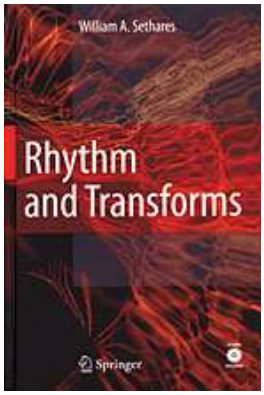
BOOKS

Rhythm and Transforms

William A. Sethares
Springer, New York, 2007. $79.95 (336 pp.). ISBN 978-1-84628-639-1, CD-ROM

Reviewed by Thomas D. Rossing

August 2008, page 53



Ten years ago, electroacoustics engineer and musician William Sethares published his widely read book *Tuning, Timbre, Spectrum, Scale* (Springer, 1998; 2nd edition, 2005). His latest work, *Rhythm and Transforms*, is a fitting sequel.

In his new book, Sethares asks and answers the question: "How can we build a device that can 'tap its foot' along with the music?" To answer that question, he explores rhythm, especially the rhythmic aspects of music, in considerable detail. Three important characteristics of rhythmic phenomena are its nonverbal nature, its relationship with motor activity, and its relationship with time. *Rhythm and Transforms* focuses on a few of the simplest features of musical rhythm, such as the beat, pulse, and short phrase, and Sethares attempts to create algorithms that can emulate the ability of listeners to identify those features.

The book comes with a CD-ROM that has many sound examples, and the author urges his readers to "listen along" as they peruse the text. A primary example he uses for sound demonstrations is Scott Joplin's popular "Maple Leaf Rag." Sethares writes, "Because

there are no legal complications, it is possible to freely augment, manipulate, expand, and mutilate the music." (See the author's website, http://eceserv0.ece.wisc.edu/~sethares, for examples.)

An introductory chapter titled "What is Rhythm?" is followed, appropriately enough, by the chapter "Visualizing and Conceptualizing Rhythm." The author begins by describing symbolic notations that have been used to represent time and duration in music: lyrical notation, musical notation, "necklace" notation, numerical notation, functional notation, drum/percussion tablature, Schillinger's notation, MIDI (musical instrument digital interface) notation, harmonic rhythm, dance notation, and juggling notation. He compares these symbolic notations with literal notations, which allow full reproduction of a performance.

The chapter "Auditory Perception" is followed by tutorial chapters: "Transforms," "Adaptive Oscillators," and "Statistical Models." Those chapters may discourage some readers who are not well acquainted with modern signal processing; however, readers are well advised to plow through the chapters, because each is well presented and clearly written.

The stated goal of the book is outlined in the chapter "Automated Rhythm Analysis." According to Sethares, "Just as there are two kinds of notations for rhythmic phenomenon (the symbolic and the literal), there are two ways to approach the detection of rhythms; from a high level symbolic representation (such as an event list, musical score, or standard MIDI file) or from a literal representation (such as direct encoding in a .wav file)." The chapter applies each of three technologies for locating patterns—transforms, adaptive oscillators, and statistical methods—to three levels of processing: symbolic patterns where the underlying pulse is fixed, symbolic patterns where the underlying pulse may vary, and time series data.

The final chapter fittingly includes "Speculations, Interpretations, and Conclusions." The first question raised, which is a sort of chicken-and-egg question, is whether we perceive a collection of individual notes and then observe that they happen to form a regular succession or whether we perceive a regular succession of auditory boundaries that is then resolved by the

auditory system into a collection of aligned note events. Another question is, what is time? For Aristotle, time does not exist without change. For Immanuel Kant, the changes are in the mind, not in the world.

There is no doubt that Sethares is a good writer with the ability to explain sophisticated ideas and mathematics in simplified terms. Readers will certainly differ in opinion on whether he has simplified those concepts enough. His extensive glossary will be a great help to those who are encountering some of the ideas for the first time, and the sound examples on the CD-ROM will also provide great benefit. Overall, *Rhythm and Transforms* is a worthwhile addition to the literature. I'm sure it will find a place alongside *Tuning, Timbre, Spectrum, Scale* in many personal libraries, as it will in mine.

Thomas Rossing is a retired physics professor who teaches musical acoustics at Stanford University in California as a visiting professor of music in the Center for Computer Research in Music and Acoustics.