint test action group JTAG interface models Digital Integrated Circuits explores the possibilities of MATLAB s tools in the development of

application specific integrated circuit ASIC design systems The book shows how to incorporate Simulink and Stateflow into the process of modern digital design *Digital Integrated Circuits* DeMassa,1996-02-01 Integrated Circuit Design Xiaokun Yang,2024-11-20 This textbook seeks to foster a deep understanding of the field by introducing the industry integrated circuit IC design flow and offering tape out or pseudo tape out projects for hands on practice facilitating project based learning PBL experiences Integrated Circuit Design IC Design Flow and Project Based Learning aims to equip readers for entry level roles as IC designers in the industry and as hardware design researchers in academia The book commences with an overview of the industry IC design flow with a primary focus on register transfer level RTL design the automation of simulation and verification and system on chip SoC integration To build connections between RTL design and physical hardware FPGA field programmable gate array synthesis and implementation is utilized to illustrate the hardware description and performance evaluation The second objective of this book is to provide readers with practical hands on experience through tape out or pseudo tape out experiments labs and projects These activities are centered on coding format industry design rules synthesizable Verilog designs clock domain crossing etc and commonly used bus protocols arbitration handshaking etc as well as established design methodologies for widely adopted hardware components including counters timers finite state machines FSMs I2C single dual port and ping pong buffers register files FIFOs floating point units FPU's numerical hardware Fourier transform matrix matrix multiplication etc direct memory access DMA image processing designs neural networks and more The textbook caters to a diverse readership including junior and senior undergraduate students as well as graduate students pursuing degrees in electrical engineering computer engineering computer science and related fields The target audience is expected to have a basic understanding of Boolean Algebra and Karnaugh Maps as well as prior familiarity with digital logic components such as AND OR gates latches and flip flops The book will also be useful for entry level RTL designers and verification engineers who are embarking on their journey in application specific IC ASIC and FPGA design industry **Introduction to VLSI Systems** Ming-Bo Lin,2011-11-28 With the advance of semiconductors and ubiquitous computing the use of system on a chip SoC has become an essential technique to reduce product cost With this progress and continuous reduction of feature sizes and the development of very large scale integration VLSI circuits addressing the harder problems requires fundamental understanding of circuit and layout design issues Furthermore engineers can often develop their physical intuition to estimate the behavior of circuits rapidly without relying predominantly on computer aided design CAD tools Introduction to VLSI Systems A Logic Circuit and System Perspective addresses the need for teaching such a topic in terms of a logic circuit and system design perspective To achieve the above mentioned goals this classroom tested book focuses on Implementing a digital system as a full custom integrated circuit Switch logic design and useful paradigms that may apply to various static and dynamic logic families The fabrication and layout designs of complementary metal oxide semiconductor CMOS VLSI Important issues of modern CMOS processes including deep

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Solutions Manual Digital Integrated Circuits CRC Press,2009-07-10
Any textbook more than five years old simply won't do in digital integrated circuits as dynamic CMOS circuits have emerged to dominate the field Providing a revised instructional text for engineers involved with Very Large Scale Integrated Circuit design and fabrication this second edition delves into the dramatic advances including new applications and changes in the physics of operation made possible by relentless miniaturization Each chapter includes numerous worked examples case studies and SPICE computer simulations The book's website offers supplementary material and more worked problems

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Chih-Tang Sah,1996 This Solution Manual a companion volume of the book Fundamentals of Solid State Electronics provides the solutions to selected problems listed in the book Most of the solutions are for the selected problems that had been assigned to the engineering undergraduate students who were taking an introductory device core course using this book This Solution Manual also contains an extensive appendix which illustrates the application of the fundamentals to solutions of state of the art transistor reliability problems which have been taught to advanced undergraduate and graduate students

Embedded SoPC Design with Nios II Processor and VHDL Examples Pong P. Chu,2011-08-29 The book is divided into four major parts Part I covers HDL constructs and synthesis of basic digital circuits Part II provides an overview of embedded software development with the emphasis on low level I/O access and drivers Part III demonstrates the design and development of hardware and software for several complex I/O peripherals including PS2 keyboard and mouse a graphic video controller an audio codec and an SD secure digital card Part IV provides three case studies of the integration of hardware accelerators including a custom GCD greatest common divisor circuit a Mandelbrot set fractal circuit and an audio synthesizer based on DDFS direct digital frequency synthesis methodology The book utilizes FPGA devices Nios II soft core processor and development platform from Altera Co which is one of the two main FPGA manufacturers Altera has a generous university program that provides free software and discounted prototyping boards for educational institutions details at www.altera.com/university The two main educational prototyping boards are known as DE1-99 and DE2-69 All experiments can be implemented and tested with these boards A board combined with this book becomes a turn key solution for the SoPC design experiments and projects Most HDL and C codes in the book are device independent and can be adapted by other prototyping boards as long as a board has similar I/O configuration

Embedded SoPC Design with Nios II Processor and Verilog Examples Pong P. Chu,2012-05-14 Explores the unique hardware programmability of FPGA based embedded systems

using a learn by doing approach to introduce the concepts and techniques for embedded SoPC design with Verilog. An SoPC system on a programmable chip integrates a processor, memory modules, I/O peripherals, and custom hardware accelerators into a single FPGA (field programmable gate array) device. In addition to the customized software, customized hardware can be developed and incorporated into the embedded system as well, allowing us to configure the soft-core processor, create tailored I/O interfaces, and develop specialized hardware accelerators for computation-intensive tasks. Utilizing an Altera FPGA prototyping board and its Nios II soft-core processor, *Embedded SoPC Design with Nios II Processor and Verilog Examples* takes a learn by doing approach to illustrate the hardware and software design and development process by including realistic projects that can be implemented and tested on the board. Emphasizing hardware design and integration throughout, the book is divided into four major parts. Part I covers HDL and synthesis of custom hardware. Part II introduces the Nios II processor and provides an overview of embedded software development. Part III demonstrates the design and development of hardware and software of several complex I/O peripherals, including a PS2 keyboard and mouse, a graphic video controller, an audio codec, and an SD (secure digital) card. Part IV provides several case studies of the integration of hardware accelerators, including a custom GCD (greatest common divisor) circuit, a Mandelbrot set fractal circuit, and an audio synthesizer based on DDFS (direct digital frequency synthesis) methodology. While designing and developing an embedded SoPC can be rewarding, the learning can be a long and winding journey. This book shows the trail ahead and guides readers through the initial steps to exploit the full potential of this emerging methodology.

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Fractional-Order Chaotic Systems Kehui Sun, Shaobo He, Huihai Wang, 2022-09-04. This book highlights the solution algorithms and characteristic analysis methods of fractional-order chaotic systems. Fractal dimensions exist broadly in the study of nature and the development of science and technology. Fractional calculus has become a hot research area in nonlinear science. Fractional-order chaotic systems are an important part of fractional calculus. The book discusses the numerical solution algorithms and characteristic analysis of fractional-order chaotic systems and introduces the techniques to implement the systems with circuits. To facilitate a quick grasp, the authors present examples from their years of work in the appendix. Intended for graduate students and researchers interested in chaotic systems, the book helps one to build a theoretical and experimental foundation for the application of fractional-order chaotic systems.

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