BOOK REVIEWS

Lightning and its spectrum—*an atlas of photographs* by L. E. Salanave. Published by The University of Arizona Press, Box 3398, Tuscon, Arizona 85722, U.S.A., pp. xvii + 136, 1980, Clothbound, $ 25.00.

Lightning and thunder are the most awe-inspiring features of thunderstorms. The spectacular effects of and destruction caused by lightning gave rise to fear and superstition in the minds of early men. In spite of great strides in the understanding of the characteristics of lightning flashes during the past seventy years, there are many gaps in the existing knowledge. Also supeistitions and misconceptions persist. Books, such as the one under review, go a long way to elucidate to the general reader the nature of lightning and present to the scientific reader some of the more recent advances in the field. Therefore, the publication of this book should be welcomed by all.

This book is devoted to the optical aspects of lightning and is illustrated with more than a hundred high-quality photographs. The author of the book, Dr. Salanave, pioneered the application of slitless spectroscopy techniques to the study of lightning at the University of Arizona. During the course of these researches conducted over a decade, he and his group accumulated many photographs of outstanding quality showing rare occurrences of lightning flashes. In addition, Dr. Salanave has studied in detail many photographs obtained by other research groups and individuals in several countries. In this book, he has presented many of these photographs to bring out the varied and astonishing manifestations of lightning.

The book begins with an introduction to the historical aspects of lightning photography. Chapter 1 deals with thunderclouds—the environment of lightning and contain some good photographs of Cumulonimbus. The formation of an electrified cloud due to volcanic eruption is presented in a unique photograph at the end of the chapter. Typical forms of lightning flashes are presented in Chapter 2. Ground flashes, intra-cloud flashes and air discharges are illustrated in about a dozen time-exposure photographs of high quality. Some combinations of ground flashes and air discharges, ground flashes to tall objects and flashes to and near spacecraft are described with several interesting photographs. The chapter ends with description of the techniques for photographing the grandeur of lightning by the time-exposure method and is illustrated by some photographs.

Unusual lightning flashes form the subject of Chapter 3. Excellent photographs of ribbon lightning, forked flashes, bead lightning caused by an eruptive water plume and lightning flashes caused by volcanic clouds and thermonuclear explosions are presented

together with short descriptions of conditions under which they were taken. Chapter 4 deals with time resolved photography of lightning flashes to level ground and tall towers. Some hints on swing-camera techniques and daylight photography of lightning flashes using filters have been given. The use of stereographic photographs as well as those taken in two perpendicular directions to bring out the tortuosity of lightning flashes are also described. These aspects are further illustrated in Chapter 5 and methods for obtaining good photographs are given in some detail.

Chapter 6 gives a collection of spectra of lightning flashes obtained by Salanave and his team. The technique used made it possible to take the spectrogram of each stroke of a flash and enabled estimation of the properties of the lightning channel. These findings are presented in some detail. Comparisons between the spectra of lightning strokes and laboratory long sparks have been presented. Some miscellaneous aspects of lightning are covered in Chapter 7. A glossary of the terminology used in the literature on lightning is given to help the casual reader. A bibliogaphy of about forty references is given to aid in obtaining additional information. A reading list of some popular and scientific books on lightning and journals devoted to this subject is also given. A short subject index is provided at the end of the book.

The high quality of the many spectacular photographs presented in the book and the unique style of delineation of the details to appeal to the general reader, the photographers as well as the specialist truly make the book a significant contribution to the existing literature on lightning.

B. I. GURURAJ

Electromagnetism and its applications—an introduction by B. Bolton. Published by Van Nostrand Reinhold Co., New York, International Student Edition, pp. xi + 157, 1980, HB £ 10.00, PB £ 4.50.

Although the subject of electromagnetic fields is well covered in classical treatises, they are often not suitable for use in basic courses intended to introduce the concepts. Therefore, a number of more elementary books have been written in recent years from different viewpoints and to emphasize specific practical applications. This book can be classified under this category and covers the basic principles of electromagnetism. It is written as a student text for first year undergraduates and those in diploma courses.

The book uses the modular teaching technique. This technique has become increasingly popular in recent years. A book for use in such a learning activity consists of self contained units having sequential learning and evaluation material to facilitate effective comprehension in terms of stated objectives. The author has used the technique for a number of years and has found it to be very effective.

The mathematical material is structured into chapters called ' tasks ' and are designed to enable the student to advance in carefully defined steps. The treatment of these

aspects is very similar to those found in some of the available books on the subject. Notes on appropriate practical applications are introduced in chapters between the ' tasks '. The author has introduced some novelty by blending the details of the applications with the theoretical material. The applications are chosen to give the student an idea of the range of devices and to develop his motivation for further study.

The teaching concepts employed in the book are summarized in Chapter 1. Electrostatic fields in its various aspects are covered in Chapters 2 to 16. Applications such as electrostatic copier and precipitator, corona and lightning discharges, electrostatic and corona motors, ion thrusters, charge coupled devices and electrostatic high voltage generators are presented in short descriptions.

Magnetostatic fields and applications based on them are covered in Chapters 17 to 29. Here again, devices such as core and bubble memories and stepping motors are described in outline. Chapters 30 to 37 cover electromagnetic induction, self- and mutual inductances, energy stored in magnetic fields and losses in iron. Practical devices such as homopolar machines, induction and shaded-pole motors and transformers are covered in some detail. The last Chapter (38) gives an elementary coverage of Maxwell's equations. Many of the chapters on applications contain references for further reading. The problems at the ends of the chapters on mathematical aspects are designed to test the students' ability to apply knowledge gained to specific situations. Worked solutions are provided for the more difficult problems and answers are given for the others.

This book is well written and can be recommended as a text-book for undergraduate and diploma students.

B. I. GURURAJ

Light current electrical applications—III (McMillan Technician Series) by A. Simpson. Published by The McMillan Press Ltd., London, 1981, pp. iv + 89, £ 4.95.

As given in the Foreword and the Preface of the book, this book is specially prepared as course material for ' light current electrical applications ', a subject at the third-year evel for electrical technicians preparing for the Technician Education Council (TEC) Diploma in U.K. The book is well written, laying more emphasis on the understand ing of operation of the different electronic building blocks which constitute the main stay of electronic equipment and systems today. As such, circuit analysis and design which normally accompany the physical concepts of the operation of building blocks do not find place in this book. However, many illustrative problems are included in the book to give the reader some insight into the characteristics and the limitations of the circuits described.

The book has six chapters, *viz.*, Regulated Power Supplies, Transistor Amplifiers, Sinewave Oscillators and Pulse Generators, Digital Electronics, High Power Electronics

and Monolithic Integrated Circuits, and is expected to cover one unit of the Diploma syllabus. In each case, the basics of circuit operation are given in clear but concise form together with neat and well-prepared circuit drawings and relevant information. Very little mathematics is employed in the description, which makes it easy to understand by the technician trainees for whom the book is meant. While each chapter begins from the conventional transistor approach to building block realization, it takes the reader to monolithic IC approach as well, so that the course is kept updated. Thus, while in Chapter 1, shunt and series voltage regulators are described with transistor circuitry together with their protection techniques, there is also a section each on IC voltage regulators and switching-mode voltage regulators. Specifications of voltage regulators are also covered in detail. This ensures that the students get to know the latest trends in this area. Similar practice is followed in other chapters as well.

By virtue of the clear understanding offered in each chapter, the reviewer is of the opinion, that the book can be of use to senior students of the diploma courses in electronics at Indian polytechnics, as well as to first/second year students in the 4-year B.E. programmes in Indian universities, as an introduction to electronic circuits—both linear and digital. However, if the author plans a revision of the book in the near future, the following additional topics may be included to make the subject coverage more complete and more useful to Indian requirements:

(i) In Chapter 1, some aspects of current sources and regulators as well as monolithic precision voltage regulators may be included.

(ii) A discussion on direct-coupled differential amplifiers will certainly add strength to the chapter on Transistor Amplifiers.

(iii) The students would find it interesting if generation of triangular waveform is described followed by square, pulse and sinewave generation from it, as is done in modern function generators.

(iv) A few additional logic circuits like EX-OR gate, together with decade counter, shift register, 7-segment display would indeed heighten Chapter 4.

(v) Some discussion on uninterruptible power supplies would be very useful in Chapter 5.

(vi) Chapter 6 is very brief. Perhaps, it could be suitably expanded by introducing current trends in monolithic ICs, particularly MOS technology, LSI, etc.

B. S. SONDE

Network theory and filter design by Vasudev K. Aatre. Published by Wiley Eastern Ltd., New Delhi, 1980, pp. 436 + vii, Rs. 33·50.

Network theory—comprising network analysis and synthesis—is a fundamental course for all students in electrical, electronics and communication engineering, as it provides the necessary basis for all other courses. This field, together with filter design, has greatly advanced in recent years, almost in step with other advances in electronics— particularly solid-state technology and ICs. Scores of text-books have been written on

these topics from time to time; but, generally most of them cover one or the other of these topics, *viz.*, analysis, synthesis or filter design. The author has made a bold attempt in this book to give a unified treatment of these topics by discussing the required analytical methods and linking the essentials of approximation, synthesis and filter design. Although in the process, the book has become voluminous, it provides the student with a clear insight into this vast and expanding field. And, it can serve as a useful text-book for undergraduate courses in network theory and filter design at the Indian Institute of Science, IITs and other engineering colleges.

The book has 15 chapters covering analysis, synthesis and filter design, followed by 5 appendices giving useful supplementary information. Of these chapters, ten are devoted to network analysis, three to network synthesis and the remaining two to filter design, thus making it possible to cover the subject matter in detail. Following a brief review of basic circuit elements in Chapter 1, fundamental concepts of graph theory and generalized network elements are covered in Chapters 2 and 3. The solution of network equations based on Laplace transforms and sinusoidal steady state analysis is covered in the following two chapters. This is followed by a discussion of the various network theorems, such as Tellegen's theorem, Superposition theorem, Thevenin's theorem, etc., in Chapter 6. The concepts of natural frequency and poles-zeros of network functions are taken up in the next chapter, followed by analysis of two-port networks in Chapter 8. Chapter 9 deals with indefinite admittance matrix wherein its important properties are first described followed by a discussion of network functions and OP AMP networks. The state equations—the concept of state including the formulation of state equations, etc., are covered in Chapter 10. These two chapters are indeed at the advanced level and are very useful in modern network theory. Chapter 11 covers image parameter filter design technique, which the author has introduced from the historical perspective and to keep the reader in touch with the concept of matching and cascading in filter design. The following three chapters cover network synthesis in somewhat detail. The Foster and Cauer form synthesis of two-element networks, and the realization of all-pole transfer functions are discussed here followed by Darlington insertion-loss synthesis techniques. The last chapter presents a good introductory treatment of active filter design methods for single and multi-amplifier filters and GIC-based structures. The area of active networks and filters has greatly advanced in recent years. Hence, the reviewer would have been happier if this topic had been covered in somewhat more detail in the book. Also, brief introduction of more recent topics, such as, digital filters, transversal filters, switched-capacitor filters, etc., should have found a place in the book.

The author has long experience in teaching network theory and filter design both in India and abroad. And, he has made a good attempt to bring out this book as a composite text-book covering analysis, synthesis and filter design, together with many illustrative and worked-out examples. This is indeed a laudable effort.

B. S. SONDE

Mathematics for technician engineers (A Third Level Course) by George E. Dyball.
Published by McGraw-Hill (U.K.), 1980, pp. xii + 358, £ 4.95.

The book is undoubtedly a fine introduction to the applications of elementary mathematical concepts to the study of electrical and mechanical systems.

According to the prefatory remarks of the author, the book is meant for technicians pursuing a diploma program of technical education. As such, the book would be useful to those studying in polytechnics and the like after completing the XI Standard (or equivalent).

The motivation for the contents of the book is set forth in the first chapter where the concept of mathematical modelling is elegantly, though briefly, explained using a flow diagram. The remaining fifteen chapters (the last one being a revision) deal with the elucidation, at a level appropriate to students of diploma course, of individual blocks of the flow diagram.

Here are the principal contents of the book, the chapters being grouped in case of a unifying theme :

Chapter 1

Clear description of the concept of mathematical modelling and the steps involved in the process. Also presented are certain techniques (like rounding off numerical values, plotting of functions) needed in analysis and design of systems.

Chapter 2

The mathematical constituents of the framework required in modelling of systems are reviewed and, wherever necessary, derived in this and the subsequent chapters. Here, after a resume of trigonometric functions, three-dimensional geometry, and sinusoidal functions (basic to electrical engineering) are treated. The terms projection, angle in three dimensions, constant angular velocity, phase shift and frequency are explained by means of well chosen examples (from both mechanical and electrical engineering).

Chapter 3

Binomial expansion, factorials, limit evaluation, exponential and logarithmic functions are explained and used to determine the value of the current in electrical circuits.

Chapter 4

Graphical and numerical techniques of curve fitting, which is an important aspect of experimental data analysis, are neatly presented and illustrated. Use of log-log and log-linear graph papers is explained.

Chapter 5

Evaluation of first and second derivatives of functions, and of functions of functions (including sums, products and quotients). Examples from dynamics of point masses and electrical circuits.

Chapter 6

Maxima and minima of functions and their evaluation. Local and overall points of maximum and minimum values. Turning points. Second derivatives for distinguishing between maxima and minima. Examples from maximization of volumes and minimization of surface areas, production costs in a factory. Calculation of minimal force required to move a point mass, and maximization of power developed in a wind-driven machine. All the examples are typical of real-life situations.

Chapters 7, 8, 9 and 10

Integration is a very essential part of any engineering design, and therefore the author has devoted considerable attention to it in the four chapters. After briefly explaining the meaning of integration and some of the rules involved (like change of variables, transformation of limits), the author passes on to applications: area and volume calculations (Chapter 8); first moment of area, centroid (Chapter 9); second moments of area, including the polar moments of area (Chapter 10). The examples are standard, d awn as they are from mechanical engineering.

Chapter 11

The meaning of solution to a first order differential equation (family of curves), given boundary conditions. Standard differential equation of the form $dQ/dt = kQ$ where k is a constant. Engineering examples from fields like thermal expansion, movement of point masses, and electrical circuits.

Chapters 12, 13 and 14

It is well known that all engineering applications involve the concept of probability in some form or the other. The author has done well in introducing this material at an elementary level. The examples chosen are mainly from production engineering. However, they do illustrate the essential concept of quantifying uncertainty. The contents (definitions, simple probabilistic calculations, dependent and independent events, mutually exclusive and non-mutually exclusive events, laws of probability) of Chapter 12 are well presented. Chapter 13 deals with discrete distribution functions (binomial and Poisson) which frequently arise in practice. However, random variables are introduced rather briefly. As is to be expected, Chapter 14 contains continuous distributions, the most important of which is the normal distribution. The method of applying theoretical results to tolerance problems (production or measurements) is thoroughly explained.

The reviewer feels that inclusion of reliability calculations would have enhanced the value of this part of the book.

Chapter 15

Complex numbers are introduced for the sake of completeness. It would have been desirable to integrate this into the body of the book, not as an appendage. However,

the student can benefit to a limited extent by working out the problems contained in this chapter.

Chapter 16

Most of the concepts of modelling (with the exception of probability) are reviewed in terms of two applications: electrical circuit (R–L–C) and the dynamics of a boat hull. A student should be able to come up with similar results for various applications if he has diligently studied the first fourteen chapters of the book.

The book contains interesting exercises with answers, and hence is useful for self-study too. It is highly recommended for diploma students of polytechnics and equivalent institutes.

Y. V. VENKATESH

Electronic devices by F. R. Connor. Published by Edward Arnold Co., London, 1980, pp. 121 + ix, £ 3.95.

This short book forms part of a series of seven books, dealing with electronics and communications problems at a relatively introductory level suitable to the middle years of an engineering degree student in Indian universities. The book gives an introduction from the side of physical electronics to a variety of electronic devices, covering solid state as well as tube devices. The coverage is quite complete. Semiconductor p-n junction diodes, Zener diodes, varactor diodes, tunnel diodes, junction bipolar transistors, junction field effect transistors, MOSFETs, cavity masers, travelling wave masers, ruby lasers and gallium arsenide semiconductor lasers are discussed after a chapter on semiconductor theory and a short chapter on atomic physics. Then a chapter on electron dynamics is given followed by a discussion of vacuum diodes, triodes, tetrodes, pentodes, cathode ray tubes, colour television tubes, light emitting diodes, photomultipliers, photoconductive cells, solar photovoltaic cells, twin cavity klystrons, reflex klystrons, magnetrons, travelling wave amplifier tubes, Gunn diodes, impatt diodes, trapatt diodes and Schottky diodes. These along with short discussions on wave mechanics, statistical physics and integrated circuit technology are all covered within 120 pages, giving an idea of the brief introduction to each topic and of the level of the treatment. Thus the book can be considered as a beginners' guide to these devices.

The utility of the book is further enhanced by a large number of worked examples and problems. Brief derivations of the important formulas are also given. A number of associated matters are treated in 8 appendices, for example the technology of I.C. fabrication or the table of physical constants. All these with a good index and good editorial work make the book quite attractive.

However in the Indian scene, it seems unfortunate that the book may not have a large market. The students of say a bachelor's degree in engineering would go in for

a more detailed treatment of electronic devices and circuits if they belong to the electronics/telecommunications streams. Otherwise they study say junction diodes/transistor in some detail and leave out other items. The same would be the situation regarding the science students in the M.Sc. first year or the B.Sc. final year. The book is addressed to the students in U.K. preparing for the Higher National Certificate or the Higher National Diploma examinations. Such a breed of students do not exist in India. The book could also be a simple handbook for professional electronics and other engineers but then most engineers would need further design details. Also the cost of £ 3.95 would make the book out of reach of many Indian buyers.

The book is well produced. In fact the reviewer could not spot any mistake in the text. Perhaps the only omission is the area of power devices like SCRs, diacs, triacs, gas diodes, thyratrons, and ignitrons as well as the important area of LCDs. The book has a pleasantly readable style. It is certainly recommended as a handbook for those who can afford the price.

E. S. R. GOPAL

Computers and social changes by Murray Laver. Published by Cambridge University Press, 1980, pp. 125. £ 8.00.

Recent years have witnessed a rapid development in computer technology and its applications to a variety of social problems. This increasing usage has given rise to a number of problems with economic, social and political ramifications. Several books and papers have been published on these aspects. In this book Mr. Murray Laver discusses some of these implications.

The author while outlining the capabilities of the present-day computers and microprocessors provides glimpses of computer usage in the near future. He expects significant social consequences because of these applications. It may be difficult to predict these consequences and assessment of the ill-effects of the new technology as it deals with complex human and social behaviour. The author also indicates that though alternative future courses are available, the choice of applications will be political and not technical.

The author describes the role of computers in systems like view data where individuals are linked through a public telephone network to computers. He outlines the pros and cons of usage of computers in different applications like education, economic analysis, crime prevention, etc. He also outlines the aspects relating to privacy and protection of data. The author also touches upon the aspects of system integrity, as computer systems could become a social nuisance by being a source of errors. Various sources of errors have been enumerated and the importance of integrity, reliability and security emphasized. Increasing use of computers has also increased the vulnerability of organisations as the bargaining power of trade unions will increase. The author has cautioned in using the systems approach which has been successful in designing machine complexes

to less determinate problems of society. He also discusses the effect of computers on the processes of democracy. He has shown how opinion polls could introduce side-effects with undesirable political consequences. He also considers the possibility of electronic referenda on important political issues, and using computer models to aid decision making. The author has finally advocated a case for social control to handle the ill-effects of the social changes caused by the use of computers.

The book in general provides a broad view of use of computers in social activities, the dangers that may arise out of these applications, and the social, political and economic consequences. The book is recommended for all users of computers.

N. VIJAYADITYA

Going solar—*A practical guide to solar water heating* by Cleland McVeigh and Diana Schumacher. Published by the Natural Energy Association, 2, York St. WIH IF4, pp. 48, £ 1.65.

Hot water is a necessity for domestic and industrial uses, particularly to western world, and large amounts of conventional fuels are currently used for heating the water. Solar energy is a good alternate source of energy even in places like the U. K. where mean average solar daily radiation is about $2 \cdot 5 \, kwh/m^2$.

This book on solar water heater has been written in layman's language. It is a practical guide for the people who would like to use solar energy for the production of hot water. The general question that may arise about solar collector, its working principle, choice of a suitable system, their life expectancy, installing procedures, its cost and economics have been discussed. Most of the data are presented in the form of questions and answers. Information about the solar collector and system manufactures in Britain is given in the appendix.

Precisely this book is a useful guide for beginners.

A. THOMAS

Basic structural analysis, by O. S. Reddy. Published by Tata McGraw-Hill Publishing Co., New Delhi 110 002, 1981, pp. 596, Rs. 39.

This book, apparently intended for undergraduate students in Civil Engineering, has an ambitious coverage of topics. Starting from the statics of structures, it covers determinate and indeterminate structures, influence lines, moment distribution methods, energy methods and matrix structural analysis. The author has discussed the basic aspects of structural analysis in a systematic manner and this book might easily be the best among similar books by Indian authors. Topics like space trusses and Kani's method, not normally found in undergraduate textbooks, have been discussed in detail. It can be very useful in providing a broad understanding of basic structural analysis.

The author's attempt, however, to include matrix analysis of structures appears to be rather ambitious. This section of the book is inadequate since the author is in a hurry to cover a large ground in a few pages. The possibilities of matrix analysis have not been fully brought out since topics like space structures have not been touched. A brief introduction to matrix methods would have been sufficient for the undergraduate student.

The author has included a large number of explanatory figures. The clarity of the presentation would have been enhanced if these figures were larger in size. The arrangement of pages beyond p. 420 has been very erratic since Kani's method gets mixed up with matrix methods.

On the whole, the book represents a welcome addition to the collection of Indian textbooks and is moderately priced.

K. S. JAGADISH

Good style by John Kirkman. Published by Pitman, 1980, pp. vii + 131, £ 2.50.

Books proposing to teach scientists and engineers how to write have proliferated in recent years. This is probably evidence of widespread dissatisfaction on the part of readers who wish to understand what scientists are writing; among those readers must be many scientists themselves, frustrated by their colleagues' often-dismal efforts in communication. Some scientists have, of course, written brilliantly, about science in general or about their own work; but there is a surprisingly large number of others who while being meticulous about their experiment or analysis, are sloppy about the way they report it.

This book by Mr. Kirkman is full of sound advice on how to write simply, clearly and accurately. A direct style is recommended; and evidence is presented, in the form of scientists' reactions to stylistically different versions of given technical material, to show that the simple, direct style is generally found to be the most readable. The purpose of this exercise is to convince scientists that their colleagues are generally unhappy with the convoluted style that is generally accepted as the norm.

I fear, however, that the relatively wide use of the first person active that the author recommends would be found jarring by many readers. On the other hand where an author is expressing a personal view, the avoidance of the first person would be affected and misleading: thus it is preferable to say ' I (or we) believe that..', when that is what is meant, rather than ' It is believed that..'. The author takes a very sensible view of problems created by jargon and ambiguity; and illustrates his suggestions by many interesting examples.

Will this book succeed where many others have failed? I think it has some advantages : it is itself well written, and is not too long (about 130 pages). But I also

believe a book that most scientists would be willing to consult would have to be even shorter: at certain places in this book Mr. Kirkman is not advising scientists, but carrying on an argument with *his* professional colleagues about *their* advice to scientists on how to write. Such arguments may well be interesting, but I doubt if the practising scientist will have the patience to examine them. He would like a short cook-book (of the kind that he would disapprove in science!), with examples that he would be able to judge directly for himself. In fact, I do not believe that any of the numerous manuals on style that have appeared in recent years have improved much on Strunk's 50-page pamphlet of 1935. A version of Strunk, with examples from writing in science and engineering (—Strunk was not concerned with these subjects in particular), would probably be successful, especially if it can be distributed free (or nearly so) as public service.

R. NARASIMHA