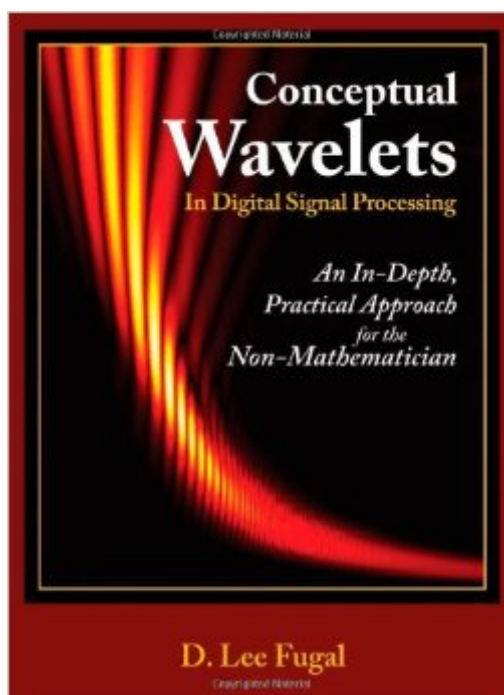


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# Conceptual Wavelets In Digital Signal Processing



## Synopsis

HOW (AND WHY) THIS BOOK IS DIFFERENT Wavelets are incredibly powerful, but if you can't understand them, you can't use them or worse, blissfully misuse them! CONCEPTUAL WAVELETS is unique as a complete, in-depth treatment of the subject but from an intuitive, conceptual point of view. In this book we stress informed use of wavelets and leave the mathematically rigorous proofs to other texts. We do look at some key equations (at a high-school algebra level)--but only after the concepts are demonstrated so you can see the wavelets (and their associated equations) in action.

FEATURES --More than 400 illustrations, figures, graphics, tables, visual comparisons, etc. are provided to simplify and clarify the concepts. All of these visual aids are explained in detail using familiar language and terminology. --Specific properties and suggested applications of the various wavelets and wavelet transforms are clearly shown using step-by-step walk-throughs, demonstrations, case studies, examples, and short tutorials. --Numerous Jargon Alerts and other Plain English explanations bring you up to speed with the current wavelet nomenclature. --References to some of the best traditional (and non-traditional) texts, papers, and websites are given for further application-specific study. We also familiarize you with wavelet software and show you how to read the results of their various displays. --Both the strengths and the weaknesses of the various wavelet transforms are revealed to help you avoid common traps and pitfalls (such as loss of alias cancellation). --This book clearly explains how to add (literally) another dimension to your signal processing capability by using wavelets to simultaneously determine the frequency, the time, and even the general shape of events and/or anomalies in your data. The last acknowledgment is to you, the reader, for having the courage to embark on a journey that you probably have heard was difficult but that has the promise of rich rewards as you add the power of wavelet processing to your professional repertoire. John A. Shedd in 1928 wrote A ship in harbor is safe but that is not what ships are built for. As you leave the safe harbor of conventional Digital Signal Processing to sail upon the wavelets, may you find the treasures you seek. Welcome Aboard!

## Book Information

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## Customer Reviews

Wanting to learn something about wavelets, I've searched the Internet for "wavelet tutorial" material. What I found was pretty much all the same thing---material written by (I presume) university professors consisting of page after page of equations. Such material is difficult for beginners to comprehend. My company library did have one textbook on wavelets, but that book was, sadly, similar to the Internet material. Lots of equations, but little explanation of why wavelet transforms are important, how do we use them, and when should we use them to analyze signals. Then I encountered Fugal's "Conceptual Wavelets in Digital Signal Processing". Wow, what a relief. Mr. Fugal begins by explaining the complicated topic of wavelet transforms in a gentle, clear, and ultimately meaningful way. He doesn't overwhelm (suffocate) the reader with equations. In the first chapter he gives several straightforward signal analysis examples that show how wavelet transforms can be used to analyze certain signal characteristics in ways that are not possible with traditional digital signal processing (DSP). After reading those examples, I sat back for a moment and thought, "Ah ha. So that's what wavelets are, and how they can be used. Now I'm beginning to understand why people are interested in wavelets." That 'made my day'. Fugal uses this neat technique called "Jargon Alert". That's where, when he introduces new terminology, he clearly defines the meanings of special terminology (new words) for the reader. What a great idea. I wish more technical authors would do the same. Now to be honest, I've only read the first chapter of Fugal's book, but I just wanted to advertise how happy I am to finally begin to grasp the meaning, and value, of wavelet transforms. I look forward to learning more as I continue reading.

I am a practicing signal processing engineer and have been working with wavelets since they were first invented. My applications have been in modulation (US Robotics), audio/image/video processing/compression/recognition, hybrid algorithms, predictive algorithms, flow prediction for a magnetically levitated artificial heart (spin-off from the University of Utah), x-ray fluorescence spectroscopy (XRF) detectors, and wavelet/neural network algorithms for gas chromatography. The science of wavelets was invented by mathematicians -- so, all of the early books were written by

mathematicians and extremely difficult to navigate. The power of these new wavelet methods beyond Fourier Transforms was obvious, but quite difficult to understand and use. I have a significant collection of books on wavelets from most of the mathematicians. When I received Lee Fugal's book, I was very pleased to see something that was written from a practical point of view. I found the book easy to read and understand, and even with a pretty heavy background in wavelets, I learned a lot. Also as a MatLAB user, it was very nice to find useful code examples along with wavelet toolbox functions explained in detail. Thank you Lee Fugal for taking all the time to write this book. Everything else on my bookshelf is gathering dust -- Lee's book, 'Conceptual Wavelets' is what I use every day in my work. Best regards, W. Kurt Dobson, CEO Sigma Technology Holdings Salt Lake City, UT

Lee Fugal has done a great job in presenting the often hard to understand (very mathematical) concepts of wavelet transforms. The book is understandable by any engineer with basic knowledge of signals and systems. The book provides an intuitive understanding of wavelets when applied to various applications, while keeping the mathematical derivations as little as possible. To mention a few examples, Lee has done a great job in presenting the following concepts: Superimposing wavelet filter points correctly on the "continuous" wavelet by using trailing zeros. For example, the Daubechies 4 wavelet filter is actually 6 points. (pp. 4, 114-117). Showing the inter-relationships between the Discrete Fourier Transform (DFT/FFT), Continuous Wavelet Transform (CWT), the Undecimated Discrete Wavelet Transform (UDWT/RDWT), and the conventional (downsampled) DWT. Whether stretching the wavelet or shrinking the data they are all still basic comparisons of the data to the various analyzing waveforms. (pp. 121-140). Demonstrating how highpass and lowpass Halfband Filters are the genesis of the Perfect Reconstruction Quadrature Mirror Filters and how they can be factored into orthogonal and bi-orthogonal wavelets filters (pp. 141-167). Explaining the true power of wavelet properties by using "fake wavelets". Obtaining the "magic numbers" of the Daubechies filters using only these desired properties (pp. 169-184). Demonstrating Alias Cancellation in both the time and frequency domains and then reconciling this process to the equations found in most other books (pp. 251-278). Understanding the Wavelet Dilation Equation as a convolution that can build an approximation of the Wavelet Function. Showing why artifacts look like the chosen wavelet filter. (pp. 281-299).

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