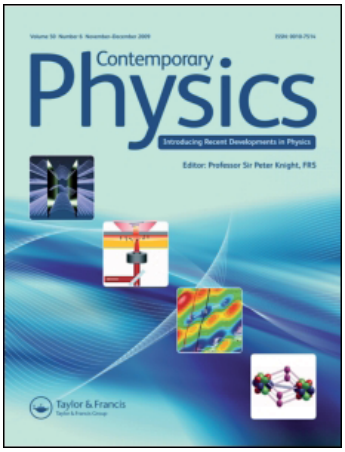

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Stochastic Resonance. From Suprathreshold Stochastic Resonance to Stochastic Signal Quantization, by M.D. McDonnell, N.G. Stocks, C.E.M. Pearce and D. Abbott

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BOOK REVIEW

Stochastic Resonance. From Suprathreshold Stochastic Resonance to Stochastic Signal Quantization, by M.D. McDonnell, N.G. Stocks, C.E.M. Pearce and D. Abbott, Cambridge, Cambridge University Press, 2008, 425 pp., £80.00 (hardback), ISBN 978-0-521-88262-0. Scope: monograph. Level: graduate students and researchers.

Stochastic resonance is a phenomenon that appears in the presence of noise in a non-linear dynamical system, and which has resulted as an essential mechanism for optimal system performance. It has been observed to occur in many physical or biological systems, including both neurons and electronic circuits. In spite of the fact that in the past few years a lot of work on this phenomenon has been done, very few books have concentrated on its mathematical foundations and its applications. The current book dedicates a great deal of effort to define and describe the historical aspects of stochastic resonance including an excellent historical description of the concept, including a very rich bibliography as well. Chapter 2, where all this information appears, is fundamental for the understanding of the rest of the book, which is also very clear and very well written. However, as the authors say, 'The aim of this book is to comprehensively outline all known theoretical and numerical results on SSR (Suprathreshold Stochastic Resonance) and to extend this theory'. This concept of SSR occurs in a parallel array of simple threshold devices subject to independent additive noise and was discovered by Stocks, one of the authors of this book, in 1999. Most chapters of the book are dedicated to describe this phenomenon in detail. Another key concept is stochastic quantisation, which the authors define to mean quantisation by thresholds that are independent random variables. Several chapters are used to describe in detail the notion of quantisation of a signal and in particular, as they define it, stochastic quantisation. Two chapters are dedicated to some particular applications: neural coding and stochastic resonance in the auditory system, with interesting applications in cochlear implants. A final concluding chapter on the future of stochastic resonance and suprathreshold stochastic resonance provides an excellent, though brief, overview of the future of the field.

The title of the book makes you feel that finally you find a book fully devoted to the phenomenon of stochastic resonance and its applications, which are many in sciences and engineering. When you open and read the book, however, you realise that indeed the book contains an excellent account of this phenomenon, but the main goal of it is to describe the phenomena of suprathreshold stochastic resonance and stochastic quantisation, with their corresponding and very interesting applications mainly in signal theory and some biomedical devices.

Something I have liked very much is that each chapter ends with a chapter summary, a chapter in a nutshell highlighting the most important aspects described in each chapter, and also a list of open questions which can be very helpful for the reader.

The book contains a foreword including comments by two well known scientists whose efforts have been dedicated to applications of stochastic resonance in the engineering and biophysics fields, and I agree with them that the book is indispensable for graduate students and researchers who need to navigate through the modern sea of stochastic resonance, and with a sufficient mathematical background.

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