Waveform Analysis of Sound
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Waveform Analysis of Sound is intended for audiences with a background in mathematical signal analysis and Fourier transform/series application. It can be used by both researchers and graduate students. It is, however, quite mathematical as this book is part of Springer's "Mathematics for Industry" series. However, a vast majority of practicing engineers would find it rather difficult to navigate their way through the contents. Even though the book claims to be "self-contained," it seems to be a companion to *Sound and Signals* by the same author (Springer, 2011) which provides a more physical representation of sound and vibration phenomena. The author has also cited his earlier book, "Fundamentals of Acoustic Signal Processing" (by M. Tohyama and T. Koike, 1998, Academic Press) at various places. Thus the readers should be well familiar with the linear system theory, discrete sequences, periodic functions, envelope analysis, Fourier transform and probability theory before reading this book.

A summary of the contents:

After a brief preface, the author provides a lengthy introduction, Chapter 1, that gives the reader an overview of the contents of the book as well as various signal analysis topics that are covered in the book.

Chapter 2, entitled "Discrete Sequences and Their Fourier Transform", reviews discrete time-event sequences, generating functions, z-transforms, zeros, poles, and unstable poles and Fourier transform of a sequence.

Chapter 3, "Temporal and Spectral Characteristics of Discrete Sequence", looks at the magnitude and phase of spectrum, frame-wise Fourier transform and filter bank before moving into a study of modulation envelope and group delay, triangular windowing and autocorrelation sequence.

"Temporal and Spectral Enhancement by Sound Path", Chapter 4, dedicates itself to steady-state response of the sound path in anechoic and reverberant rooms and early reflections as well as the source effects on sound paths and the decay of reverberation.

Chapter 5, "Modulation and Periodic Properties of Temporal Envelope", will give readers a glimpse of the modulation spectrum envelope, narrow-band envelopes and speech intelligibility and fundamental frequency and period of envelopes.

Chapter 6, called "Transfer Function of Linear Systems", begins with a review of zeros of a transfer function and then moves into phase and accumulated phase, minimum phase and cepstral sequences, decomposition of transfer function into minimum-phase and all-pass transfer functions and ends with a discussion of linear phase and ideal low-pass filter.

Chapter 7, "Sampling Theorem and Discrete Fourier Transform", discusses the sampling of spectral function, discrete Fourier transform and periodic property, sampling theorem, discrete Fourier and sampling theorem and interpolation and decimation of sequences.

"Sinusoidal Representation of Sequence", Chapter 8, takes readers though spectral peak selection, clustered line spectral modeling and the prediction of compound sinusoidal sequences.

Finally, Chapter 9, entitled "Modeling for Zeros in Complex Time and Frequency Plane", discusses sinusoidal modeling and zeros for transfer functions, clustered time-sequence modeling and adjacent pairing time-pulse modeling of zeros.

After an extensive search for other opinions on this book, I have come to believe that this is the first formal review for this book. Personally I have found this book very interesting as it would reinforce and enhance conventional digital signal processing techniques and their applications to physical systems. Of particular note is the "frame-wise" approach to sound waveforms in time, correlation and frequency domains. Role of triangular window for short term events is illustrated along with the importance of phase spectra and zero and poles of a transfer functions. Students and researchers interested in analytical and computational aspects of source signature identification, speech and voice recognition, noise control engineering, machinery diagnostics and health monitoring and related subjects will find this book to be a valuable resource. In fact, the reviewer is aware of the prior papers in *J. Acoust. Soc. Am.* or *J. Sound Vibr.* that described the methods contained in the book and it is good to see them in a compact and cohesive form.

Some deficiencies that I see from the perspective of readers and users (and perhaps more from the viewpoint of a teacher of a graduate level course on digital signal analysis and random data processing) are as follows. A comprehensive list of symbols for the book is missing. Each chapter has its own list of references and there is no common bibliography. Abbreviations such as CLSM, CTSM and APTM are distracting. Users might have been interested in MATLAB codes based on the techniques presented here but these are nowhere mentioned or placed anywhere on a website. No practice questions or exercises at the end of each

chapter are given and thus it would be difficult to use it as a primary textbook. Nevertheless, it is an interesting book for serious analysts. It is available via amazon.com and perhaps other sites.

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