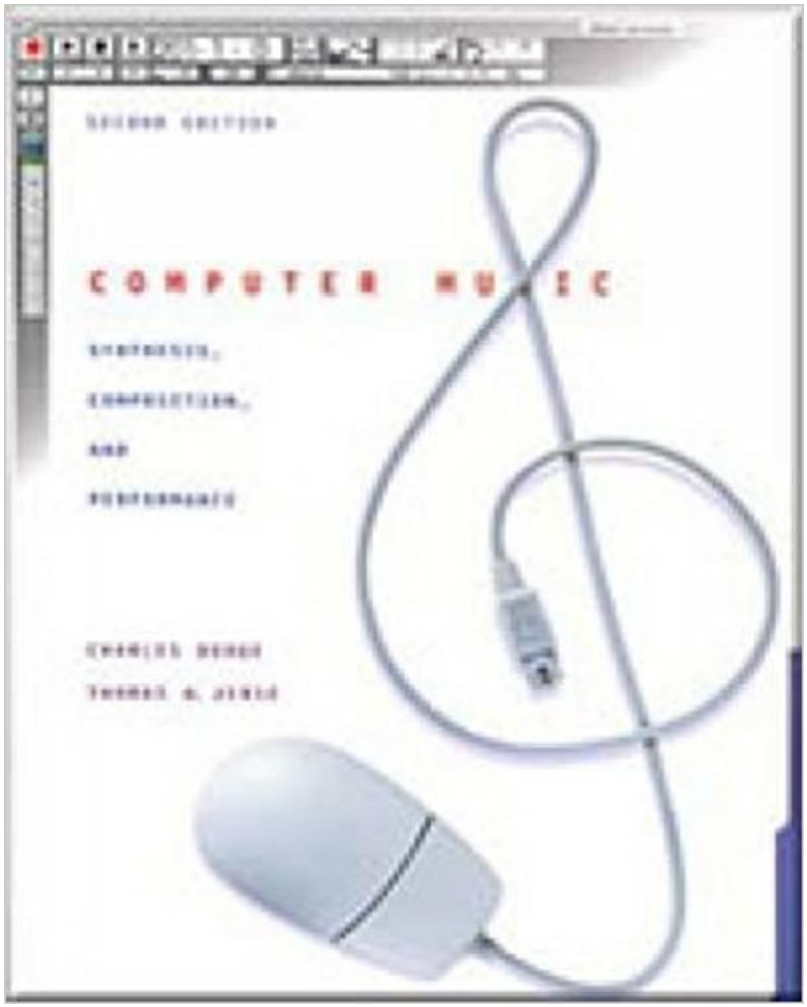
Computer Music: Synthesis, Composition, And Performance



Synopsis

This text reflects the current state of computer technology and music composition. The authors offer clear, practical overviews of program languages, real-time synthesizers, digital filtering, artificial intelligence, and much more.

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Preface to the Second Edition. Preface to the First Edition. 1. Fundamentals of Computer Music. 2. The Acoustics and Psychoacoustics of Music. 3. Fundamentals of Digital Audio. 4. Synthesis Fundamentals. 5. Synthesis Using Distortion Techniques. 6. Subtractive Synthesis. 7. Analysis-Based Synthesis Techniques. 8. Granular Synthesis. 9. Physical Modeling. 10. Reverberation, Auditory Localization, And Other Sound-Processing Tehniques. 11. Composition with Computers. 12. Real-Time Performance of Computer Music. Glossary. Index.

This is a great first book on computer music for anyone who already has some training in music theory and computers. By "music theory" I simply mean that you should be able to read and write music and understand its terminology. By having knowledge of computers, if you have had any college course equivalent of "Introduction to Computer Technology" or equivalent work experience, then you qualify. I discuss the contents of this book in the context of its table of contents:Chapter one is a broad overview and introduction to computer music and its components - operating systems, block diagrams, software, and the use of a computer in computer music.Chapter two is a

very basic introduction to acoustics and psychoacoustics in music. It presents the basic measurements of acoustics, describes the transducer mechanism of the human ear, and then discusses the psychoacoustic response of pitch, loudness, duration, and timbre.Chapter three, "Fundamentals of Digital Audio", discusses the process of converting a signal between its analog and digital forms. This includes the restrictions, errors, and limitations imposed by the numerical representation of an audio signal. Finally, the chapter addresses the issues raised by the speed at which digital audio can be synthesized or processed. This last issue is a moving target and has changed considerably since this book was published.Chapter four, "Synthesis Fundamentals", begins with the fundamentals of signal generation and presents techniques of additive synthesis, modulation, and noise generation. Several example computer instrument designs are shown along with examples of composition. This chapter is very important because it introduces the building blocks of synthesis - the oscillator, unit generator, etc.Chapter five, " Synthesis Using Distortion Techniques", concentrates on frequency modulation and nonlinear waveshaping. The chapter concludes with three examples of synthesis methods that explicitly use discrete summation formulas.Chapter six, "Subtractive Synthesis", is about creating musical tones out of complex sources by sculpting away selected portions of the spectrum of the source. Filtering is discussed at length, and musical examples are provided to show the design considerations for computer instruments with noise and periodic sources. Several examples from musical literature are given. The chapter ends with a technical description of digital filtering and some filter recipes.Chapter seven, "Analysis-Based Synthesis Techniques", discusses techniques such as the short-term Fourier transform and wavelet methods and also discusses limitations. The operation and application of the phase vocoder is presented.Chapter eight, "Granular Synthesis", is a very brief discussion of a complex synthesis technique whose name was coined by Xenakis, who detailed an extensive theory of grain selection in his writings. If you want to implement this technique you should read Xenakis' work on the subject plus there are some applicable articles in "The Computer Music Tutorial".Chapter nine, "Physical Modeling", is also a very slim chapter on a very complex subject. It talks in very high level terms about approaches, excitation for physical models, waveguide filters, the physical model of the vocal tract at a block diagram level, and the use of mechanical models. The authors rightly refer the reader who wants details to "The Physics of Musical Instruments" by Fletcher and Rossing. Another and more recent work on the subject published after this book is Perry Cook's "Real Sound Synthesis for Interactive Applications".Chapter 10, "Reverberation, Auditory Localization, and Other Sound-Processing Techniques", talks about various techniques that have to do with sound reflection, sound placement,

and sound motion. This book has more implementation details than the previous two chapters had.Chapter 11, "Composition with Computers", examines the techniques of using the computer for both random and deterministic operations to produce a composition. There are examples of actual compositions shown to help the reader develop a sense of the possibilities that are achievable with computer-aided composition. This is a chapter where musical literacy is necessary. There is also some C-code present, but it is well commented and should be somewhat legible even to the layman.Chapter 12, "Real-Time Performance of Computer Music", presents various modes of computer music performance and some of the many devices that can be used to change the actions of a performer into musical information. Methods of transmitting information between pieces of computer equipment are discussed as well as the use of a computer to respond musically to the sound from a live performer. There is a discussion of MIDI in this chapter that may be inadequate to some readers. I suggest the latest edition of "MIDI Power" for those readers. Also, there is some discussion here about the speed of computer equipment that is no longer relevant given the date of publication.In spite of the fact that it is nine years old, I would highly recommend this book to anyone interested in computer music. With the exception of a few paragraphs on computer technology, the entire book is still relevant, and it introduces all of the terminology that anybody interested in this subject must know. Also it is a well written and well illustrated book that reads easily.

i’ve been making computer music with supercollider and before thatwith a commercial graphical patch up package for several years now,and i wish that this had been the first book i had read.the first book i did in fact read was roads’ ’computer music tutorial’,which is a great book which i also highly recommend, but is more ofa reference than a tutorial, both in its layout and style. the dodge/jerse bookis so clearly and pedagogically written, that even though i already knewa great deal of the material, it solidified quite a lot of it into place for me.the thing i liked best about it is that the authors invariably direct youto compositions made using the methods just described. in other wordsthe methods are not just described in a vacuum.expect to learn from this book the basics of acoustics and psychoacoustics,digital audio and sampling theory, and a slew of sound synthesis techniques,as well as about composition.who should buy this:the serious computer music student, who does not necessarily have anyexperience yet in computer music, but who is not afraid of some hard study.the computer musician using either a graphical patch up system (max/msp, reaktor, pd etc...)or using some Music-N derived language (supercollider, csound) would both benefit tremendouslyfrom a thorough study of the contents of this book.the mathematics level required for this book is not high. your algebra should be strongwith a solid understanding of exponents and

logarithms, and some basic trig wouldn’thurt either.a note about the C++ source code. first off if you don’t program, there is nothing to be scaredof, the source only appears in the chapter on composition, and if you do program in C but not C++,then you should know that you will be fine, because the code snippets are effectively written in C. aparantly the first edition included fortran code for ugens and was quite a different book. if you want a book on ugen internals, you won’t find it in this second edition, but Moore’s is terrific, ’Elements of Computer Music’.

If your intent is to create music *by synthesizing the tones with a computer*, with a program such as Csound, this book is invaluable. It is *not about sequencing*, looping, controlling synthesizers or samplers with MIDI, etc. That said, the serious treatment of various types of sound synthesis is more than adequately technical, with lots of flowcharts, diagrams and a little algebra. The flowcharts illustrate generically how sounds can be synthesized, without getting into the specifics of particular programs. You must be able to leap the gap between the concept and the realization in a particular computer music program. Other chapters nicely introduce psychoacoustics, fundamentals of digital audio and the use of sound processing methodology. Warning: For a person with little technical (engineering-type) background, the book will be tough going in places, possibly overwhelming. It is not an introductory-level text.

Music synthesis is understood by a number of people just as manipulating a keyboard or just a work done by frequency equalizer. This book can remove such a misunderstandings and can give the readers the basics and advanced idea of building sound waveforms from zero to one. The readers are expected to have some knowledges of Fourier transform and analogue electronic circuits. All the engineers who are engaged in noise and vibration control should read this book.

This book is an excellent introduction to computer music. It has been my reference and textbook for a year-long University course on computer music, providing many explanations that were in-depth enough to understand what is going on and how methods work the way they do, yet does not tie the reader down to a specific software or architecture. This is defintely a good read on the subject.

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