REVIEW

The Measurement of Time-Varying Phenomena: Fundamentals and Applications. By E. B. MAGRAB and D. S. BLOMQUIST. John Wiley, 1971. 347 pp. £7.95.

Over the last few years several books on the statistical analysis of random signals have appeared, written for experimenters who do not need, or cannot cope with, the detail and rigour of books on stochastic processes written by, and for, mathematicians. The authors of this book have taken pity on the large section of the community which is electronically as well as mathematically underprivileged; they have combined a short introduction to the mathematical operations of statistical analysis with a discussion of the instruments which perform those operations on electrical signals. This seems a very sensible approach, ideally suited to experimenters whose professional competence lies in the *physics* of time-varying phenomena in fluid mechanics and solid mechanics, rather than in statistical mathematics or electronics.

The authors have cleverly linked the mathematical introduction to the treatment of electronics with a chapter on electrical filters, passing from the analysis of ideal filters to the implementation of practical ones, and including a good deal of information on averaging errors which is applicable to any linear device. The mathematical analysis is at an acceptable level of rigour and generality, making responsible use of the formula 'it can be shown that' and an appeal to more specialized references (the book contains over a hundred references, only 15 of them dated before 1960). The authors drop the reader in gently by treating periodic, aperiodic (transient) and continuous random processes in that order; unlike many writers of introductory textbooks they *do* indicate the notorious difficulties of passing to infinite sample length in defining power spectra (though their resolution of these difficulties depends on a double limit which is not explained).

Chapters 3–6 deal with amplifiers, detectors (i.e. peak, rectified-mean or R.M.S. meters), recorders (chart, CRT or magnetic tape) and signal generators. There is no discussion of semiconductor theory and the account is written around block diagrams, acknowledging that the experimenter need not concern himself with the contents of the matchbox-sized black boxes which are the real-life equivalent of the blocks on the diagrams. Chapter 7 is a discussion of digital systems, dealing with quantization and aliasing errors as well as with the hardware of ADC's, DVM's, logic elements and the rest, and including a helpful description of mini-computers. Perhaps in future editions this chapter could be extended to include more details of digital filters and software problems, though it is a pleasure to find an account of digital analysis that does *not* go into all the tedious details of fast Fourier transforms! The book ends with a 20-page glossary of electronic terms and several appendices on practical details.

In general the treatment is very clear: there is a continuing emphasis on

measurement accuracy, sample length and confidence limits, and many examples are given of applications of the techniques described. I found a dozen or so misprints, the only non-obvious ones being the transposition of the diagrams for AND and NAND gates (figures 7.8 and 7.11) and the apparent omission of a factor 2π (p. 38) at a critical point in the derivation of the power spectrum of a random signal. (This last is particularly confusing because the authors define the power spectral density so that its integral over all circular frequencies is $1/2\pi$ times the total power instead of equalling the total power as custom and logic dictate.) In a couple of places electronic jargon or the English language gets the better of the authors but the only seriously opaque passage that I noticed is the description of the use of feedback to obtain root-mean-square values from a squaring circuit. Considering the range of subjects discussed, the standard of exposition is admirable.

The book should be a useful companion to anyone concerned with the measurement of time-varying phenomena, expecially to people with little previous experience of electronic instruments.

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