Preface

One of the challenges of writing an introductory text like this is to forget what you know about the subject in order to imagine encountering it for the very first time. We have tried to do so for this text, so we hope that the result is a book that anticipates and answers questions that arise for students new to circuit design. After thinking about how we learn best, we included detailed examples that walk through application of the new concepts to concrete problems. We also tried to resist the powerful temptation to include too much information and too many digressions into the intricacies of every topic. Since this book is for new circuit designers and not for our colleagues, we leave those more detailed issues to further study using other texts. After mastering the fundamental concepts from this book, students should be ready to undertake such a study.

If you are interested in learning about digital circuits and have basically no prior experience with them, then you are the intended audience for our book. We think that you can learn what you need to know from our book with very little background knowledge at the beginning. Ideally you will already know some basic circuit theory such as Ohm's Law, Kirchhoff's Laws, and RC circuits (circuits with resistors and capacitors). You will also have had some exposure to digital logic design including DeMorgan's Laws, Karnaugh maps, and basic logic gates, and knowing something about transistors will help. However, even without knowing about these topics, we think that you can make great progress through this book without requiring too many excursions to pick up background information along the way.

The book starts with an introductory chapter (Chapter 1) that defines digital integrated circuits and positions their study in the larger context of semiconductor based system design. Chapter 2 describes how we connect the abstractions of digital logic, which deals with ones and zeros, with circuits that exist in physical reality and teaches you a method for implementing arbitrary functions using transistors. Chapter 3 dives into the circuit level issues related to building an inverter with real transistors. Chapter 4 expands these considerations to different types of logic gates, and Chapter 5 shows how to design basic memories. To help you evaluate your understanding of concepts in each chapter, we have included problems at the end of the chapter. Instructors who adopt this book can contact the publisher for access to the problem solutions.

This book is meant to apply most directly to introductory courses in circuit design, which appear during the second or third year in many engineering curricula, but it can also provide a supplement to other courses for which some knowledge of circuits is useful. The book belongs to the Modular Series of Microelectronic Device and Circuit Design. Each module in the series, like this book, provides a brief fundamental look at a specific topic. Selecting multiple modules of interest can allow an instructor to customize content for a class more economically than by selecting chapters from a single large text book, or a single module can supplement a course whose textbook omits an important relevant topic. More information about the series appears on the back cover of this book.

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Ben Calhoun