BOOK REVIEWS

Nuclear Electronics

E. Kowalski, Springer-Verlag, Berlin, Heidelberg, 1970 Pp. 402 with 337 figures, $ 26 40

The book presents a comprehensive survey of current literature on nuclear electronics and is based on 'a study of a thousand or so original papers' dating upto the end of 1968. The text folllows the order of construction of a piece of electronic apparatus . first the detectors and input circuits, then the analog portion, the analog-to-digital and time-to-digital converters and the digital analyzers, and finally the build-up of rather complex total systems are discussed. The material is organized into seven chapters supplemented by an Appendix.

The first chapter is introductory while the second deals with 'radiation detectors and related circuits'. It covers ionization chamber, proportional counters, GM counters, semi-conductor detectors and scientillation and Cherenkov counters. In each case the processes involved in the formation of the pulses, the pulse shapes, and the circuits immediately following the detectors are described in a clear and concise manner. A number of practical circuits also are given in this chapter.

The third chapter deals with 'analog circuits'. It covers linear pulse amplifiers, arithmetics operations on analog singals, window amplifiers, linear gates, pulse stretchers and fast pulse amplifiers. Under pulse amplifier, the topic of pulse-shaping has been dealt with exhaustively and the uses of differentiators, integrators, delay lines and compensating networks in this connection have been covered throughly. The effect of pulse shape on the equivalent noise charge has also been mentioned. Under arithmetics operations the use of operational amplifier, pulse amplifier, log-and antilog-convertors have been discussed. Among the many practical circuits described in this chapter, there is an interesting circuit of a transistorized 5-stage fast pulse amplifier with a gain of 1500 and rise time of 3 nano-seconds.

The fourth chapter is captioned 'analog-to-digital convertors' and deals with pulse-height discriminators, digital encoding of pulse height, and pulse-height discriminators. Under pulse height discriminators, the principle of working of various types of multivibrators and the Schmitt trigger circuit has been reviewed and applications of these basic circuits in conjunction with anti-coincidence circuits, window amplifiers, clamping diodes etc., in integral differential discriminator have been discussed in details. The use of tunnel diode in fast discriminators

has also been indicated. Under digital encoding, convertors of Wilkinson type have been treated in depth and the internal organization of an analog-to-digital convertor with a buffer register has been described . Other convertor systems have also been mentioned.

The fifth chapter deals with 'evaluation of the time information, and covers general consideration of resolution, pulse shapers, concidence circuits, digital encoding of time entervals and auxiliary circuits. A number of practical coincidence circuits employing pentodes, diodes. transistors and tunnel diodes have been discussed; a particularly interesting circuit due to Whetstone and Kounosu uses tunnel diodes and achieves resolving times of the order of a few nano-seconds. The chronotron principle by which the time-intervals between correlated events can be measured with the aid of a simple fast coincidence stage by varying the signal delay in one of the signal paths, has been explained and illustrated. Under digital encoding of time interval the principles of direct encoding with a reference oscillator (clock) and time-to-pulse height convertors have been discussed and followed up by practical circuits of start-stop convertors and overlap convertors.

The sixth chapter is a short introduction to 'digital circuit' and covers the fundamentals of Boolean algebra, gates and flip-flops, pulse scalers, logical and arithmetical circuits, memories, data output and count-rate meters. This chapter provides the basic knowledge of digital techniques essential for understanding the discussion on digital data processing covered in the next chapter.

The seventh chapter is a brief survey of digital devices for the nuclear "data processing". It covers simple counting systems, multi-scaler arrays, multichannel analysers, multiparameter analysers and on-line computers The use of on-line computers has been illustrated by describing the experimental setup for the detection of small angle elastic scattering at the Brookhaven 33 BeV alternating gradient synchrotron.

The appendix consists of two sections—one on Laplace transform calculus and the other on noise. It provides back ground material and serves as useful addition to the main theme of the book.

The book contains a wealth of information organized in a logical and systematic manner. Wherever necessary the basic principles have been explained first and then the practical circuits have been discussed This makes the book valuable both as a text book and as a hand-book. The broad survey of all aspect of the subject will enable the physicist to assess the feasibility of converting his ideas into workable hardware. The large number of practical circuits will be of great help to those who construct and develop nuclear electronic devices. The exhaustive list of references will provide access to material for further study on the subject.

The book fills a widely felt need for a modern and comprehensive review of literature on specialized electronic circuits and instruments used in measuring nuclear radiation. It is primarily addressed to the experimental physicist who, when designing an experiment, needs to be able to review the possibilities of the available instrumentation so as to instruct his technicians (electronic engineers) accordingly. It can also be of help in the training of electronic engineers and and a work of reference for the technicians in allied fields, who are expected to construct and maintain nuclear electronic apparatus, often without any special training.

S. D. C.

The Classical Theory of Fields
(Vol. II *A Course of Theoretical Physics*)

L. D. Landau and E. M. Lifshitz (Trans. by M. Hamermesh), Pergamon Press, 3rd Edition, 1971, pp. 347, $ 5.75

The course of theoretical physics by Landau and Lifshitz is a remarkable series which has long since earned the appreciation and esteem of physicists round the world. It is therefore hardly necessary to speak about the authoritative and lucid exposition of different topics in Maxwell field theory and the Einstein gravitation theory that one finds in this volume and especially so, as the present reviewer remembers that he had done that pleasant task when reviewing the second edition in the pages of this same journal. Although here and there one finds many minor changes in the presentation as compared with the previous edition, the important changes appear to be the addition of a section on gravitational collapse (Section 100, Chapter II) and the last four sections in the chapter on cosmological problems (Chapter 12). The discussion on gravitational collapse is neat and fairly complete so far as simple spherically symmetric collapse is concerned but the recent investigations due to Price and Hartle which have led to the conjecture, "A black hole has no hair", do not find a place. The new sections in the Chapter on Cosmology are welcome as bringing the discussion up to date and while the authors' revision of their previous attitude regarding the singular origin of the Universe is as expected, it could have been nice if there were some references to the works of Geroch, Penrose and Hawking in this field. Lastly while the authors' reasonings in favour of the "oscillatory character" of the singularity and their suggestion of pushing the origin of the Universe to an infinite time in the host because of the infinite number of oscillations in the approach to the singular state, are surely interesting, they are not likely to gain general acceptance.

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Find out information about Nuclear Electronics. the aggregate of methods of nuclear physics in which electronic instruments are used to receive, convert, and process information from nuclear radiation Explanation of Nuclear Electronics. Nuclear electronics is a subfield of electronics concerned with the design and use of high-speed electronic systems for nuclear physics and elementary particle physics research, and for industrial and medical use.Â Elementary components. Some of the essential components that make up the elements of a nuclear electronic analysis system include: Detectors. Preamplifiers.