ACADEMIC PRESS

Available online at www.sciencedirect.com

SCIENCE DIRECT®

Journal of Sound and Vibration 266 (2003) 1131–1132

JOURNAL OF SOUND AND VIBRATION

www.elsevier.com/locate/jsvi

Book review

Signal Processing Noise by V.P. Tuzlukov, CRC Press, Boca Raton, 2002, pp. 688, price US$129.95, ISBN 0-8493-1025-3

In this book, Prof. Tuzlukov presents the approach he has developed over the past 20 years for signal processing, particularly signal detection, in the presence of both multiplicative noise and additive Gaussian noise.

Signal processing in additive Gaussian noise has been very thoroughly investigated, and described in many excellent textbooks. This is partly because additive Gaussian noise is an almost universal phenomenon, and partly because the equations which result are tractable using linear algebra. Two other types of real-world signal perturbation have received far less attention until recently; they are non-Gaussian additive noise, and multiplicative noise. Multiplicative noise arises in a number of physical systems, such as radio communications, where multiple scattered and reflected paths cause time-varying fading—something familiar to all mobile phone users when it results in calls breaking up. Multipath effects also occur in underwater signal propagation, and multiplicative noise is therefore important for sonar and for underwater communications.

Multiplicative noise arises in a wide range of physical modelling problems (for example in atmospheric dynamics, or modelling of catalytic reactions), biological modelling (population dynamics), and in economics and the social sciences. It also arises in many technological applications (CCD imagers, "speckle" in Synthetic Aperture Radar, and Fourier Transform Spectrometry).

This book's major contribution will be to bring Prof. Tuzlukov's work to the attention of a wider audience of researchers. Many of his papers on signal processing in multiplicative noise are in Russian, in publications initially from the USSR, and more recently from his home country of Belarus and University of Minsk. He has presented his work in English through conference papers, and also in a 1998 review paper, which was not in one of the more widely accessible journals, and has (according to a major bibliographic database) not yet been cited by others.

This leaves two questions: how well does the book succeed in disseminating Prof. Tuzlukov's results, and how important are those results in the overall development of signal processing algorithms for multiplicative noise environments?

The book itself is not as good an advocate for its subject matter as it could be. While Prof. Tuzlukov deserves admiration for writing this, his third book in English, his ideas would have been communicated much more clearly by a native English speaker. The book is, in fact, hard to read, with the meaning not always clear. The reader needs either to get used to the forms of words or refer repeatedly backwards and forwards, so it is not an easy book to dip into. A few examples may illustrate some of the problems.

doi:10.1016/S0022-460X(03)00675-8

There is repeated use of certain multiword phrases, for example "complex signal processing systems" where the word "complex" is unnecessary (and confusing since it does not mean complex as opposed to real). Other terms coined by Prof. Tuzlukov are simply different from accepted terms in the English-language literature—for example an "amplitude shoot", which is what is called an "outlier" or "impulsive noise" by most researchers.

The non-idiomatic grammar includes reversed word orders such as "Multiplicative noise is called the stochastic distortions of the parameters ..." which means "The stochastic distortions of the parameters ... are called multiplicative noise". Some sentences are harder still to decode, such as "In practice the fluctuating noise, lumped interference and pulse interference are usually considered for representation of a total composition of the additive noise." These are not a few isolated examples, but widespread, and make reading the book hard work. On a positive note, each chapter ends with a summary, which is useful, although it is necessary first to learn the meanings of the terms and phrases used.

In marked contrast with, for example, Whalen's famous book *Detection of Signals in Noise*, Prof. Tuzlukov's book does not have a tutorial style, and is best classified as a substantial research monograph. The results are not presented in terms of example applications, and it is impossible to judge from the book how well the techniques would perform with actual signals rather than modelled ones. The reference lists at the end of each chapter may be valuable to researchers; a large number are from Russian-language sources.

In relation to the second question, how important are Prof. Tuzlukov's results?—I think the answer to this will become clearer once his ideas have been absorbed and developed by other researchers. I would not be surprised to see them found to be valuable, and used, once they are better known and understood. However, although the results are "general" in one sense, a great deal of further work will probably be needed to build working algorithms which use them, tailored to the types of multiplicative noise which arise in specific application areas.

This, therefore, is a book primarily for committed researchers to read. It is already on the shelves of many University libraries, where it will doubtless make Prof. Tuzlukov's work better known. However, I suspect that only when others have built on it and described it in a more accessible way will the work presented in this book be taken up, to reach a wider audience.

M. Macleod
QinetiQ Malvern, St. Andrew's Road, Malvern, Worcestershire WR14 3PS, UK
E-mail address: m.macleod@signal.qinetiq.com