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## Book Review

*Signals and Noise in Communication Systems*, by Harrison E. Rowe, 1966; 341 pages. (London: D. van Nostrand Co. Ltd., 86s.)

This book is the latest addition to the well-known *Bell Telephone Laboratories Series*, based on the research and development activities of that organization. It is clearly intended as an authoritative, complete and modern text on its subject, the mathematical analysis of signals and noise in conventional communication systems employing amplitude, frequency, phase and pulse modulation.

The first chapter introduces the communication systems subsequently studied in the book. Chapter 2 summarizes briefly the mathematical techniques used to represent signals and noise and to analyze the various modulation methods. The treatment is deliberately concise since a comprehensive bibliography refers to other works providing a more detailed presentation. The Hilbert transform is introduced; this leads to a more concise and general analysis of distortion and noise in various systems without the introduction of Fourier series representation.

Chapter 3 deals with amplitude modulation and related systems, the generation and detection of various types of AM signals, the analysis of non-linear devices used as modulators, demodulators and frequency changers. Distortion in the output signal caused by imperfections in the terminal equipment and by amplitude and phase distortion in the transmission channel is studied together with the effect of noise. Chapter 4 analyzes both frequency and phase modulation showing how they are closely related and distinguishable only by observing both the modulated wave and the original modulating signal. The spectra of such angle-modulated waves is then studied for sinusoidal and more general simple periodic modulation and also by a stationary Gaussian random process. The quasi-static and related approximate methods of Carson and Fry and of van der Pol for analyzing the transmission of a rather general angle-modulated wave through linear circuits are discussed. The detection of FM waves by an idealized limiter and discriminator is analyzed,

and the effects of noise and interference on the output of an angle-modulation system are studied for the small-noise case.

Chapter 5 covers the complex field of pulse-modulation systems. It discusses the basic principles of the various unquantized systems, pulse-amplitude modulation, PAM, pulse-position modulation, PPM, and pulse-duration modulation, PDM. It explains the concept of quantizing and its advantages over noise effects and illustrates it with the binary pulse-code modulation system. The effects of additive noise and distortion in the transmission channel are considered briefly for PAM, PPM, and PDM systems. Quantizing noise is discussed in connection with PCM systems. The effects of certain imperfections in the terminal equipment are discussed and idealized modulators analyzed. Brief consideration is given to the spectra of certain random pulse trains occurring in some of the pulse systems. The treatment is simple and restricted to subjects capable of being handled analytically.

The author is a member of the technical staff of *Bell Telephone Laboratories* and the book grew out of a series of notes written for a course first given in the Communication Development Training Department in 1960. Consequently, the treatment is thorough, elegant and professional. It does assume a good mathematical grounding on the part of the reader without which the reading is difficult. This is partly eased by a most comprehensive bibliography at the end of each chapter which covers the original papers from which many of the detailed analyses presented in the text are taken.

The book would also be valuable as a textbook for a course on communications theory and this is helped by the inclusion of 145 problems for the reader to solve himself. These are carefully designed to extend or clarify topics in the main text or to supply missing steps in the mathematical treatment. The book can be recommended as an authoritative text on modulation methods which would serve equally as a textbook or as a reference book for a specialist in communications engineering.

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