BOOK REVIEWS

Science and technology in India by A. Rahman. National Institute of Science, Technology and Development Studies, Hillside Road, New Delhi 110 012, 1984, pp. 212, Price not stated.

A. Rahman's *Science and technology in India* is an account of the development of science and technology since independence. It also examines the problem in the historical perspective by describing the development during the ancient, medieval and the British period before 1947. The problems touched upon cover: progress of science and technology education, organisation of science and technology, science policy planning and financing research, scientific societies, scientific information system, contribution of indigenous R and D to India's development and international co-operation. The appendices provide a list of institutions under various ministries/departments and other statistical information which will be of immense use to the reader. Prof. Rahman has examined the earlier edition of science and technology in India by R.N. Bhargava and S. Pruthi (Indian Council of Cultural Relations) and annual reports of various Government departments and research institutions.

During the ancient and medieval period, considerable work was done in the fields of mathematics, astronomy, medical sciences, chemistry, town and country planning, architecture, artillery, agriculture, textile technology and smelting of metals and alloys. In this context, reader will find the proceedings of the 1983 seminar on 'Technology in India (ancient and medieval periods)' edited by K.K.A. Venkatachari (Ananthacharya Indological Institute, Bombay) of some interest.

While mentioning the progress during the British period, Prof. Rahman observes – through the policy of promotion of science and technology and their use for developing agriculture, health and industry that they made notable contributions to science through surveys of plants and animals, in the field of pathology of tropical diseases, in the field of engineering by way of construction of rail-roads, roads, canals and bridges, in the field of chemistry of natural products, in the area of food and agriculture as well as commercial plants. They established a number of professional societies and associations. In this way, they provided a scientific and technological base, from where it was easy to take off after independence.

During the post-war period and after, education in India was guided by Sargent Committee, University Education Commission, Secondary Education Commission and Education Commission. There has been a tremendous spurt in the growth of education by way of universities and the enrolment of students. Improvement in higher education has been achieved by organising summer schools for teachers, giving financial assistance to teachers to pursue research and by review committee reports in various subjects. A number of institutes of higher learning were also established.

The organisation of science and technological activities of Government of India are described. There are about 900 research and development institutions under Central and State Government control. The three councils are: Council for Scientific and Industrial Research, Indian Council of Agricultural Research and Indian Council of Medical Research. Besides, R & D work is carried out by the Departments of Atomic energy, Electronics, Environment, Space and Ocean Development. Other ministries involved in R & D activities are Defence, Energy, Health and Family Planning, Industry, Information and Broadcasting, Irrigation, Railways, Steel and Mines, Communication, Petroleum, Chemicals and Fertilisers and Agriculture. In addition to R & D establishments, the ministries and departments also have production units. It is estimated that about Rs. 18,000 crores has been invested in public sector organisations. An organisation chart of science and technology in India gives a bird's eyeview of the organisation of the departments, commissions, surveys, etc., under various ministries. The Department of Science and Technology acts as a promoter, and is responsible for co-ordination of S and T work among various departments/ministries and also looks after international collaboration. State Governments have their own departments of science and technology.

The importance of science was recognised long before independence and in 1939 the National Planning Committee also dealt with general and technical education and scientific research. After independence, the scientific policy resolution was passed by Parliament in 1958. In 1983, the Government issued a technological policy statement. These have emerged after long deliberation among representatives of Government, Planning Commission, scientists and industrialists. There is a need to review the science policy periodically and to set objectives in the light of the progress made. For the promotion of science, a number of societies and associations are functioning and their deliberations are useful in forming public opinion and drawing the attention of the Government on various issues.

A number of agencies fund the research projects to individuals and institutions. The research findings are published in journals or appear as departmental reports. There is a need for effective co-ordination and communicating the research findings both to the specialist and the general reader. A number of institutions are involved in the documentation of information in different subjects. Prof. Rahman makes a plea for a national information policy statement for its utility for decision-making at various levels.

The contribution of indigenous research and development has been recognised in peaceful use of atomic energy, space, medical sciences and food and agriculture. The other areas are: animal husbandry, rural development, defence R & D, electronics, energy, transport and communication, science and technology, environment, oceanographic research, large scale plants for industries and national test facilities. India has imported technology for its industrialisation and development, but at the same time has contributed in the development of other developing countries by way of technical consultancy, project export and collaboration with international contractors in setting joint ventures and in other ways.

In sum, this book gives a fair idea about the development and progress of science and technology in India. It will be of interest to specialist and general reader. For effective utilisation and better appreciation there is a need for constant dialogue between scientists, industry and society at large, in order to know each other's demands and to work to meet

these requirements. Need for indigenous technology is imperative and it is industry and entrepreneurs who have to use it to convert the research ideas into products. Provided a congenial working environment and a little more involvement and commitment of scientific community it would be possible to move towards self-sufficiency in technology. There is also a need to bring out status, trends and review studies emphasizing Indian contribution, pointing out gaps and problems for research in various areas of science and technology. It will help both the research workers and specialists in stimulating ideas to work with. The book is easy to read and get-up and printing is nice. The Union Minister of State for Science and Technology and Vice-President, C.S.I.R., Sri Shivraj V. Patil has written a stimulating foreword. The reviewer hopes that this book will arouse interest in science and technology in the public and provide a forum for public debate. Prof. Rahman and his associates deserve thanks for their endeavour.

Selection Centre South   P.C. BANSAL
Bangalore 560 042.

Introduction to random vibrations by N.C. Nigam. The MIT Press, 28, Carleton Street, Cambridge, Massachusetts 02142, USA, 1983, pp. 360, $ 40.25.

This is the first of the two-volume work by the author. It contains a systematic, comprehensive, and up-to-date treatment of the theory of random vibrations. The book is organised into ten chapters and three appendices. Probability theory and thoery of random variables is dealt with in one chapter each. Three chapters each are devoted to random processes and response analysis of discrete and continuous systems to random excitations. In the last chapter the response analysis of the nonlinear systems is considered. Two appendices, one on Fourier analysis and the other on ordinary differential equations, provide a valuable support for understanding the book. The third appendix demonstrates the application of the theory of random vibration to a single degree of freedom system.

This book has grown out of the teaching material of the author who has taught this course for a number of years at undergraduate level and the organisation of the book reflects this. The contents are arranged in an appropriate sequence. The classical material is presented in a concise and simple manner and the new material is introduced systematically. A number of worked out examples, introduced at various stages in the text, are extremely useful to clarify concepts and the examples listed at the end of each chapter to verify one's own understanding. Thus this book is likely to be very popular with the students.

It also contains many other noteworthy features. The theory is introduced with a high degree of generality so that it emcompasses a variety of applications. The response of discrete and continuous systems to random vibrations is treated in detail. A number of random process properties of direct practical importance including level crossings, peaks, first-passage time, etc., are discussed. The response of nonlinear systems is considered in an unified manner incorporating some of the latest developments. Thus researchers and practicing engineers will find it a valuable companion.

Professor Nigam must be congratulated for bringing out such a valuable book which will be useful to the students as a course text and to the researchers and practitioners as a valuable reference source. The second volume dealing with application of the theory to problems in fatigue, reliability analysis, aircraft response, wind, off shore and earthquake engineering, is expected to appear during 1984.

Aerospace Engineering Department   A.V. KRISHNAMURTHY
Indian Institute of Science
Bangalore 560 012.

Theory and practice to recursive identification by Lennart Ljung and Torsten Sonderstrom. The MIT Press, Cambridge, Massachusetts, USA, 1983, pp. 529, $ 54.95.

The motivation of the authors in writing this book has been 'to provide a comprehensive, yet coherent treatment of the field of recursive identification'. This field, commonly known as 'recursive identification' in control literature, is termed 'sequential parameter estimation' in statistical literature and is called 'adaptive algorithms' in signal processing literature. The topic is also of relevance to practicing engineers and industrial 'users' who have to work with complex systems and find adaptive techniques (adaptive control and adaptive signal processing) useful or necessary. The availability of microprocessors for easy implementation of algorithms has made it necessary to study recursive identification. The authors, therefore, feel that the topic of recursive identification should be included in undergraduate and graduate courses and the reviewer agrees with this point of view.

The book is organised in seven chapters. The introductory chapter deals with how to obtain a model of system and justifies the necessity of recursive identification and develops the general framework of recursive identification.

Chapter 2 contains a more 'leisurely' introduction to the field of recursive identification. The purpose of this chapter has been to give an overview and introduction to some useful concepts and approaches such as:

   (a) Modification of offline identification methods (Least squares method, instrumental variable method, prediction error method)

   (b) Recursive identification as nonlinear filtering (Bayesian approach) (Linear regression, Kalman filtering & Extended Kalman filter)

   (c) Stochastic approximations

   (d) Model reference techniques and pseudolinear regression.

Tracking of time varying systems is also discussed in this chapter.

Chapter 3 contains a general framework of models and methods. A unified approach to the recursive identification is developed in three phases, namely, definition of the framework, derivation of the algorithm and application of the algorithm to particular model sets.

Chapter 4 contains a study of the properties of the estimates produced by the general algorithm. This study is 'analysis' and the authors recognise that the analysis is technically difficult and say 'portions of this chapter are more difficult to read than the rest of the book. At the same time, it is necessary to understand the basic analytical results in order to follow the discussions in the remaining chapters'. The authors have given a necessary and sufficient path through Chapter 4 so that the reader can acquire such an understanding without having to get involved in technicalities of how things are proved.

A very large member of recursive identification algorithms are available in the literature. Naturally one gets confused as to which one to select for a particular application. How to choose a particular algorithm has been discussed in Chapter 5 with special reference to eight choices—of model, input, criterion functions, gain sequence, search direction, initial values, gradient approximation and residuals or prediction error.

A discussion of the implementation of the algorithms is the subject matter of Chapter 6. This includes computation of the gain vector for a specific algorithm, fast algorithms for gain computation, and stability tests.

The final chapter is devoted to the applications of recursive identification in areas of control, communication and signal processing.

A general background and explanation of the technical concepts such as probability theory, statistics, models for stochastic dynamical systems and off-line identification are given in several appendices.

The organization of the topics and chapters is indeed very good. The presentation of ideas and concepts is very lucid. A very attractive feature of the book is that it contains wherever necessary, section and chapter summaries. Each chapter begins with a clear statement regarding what has been done in the previous chapter and what is intended to be done in the current chapter.

In fact, the style of writing this books has immensely helped the reviewer in writing this review.

Another valuable feature of the book is that 'user's summary' is provided towards the end of each chapter which has a tendency to be more theoretically oriented. This user's summary is of immense benefit to the practicing engineer and industrial user to understand the algorithms without having to go through the detailed theoretical discussion.

Each chapter contains a comprehensive bibliography and an extensive list of references is given towards the end of the book.

The list of symbols, abbreviations and notational conventions at the beginning of the book enables the reader to follow the book without difficulty.

In the opinion of this reviewer, this book should prove to be valuable to the research worker, the practicing engineer, industrial users, students and teachers. It can serve as a reference source as well as a text book.

School of Automation   M.R. CHIDAMBARA
Indian Institute of Science
Bangalore 560 012.

Functional electronics by K.V. Ramanan. Tata McGraw-Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi 110 002, 1984, pp. 768, Rs. 36.

Innumerable books are being published on electronics these days. They all seem to deal with the same topics. However, once in a while a book comes up with a refreshingly new approach. Dean Ramanan's book titled *Functional electronics* is one such.

Electronics is a fast changing field with new devices being introduced every year. With the advent of integrated circuits, achieving specific functions has become easier and electronic instruments have become common place. However, the task of the electronic engineer required to achieve a given output for a particular set of inputs has become more demanding. The engineer must also deal with and understand new devices. For this reason a functional approach is suitable for electronic engineers where they learn about the building blocks of the modern electronics. However, it is important that a good engineer should not treat the functional blocks as black boxes as many of our young men tend to do these days. A good understanding of the working of the blocks is necessary if the engineer wishes to continue to adjust to new requirements of the future.

This book adopts such an approach and deals with the functional blocks and yet describes the basic devices such as bipolar transistors, field effect transistors, etc., including their equivalent circuit models quite well. A substantial number of problems have been worked out at the end of each chapter. In my opinion such problems should be distributed throughout the chapters so that students can easily correlate the illustrated principle. A good number of review questions and problems are also given in each chapter and their answers at the end of the book. This is an important aspect since the engineer should get a feel for the numbers.

All conventional electronic functions have been adequately discussed in this book, in addition to the new functional blocks such as phase-locked loop and balanced modulator. Introduction to signal processing and digital electronics is good. However, a few of the new devices such as optocoupler, switched capacitor, switching mode power supply, and display devices such as light-emitting diodes and liquid crystal displays have not been included. I would have also appreciated slightly more coverage of power control circuits including various firing methods for thyristors. A section on microwave devices and examples based on gallium arsenide devices would also have been welcome.

Overall Dean Ramanan's book will serve as a very useful text for under-graduate electronics engineering courses.

Department of Physics   VIKRAM KUMAR
Indian Institute of Science
Bangalore 560 012.

Programming in BASIC by E. Balaguruswamy. Tata McGraw-Hill Publishing Company Limited, 12/4, Asaf Ali Road, New Delhi 110 002, 1983, pp. 210, Rs. 22.50.

A major impediment to the widespread use of the computer is the necessity of mastering a computer language. While computer professionals, engineers and mathematicians find it easy to learn languages such as FORTRAN, COBOL and PASCAL, the use of the computer in fields such as the humanities, and the social and biological sciences has been retarded by the reluctance of the researchers in these fields to develop programming skills in languages that appear alien to them. The availability of BASIC, which closely resembles the English language, has encouraged many potential users to take their first steps in problem solving on the computer. Once familiarity with BASIC has been established, it is relatively easy for the programmer to graduate to other languages which may be more suitable for the tasks on hand.

The use of BASIC has received a fillip with the easy availability of micro-computers, all of which have BASIC compilers. A large body of computer users has thus come into existence; these potential programmers all need a manual on BASIC, either to teach themselves the language, or to use as a supplement to the lectures in a course on BASIC. The book under review is aimed at this audience.

The author, rightly assuming only the most elementary mathematical background, begins with an introduction to computer organisation and problem solving. In keeping with this philosophy, the presentation is at an elementary level and only simple illustrative examples are used. However, from the point of view of the neophyte, the explanations of some of the concepts are rather sketchy. The chapters on string manipulation, matrix operations and histograms are likely to be very useful to the budding programmer. The Backus-Naur form of language definition, which tends to be very confusing to the beginner, has rightly been avoided, although it may be of relevance to more advanced books.

The book is to be recommended to those who are registered for a course on BASIC or who feel the need to acquire the minimal programming skills for computer-aided problem-solving.

Department of Electrical Engineering   LAWRENCE JENKINS
Indian Institute of Science
Bangalore 560 012.

Stoichiometry (2nd Edition) by B.I. Bhatt and S.M. Vora. Tata McGraw-Hill Publishing Co. Ltd., New Delhi 110 002, 1984, pp. 558, Rs. 78.

One of the basic requirements for a process and equipment design is the stoichiometric calculations, involving mass and energy balances. The authors have done a splendid job, providing basic concepts of dimensions, units and chemical calculations, and then proceeding to material and energy balance calculations, with a large number of solved examples to illustrate the scope of the subject. Chapters on use of stoichiometric calculations in unit operations, combustion and industrial problems are very informative and have an industrial flavour. Thus the book covers topics in both unit processes and unit operations. The last chapter on digital computation is just an introductory one, wherein the basics of computer techniques are discussed.

On the whole, the book is a very useful one for students, teachers and design engineers. Since it is written by authors from industry, the treatment is practice-oriented and authentic.

Chemical Engineering Department   P.K. DESHPANDE
Indian Institute of Science
Bangalore 560 012.

International Conference on CAD/CAM/CAE for industrial progress

The Computer Society of India in association with the International Federation of Information Processing prop ses to conduct an international conference on CAD/CAM/CAE for industrial progress at Bangalore on June 29 and 30, 1985. It will be concerned with the architecture, engineering and application of computers in design and manufacture and will consider user experiences and related case studies.

The following topics will be covered:

— Computer-aided analysis, design and manufacture in electronics, mechanical, structural, chemical, aerospace, electrical and associated areas
— Software aids in CAD/CAM
— Graphics software
— Man-machine interfaces
— Robotics

The Conference invites original technical papers, survey papers and proposals for tutorials in CAD in mechanical engineering or CAM applications. Pre-conference tutorials will be held on June 28, 1985.

Extended abstracts (1000 words) be sent to Professor V. Rajaraman, Chairman, International Programme Committee at the Computer Centre, Indian Institute of Science, Bangalore 560 012, India, by January 15, 1985; acceptance will be notified by March 1, 1985 and the last date for receipt of camera-ready papers is March 30, 1985.

Professor D.K. Subramanian, Chairman, Organising Committee, be contacted at the School of Automation, Indian Institute of Science, Bangalore 560 012, India, for registration and participation of tutorials and exhibition of products.