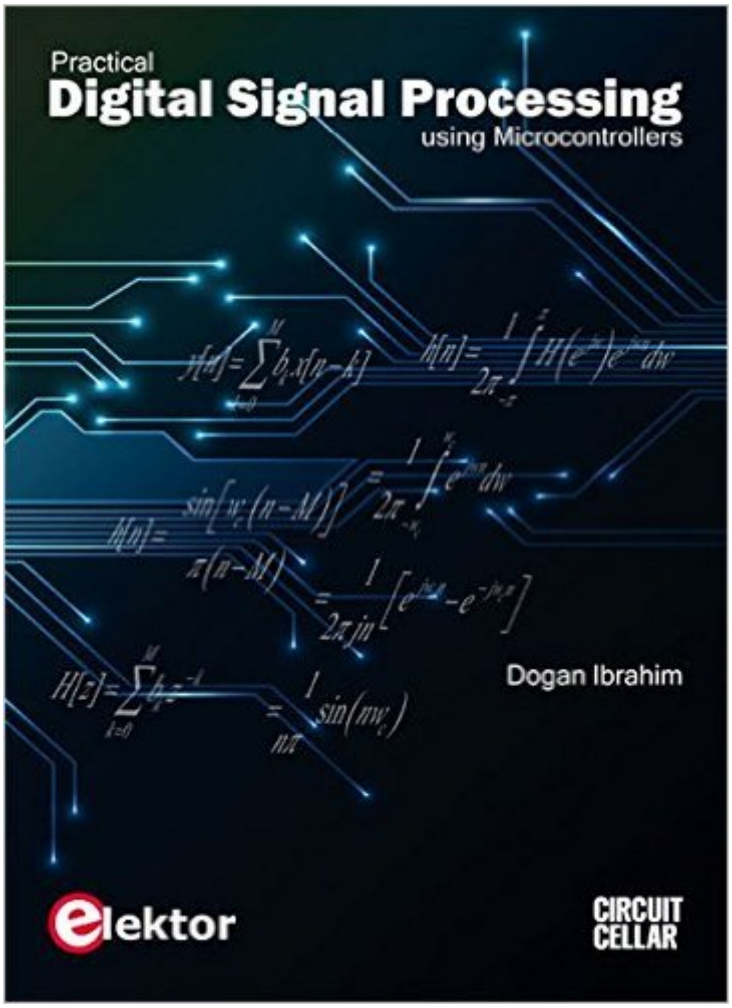
Practical Digital Signal Processing Using Microcontrollers



Synopsis

Digital Signal Processing (DSP) is the process of capturing, analysing, and manipulation of usually an analog signal by a digital processor, e.g. a digital computer. The theory of DSP is quite complex and requires good understanding of high level mathematics. Students new to DSP are usually taught the theory in great detail with very little or no practical application. For example, in many cases a student can derive complex equations for digital filters, but is unable to implement a digital filter in real life. Some institutions use tools such as MATLAB to derive the coefficients of digital filters and then simulate the behaviour of these filters on a PC. Although simulation can be an invaluable tool in teaching, it is never the same as real-time and real-life implementations. The aim of this book is to outline the basic principles of DSP and to introduce DSP from a practical point of view, using minimum of mathematics. The practical implementation is described using widely available low-cost general purpose microcontrollers so that DSP applications can be designed with ease. The book makes use of the high-end PIC18F series of microcontrollers.

Book Information

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Customer Reviews

If you have an interest in using digital signal-processing (DSP) techniques on a microcontroller (MCU) don’t buy this book. Instead, I recommend you look at integrated-circuit manufacturer’s DSP application notes, review comments and posts on DSP user groups, choose a microcontroller, and jump in. You’ll get more for your money. For people new to DSP I recommend the ARM mbed (ARM Cortex-M3 MCU) and Digilent ChipKit Uno32 (Microchip PIC32MX320F128 MCU). You will find other inexpensive boards from Texas Instruments, Freescale, Cypress Semiconductor, and other

MCU manufacturers. For an introduction to DSP, I highly recommend Richard Lyons' book, "Understanding Digital Signal Processing," ISBN: 978-0137027415. You might find used copies of this book, which has labeled, ".com's Top-Selling DSP Book for Seven Straight Years." Although Lyons doesn't focus on MCUs, you'll learn how signal processing works and better understand what MCU hardware and software requirements DSP needs.Dogan Ibrahim's book focus solely on the Microchip PIC18F45K2 8-bit MCU and does so only in the last appendices! And instead of using the free C/C++ development environment (and free DSP code) from Microchip, the author chose the mikroC Pro, which students and engineers can download as a free version with a 2-kbyte code limit. (A full version of this software costs about $US 250.) The author notes the free version should suffice for the book's examples. (But perhaps not for any other software you might choose to include with the DSP routines.) Although the author provides some basic DSP information, readers will not learn how to effectively and efficiently implement DSP algorithms on an MCU. Important questions go unanswered: How does an 8-bit MCU handle floating-point or fixed-point math?

I have been learning, working with, and designing electronics for over a decade in both the analog and digital fields. I have bought and read many books covering many specialized electronics subject matter and I have to say hands down that this is the worst one yet. Let me try to explain why I say this and why I feel it deserves nothing more than one star rating and far less the high Elector asking price.I started reading this book a couple weeks ago and just finished this morning and I thought to myself that I need to save others from wasting their money so I had better go write a review of it. I painfully read it from cover to cover. The first thing I noticed while reading it was that it appeared to be filled with over 50% filler material instead of true subject matter. I couldn't agree more with the first full review of the book by reviewer Jonathan Titus here on . Come on now, over 30 pages in the second chapter covering nothing but number systems! This should be in ana appendix. He does a great job of explaining the number systems but this should be a cursory review at best for a specialized electronics subject matter book. Then, the next 30% of the book is filled up with blah, blah, blah about the mikroC software (programming language and IDE)and MATLAB software. Finally, on page 173 out of 356 (not including appendix A thru I) he begins to talk about the DSP subject matter but that quickly ends on page 292. The problem I have with the main coverage of the DSP subject matter is that he doesn't really EXPLAIN anything. It's sort of like a math instructor throwing up a bunch of formula on a black board and informing the class that "this is calculus" without explaining any of it. That just made my head hurt.

Prof Dogan Ibrahim’s book on Digital Signal Processing is an excellent book. It is, as far as I am aware, one of the few books that teaches the practical aspects of DSP. I spent many days reading several other books and looking at the DSP manufacturers’ data sheets, application notes and development kits to try and understand how to implement a simple digital filter but did not have much success. Thanks to this book, after reading only a few chapters I was able to actually design and implement my filter successfully. It is hard to understand the reason why another reviewer thought it was only worth one star. In my opinion the book deserves fully its five stars - and more.The book starts with a general introduction to DSP and numbering systems. The chapter on numbering systems is extremely important and is especially helpful when it is required to implement DSP algorithms on MCUs.Chapter 3 is devoted to DSP development kits. Chapter 4 is about the mikro-C programming language used in the projects. Chapters 5, 6, and 7 are about the MATLAB, discrete time systems theory, and the z-transform.I particularly liked and found useful the chapter on MATLAB, as MATLAB is used extensively in our engineering course and in laboratory experiments. Another area that I had always had difficulty with was the Discrete Fourier Transform until I read this book. Prof Ibrahim’s book explains this important topic very well with many examples.After covering the basic theory and giving computer-aided techniques for the design of FIR and IIR filters the author explains the design and implementation of digital filters on standard off-the-shelf low-cost MCUs.

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