

Preface

For some time I have been interested in a group of phenomena depending upon random processes. On the one hand, I have recorded the random shot effect as a suitable input for testing nonlinear circuits. On the other hand, for some of the work that Professor W. A. Rosenblith and I have been doing concerning the nature of the electroencephalogram, and in particular of the alpha rhythm, it has occurred to me to use the model of a system of random nonlinear oscillators excited by a random input. For many years I have been discussing my ideas with Professor Y. W. Lee and Professor A. G. Bose of the Electrical Engineering Department and of the Research Laboratory of Electronics of the Massachusetts Institute of Technology. About the beginning of 1958 they suggested to me that it might be useful to give a few lectures on the subject in a seminar for a chosen group of graduate students in electrical engineering. They offered me every possible help in the technique of recording these lectures and of working them up in a semipermanent or permanent form. They made use of tape recording of my spoken words and of the photography of formulae that I wrote down on the blackboard. From these they prepared a set of hectographed notes.

At the beginning we had contemplated a sequence of only four or five lectures. My ideas developed *pari passu* with the course, and by the end of the term we found ourselves with a set of fifteen lectures. The last few of these were devoted to the application of my ideas to problems in the statistical mechanics of gases. This work is both new and tentative, and I found that I had to supplement my course by the writing over of these lectures with the help of Professor Y. W. Lee.

I here wish to express my deep gratitude to Professors Lee and Bose, and to the members of the course whose names I give here: D. A. Chesler, D. A. George, I. M. Jacobs, A. H. Nuttall, C. E. Wernlein, Jr. (members of the Research Laboratory of Electronics and graduate students in the Department of Electrical Engineering, M.I.T.). Without their active help and sympathy and without the relief and freedom that they gave me by assuming the hard work of writing up the notes, this book would either never have come to exist or at best would have waited one or more years. They also freely advised me on the type of content that would be interesting to electrical engineers and to workers in related fields. I also wish to express my appreciation to Mrs. Ruth E. Rosensweig for undertaking the difficult task of typing the lectures from tape recording, and for typing the manuscript that was prepared by members of the course.

This book is written in an informal style, very largely as I spoke the material in the lectures. This has both advantages and disadvantages, but I hope that the informality will be pardoned in view of the life thrown into the material by presenting it just as it was given. I hope that my results will be of interest to workers in several fields. Among these are: electrical engineers working in communication theory; students of non-linear electrical networks; those interested in the stability of electrical generating systems; biophysicists, and, in particular, those concerned with all types of rhythmical phenomena; atomic physicists; and students of all branches of statistical mechanics. Among the last I have put students of hydrodynamics as well as meteorologists and oceanographers. My book represents a transcription of the present state of a growing subject, and it is my sincere hope that it will soon be superseded by the future work provoked by it.

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