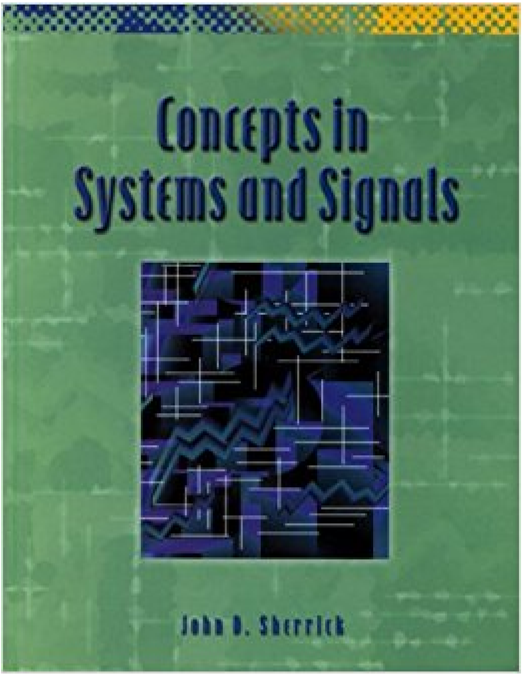
Concepts In Systems And Signals



Synopsis

For junior-level courses in Continuous-Time and Discrete-Time Systems and Signals, and Using MATLAB in Systems and Signals, for electrical, computer, and telecommunications engineering technology programs. Students must be comfortable with calculus.This text provides a comprehensive review of the foundations of continuous-time systems, and introduces, with equal emphasis, the "new circuit theory" of discrete-time systems. It looks at the concepts and analysis tools associated with signal spectra--focusing on periodic signals and the Discrete Fourier Transform, and makes students aware of the capabilities of MATLAB.

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PREFACE This text was written for a 40-lecture-hour, junior-year course in the Department of .Electrical, Computer, and Telecommunications Technology at Rochester Institute of Technology. It is a required upper-division course for all three of the department's engineering technology programs. Considering the wealth of diverse topics competing for students' attention, the faculty action establishing this common upper-division course requirement is significant. The goals of the course are to:1. Review the foundations of continuous-time systems and introduce, with equal emphasis, the "new circuit theory" of discrete-time systems. Introduce the concepts and analysis tools associated with signal spectra, with emphasis on periodic signals and the discrete Fourier transform. Make students aware of the capabilities of MATLAB, the general-purpose mathematical software available in our department computer facilities. Typical electrical engineering technology programs in our region start students off with an ac circuits course in their freshman year before they have the mathematical background to really understand where the phasor comes from. Just when they are getting comfortable working with phasors and complex numbers, they are sent off to electronics courses, where capacitors and inductors are open or short circuits, and their ac circuits skills deteriorate. This text attempts to recapture and extend those skills in preparation for such upper-division specialty courses as communications theory and transmission lines. The elements of linear, discrete-time systems parallel exactly those of the continuous-time domain. Filtering is a subject Well within the mathematical capabilities of an undergraduate technology student, and serves as a common focus for the two domains. The sampling theorem, a key issue in converting between the continuous and discrete domains, is presented at two levels of mathematical sophistication. It is deduced from sampled sinusoids, but it is also derived more formally using the definition of an ideal sampler. Sampling schemes that minimize the need for analog filtering conclude the course. Among department faculty who use a general mathematical software package in their courses, MATLAB is the package of choice. It is introduced systematically in this text, and used both to support the concepts presented and as a filter design handbook. The student edition of MATLAB v.5 was used for all MATLAB applications in this text. The latest student versions, which also contain several features not used in this text, may be purchased on the Web from The MathWorks, Inc. (mathworks) of Natick, Massachusetts, at a reasonable price.The discrete-time portion of the course benefits significantly from some demonstrations of sampling and real-time filtering. Any digital scope having an FFT math option can be used to demonstrate most of the sampling concepts and aliasing. A modest microcontroller, such as the Motorola 68HC11, contains all the features necessary to demonstrate real-time processing using a finite averager program. An 8-term averager has an interesting frequency response easily compared to theory. Lately, we have had the benefit of demonstrations provided by a few students pursuing an independent study of Analog Devices' EZ Lite 16-bit DSP kit. Even in the absence of these demonstrations, filtering a signal that has been saved to a file can be an impressive, eye-opening experience for most students. ACKNOWLEDGMENTS This text is a collection of concepts that I have had, in some cases, 40 years to digest. In that time many of these ideas have blended together, and it would be impossible to pinpoint where they all originated. All I can do is acknowledge that few, if any, of the ideas presented are originally mine. This is an attempt to recognize and thank those sources who are the most likely to have contributed to my background as represented in this text. s Domain Most electrical engineers of my age were introduced to the s domain by M. E. Van Valkenburg in his classic text Network Analysis (Prentice Hall, 1955). The form of the Routh-Hurwitz test I have used

in this text comes from Introduction to the Design of Servomechanisms, by Bower and Schultheiss (Wiley, 1958). Modern texts favor a different form of the test, although I fail to see its advantages. B. P Lathi set the standard for continuous-time signals in Signals, Systems, and Communication (Wiley, 1965).1 understand this text is used in some technology programs today, although it is really an engineering-level text. Graduate school brought Louis Weinberg's Network Analysis and Synthesis (McGraw-Hill, 1962) to my collection. This theoretical treatise on network synthesis concludes with practical filter-design information that includes the classical filters discussed in this text. Over the years I have used many different texts that may have contributed to my knowledge of the s domain. My favorite text to teach from was Linear Circuits by Ronald E. Scott (AddisonWesley, 1960). z Domain In this area, both the texts and my experiences are more recent and my sources more accurately identified. My first experience with DSP came from an excellent 3-day seminar conducted in 1981 by Edward R. Salem and W F. Walker of the RIT electrical engineering department. A tremendous number of engineering-level texts in DSP made an appearance in and since the mid-1980s. I am sure some of them were exceptional, but I paid little attention to those that were not at the mathematical level I was seeking. Digital Signal Processing by Stanley, Dougherty, and Dougherty (Reston Publishing, 1984), although written for engineers, was the first text I found mathematically suitable for my senior-level technology elective in DSP. I use its explanation of the sequential design steps in the development of the window design of FIR filters. When it went out of print, I was forced to begin preparing these notes for my course. In its initial version, my DSP elective contained a lab practicum. It did not seem possible to teach both a special processor and the required DSP theory in the allotted time. As a result, we performed some simple DSP using the Motorola 68HCll microcontroller, which students learn in a required course. Doing this made the problems of coefficient accuracy clear and led to some results we could not, at that time, explain (limit cycling). These experiences also raised questions about the value of digital filtering when high-order analog anti-aliasing or reconstruction filters still seemed to be needed. These and other questions were addressed ifs two recent publications: a draft manuscript of Understanding Digital Signal Processing by Richard G Lyons (Addison-Wesley, 1997) and a Motorola University publication, Digital Signal Processing and the Microcontroller by Dale Grover and John R. Deller, with illustrations by Jonathon Roth (Prentice Hall, 1998). I am sure these issues were presented in other publications and texts, but this is where I found them and understood them. Finally, Version 4 of the User's Guide to MATLAB, by The MathWorks Inc. (Prentice Hall, 1995), is as well done as the software it supports. Thanks also to my students who shared the adventure of exploring DSP with me and who contributed ideas and corrections to the manuscript. I would also like to acknowledge the valuable feedback from the following reviewers: John Cmelko, Bryant & Stratton; Judy Serwatka, Purdue University-Calumet; Donald Stelzer, DeVry Institute-Phoenix; and Omar Zia, Southern Polytechnic State University.JOHN D. SHERRICK

This innovative book for technology students presents both continuous and discrete domains under one cover. It reviews the foundations of continuous-time systems and introduces the concepts and analysis tools associated with signal spectra, with emphasis on periodic signals and the Discrete Fourier Transform. Topics include: Analysis techniques Frequency response Standard filters Spectral analysis Discrete-time signals and systems IRR and FIR filter designs Sampling strategies The book also contains an introduction to and lessons in MATLABÂ®

I purchased this book for school.

Great book. I was able to find all of the answers I needed for the course that I was taking.

On a superficial level, this book looks good: it covers most (if not all) relevant topics, has MATLAB sections, and a range of difficulty on the problems. The issues arise in that the quality of the information is horrid.The presentation of the information leaves a great deal to be desired: I often think that the authors are intentionally trying to be obtuse by their use of terminology that they don’t define and by providing only a bare minimum of effort in their examples which are briefly skimmed over and not up to par with their questions at the end of each section.It is impossible to teach yourself from this book without a good set of lecture notes to aid you. There is very little information actually present and what is presented tends to be non-comprehensive in quality. The author has a tendancy to skip over the mathematical foundation behind what is going on.The mathematical foundations are, in fact, not really covered at all.The matlab sections are of similar quality: skimming over the examples and setting information without explaining the whys and the wherefores.I found that the questions at the end of the sections were good, but that is about the extent of it.

This review specifically addresses the text in respect to digital signal processing because of the book’s claims on the back cover.The examples are not simple and clear, they’re simplistic. The MATLAB integration feels forced. The book has a thrown together feel about it. This book is maybe better as a review of signal processing, but definitely not an introduction. If this is going to be your textbook, then start searching for supplemental material. Check out Joyce Van de Vegte’s

Fundamentals of Digital Signal Processing as a better alternative.

(I'm not sure what book the previous reviewer was reading when he refers to the "authors" -- Sherrick is the lone author). This book is clear, simple, and filled with worked examples. It succeeds at its modest goal of preparing students for upper-division specialty courses. Very clear explanations and applications of the s-plane and phasors to signal analysis. A real gem if you are interested in learning how to perform simple and practical signal analysis and filter design without getting bogged down in abstract mathematical theory.

Very unconventional method of portraying how to do things. The methods to solve the questions at the end of each chapter are insubstantially reviewed in the chapter. This is a terrible book unless you already have a PhD in filter design. If you are a beginner like me, avoid this text at all costs.