# BOOK REVIEWS

**The computer comes of age: The people, the hardware and the software** by R. Moreau. The MIT Press, Cambridge, Massachusetts, USA, 1984, pp. 227, Price not stated.

In the short span of a few decades, the computer field has witnessed progress of an order that is unrivalled by any other field of human endeavour. The early computers were massive, extremely slow, cumbersome and costly machines; the modern desktop microcomputers, which cost a small fraction of the price of those lumbering giants, can far surpass them in performance, while the super-computers have a computational speed and memory capacity that was not even visualised even a few years ago. It is surprising to note that progress in the field has been achieved largely through the technological development of components such as the VLSI chip, while the fundamental concepts have remained unchanged since the days of the early computers.

The book under review surveys the first two computer generations, whose machines were based on vacuum tube and transistor components respectively. The author clearly, and in much detail, describes how the computer evolved out of the concepts of Babbage's 'analytic engine', and the Jaguard loom. These two devices, coupled with the idea of a stored program, culminated in the development of the machines with the van Neumann architecture, with which we are now familiar.

The book is written with consideration for the needs of the non-specialist. The different computer concepts are clearly explained, in language that is remarkably free of jargon, and the significance of each new development is clearly brought out. The material also makes fascinating reading for the computer scientist; although the different ideas will be well-known to such persons, they would find it interesting to retrace the steps through which the computer reached its present state of development. The process by which the two families of computers, namely, those that were designed for business applications, and the others that were meant for scientific computations, gradually began to resemble one another more closely, until the same computers could be used for both the purposes, is an interesting one to review.

Different groups of researchers, in the United States and Europe, sometimes working in collaboration, and at other times independently, contributed to the progress in the field; on some occasions the contributions parallelled one another. The author, being the Director of Scientific Development at IBM, France, stresses the contributions of the French, and the early work at IBM. This, however, is not a bias, when one considers the degree of dominance that IBM has achieved in the industry. The pioneering role of Thomas J. Watson of IBM in encouraging the introduction of electronics in the original electromechanical calculating machines is cited here.

The most impressive chapter is the one on computer languages. The desirable characteristics of computer languages are described, and the evolution of different langauges, in

attempts to meet this ideal, is outlined. The importance of languages in the gradual transformation of the computer from an advanced tool of the research laboratory, to its present prominent role in everyday life, is clearly brought out.

The book is written in a lucid and elegant style, and the translation into English is smooth and readable. The author has provided a comprehensive set of footnotes, that have been supplemented by those of the translator. This volume is to be appreciated as a contribution to the growing body of literature on the history of science and technology.

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**Structure and interpretation of computer programs** by Harold Abelson and Gerald Jay Sussman with Julie Sussman. The MIT Press, Cambridge, Mass., 1984, pp. 565, $ 34.50.

This book provides a conceptual introduction to programming. The authors view programming not merely as the task of instructing the computer what to do. Instead, programming is viewed in the much broader context of software engineering. Consequently, unlike the familiar breed of texts on programming the emphasis is not on syntax of a particular language or coding but on methodological concerns relating to the conquering of software complexity through the exposition of sound organisational principles and well established abstractions.

The concept of abstraction forms a central theme of this book. The five chapters deal with different views and aspects of abstractions. The first chapter develops the use and role of procedural abstraction in program design. Procedures are described as a means of hiding the details of implementation and viewed as a means of defining higher level concepts. The notions of iteration, recursion, higher order procedures and procedures as values, substitution model of evaluation are all developed with great clarity.

The second chapter elaborates the role of data abstraction. After developing some simple data structures, hierarchial data types like tree, sets, etc., are dealt with. Data-directed programming is explained using an arithmetic package for different operand types. This chapter contains a variety of examples including Huffman coding and symbolic algebra.

While the earlier chapters deal with procedural and data abstrations, the third chapter deals with organisational principles which help in structuring large programs. Both object-oriented and stream-oriented organisational techniques are discussed and the associated linguistic issues in programming are elaborated. The concept of assignment, its need and problems associated with it are dealt here. The environment model of evaluation is introduced here to take care of assignments. Another interesting feature of this chapter is the introduction to the concept of constraint system, wherein programs are viewed as being organised not in terms of one directional computations as in the case of traditional methods, but rather as a system modelled in terms of relations among entities.

One of the effective ways to control complexity is to evolve languages that provide relevant primitives, methods of combination and abstractions that are suited for the prob-

lem. Chapters four and five address the problem of establishing new languages and the principles concerning their evaluations. Logic programming, query languages are considered as examples of metalinguistic abstractions. The evaluation of LISP is considered in a fair amount of detail.

This book is to be strongly recommended for both the importance of the subject matter and the exemplary exposition style of the authors which permeates throughout the text. Non-trivial yet easily understood examples have been used to demonstrate concepts. The footnotes have been effectively used to discuss related problems, highlight theoretical issues and to leave pointers for further study.

The use of Scheme, a dialect of LISP, in the book, should not deter readers unfamiliar with the language. The necessary elements of the language are introduced as and when required in the most unobstrusive way.

The material in the text has been used for over five years in an entry level course for computer science at MIT for which no prior formal training in computation is required. This book would be of great interest and value to students, teachers, practicing programmers or for that matter anyone who has more than a casual interest in programming.

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**Basic programming with applications** by V.K. Jain. Tata McGraw-Hill Co Ltd., New Delhi 100 002, 1984, pp. 191, Price not stated.

In the earliest computers, programming was done in machine language, and was a tedious task. Assembly language, with its memonics, improved matters, but it still limited computer usage to the specialist. It was only the development of user-oriented languages such as FORTRAN, COBOL and BASIC that the computer became a universal tool; one could scarcely have experienced the computer revolution without the convenience of these languages.

BASIC, the simplest of all computer languages, has two major categories of users. The first group belongs to the humanities and the biological sciences; owners of personal computers also often fall into this category. For such persons, the limitations of the language are not a serious constraint, since their computational needs are not complex, and the resemblance of BASIC to English is a major asset. The other category comprises student beginners in programming, who use BASIC as a stepping stone to more advanced languages; while easy to learn, BASIC possesses many of the features of these languages. The book under review is aimed at both these categories of user.

The author has stressed the fundamentals, and has explained concepts in very simple terms; such simplicity is essential, since the user is unlikely to have much background in the computer field. The examples have been taken from many diverse areas of study, and illustrate the concepts. It is convenient for the learner to begin to program with problems in

his own field of study, where he already has a feel for the nature of the solution that is sought. The chapter 'Problems for fun' is aimed at the hobyyist, and will appeal particularly to young readers. The book is useful as a primer for the beginner in BASIC programming.

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**The AI business** edited by P. H. Winston and K. A. Prendergast. The MIT Press, 28, Carleton Street, Cambridge, Massachusetts, 01242, USA, 1984, pp. 324, $ 18.34.

Artificial intelligence is at present the hottest topic of computer science and is very much in business. Nevertheless, the subject is still in a fluid state and many concepts associated with it are illdefined, vague and fuzzy. Indeed even about seven to eight years back, it was hard to find a good text-book. The situation has since changed with excellent books by Nilsson, Elaine Rich and the comprehensive handbook by Barr and Feigenbaum.

The scope of AI is very broad, encompassing a wide range of application areas from game playing to question-answering (QA), from theorem proving to robotics. It has topics of immediate applications as well as philosophical issues open to debate and controversy. In this forest of research and developmental activity it is quite possible to get lost and reinvent irrelevant theories and techniques. It is therefore very gratifying to come across a book such as the present one where the experts in AI critically take stock of the developments and sort out the good and promising from the ephemeral and the inefficient. The authors have done well to confine their attention to only one aspect of AI, its potentialities for commercial application. Hence the title. The book is more like a discourse than exposition. Many contributors are authorities in their respective fields and several company executives have participated in assessing the promise of AI in business. The panel discussions are very lively reading. It is a pleasure to read the book as it gives a global view of the state-of-art in the area and speculations in which AI is heading. The book is not intended for beginners nor is it a comprehensive or reference text. It is meant for workers who are interested to know what areas of AI are likely to result in application products. The overall impression one gets should be comforting to AI workers as their area is no longer dubbed as frivolous and childish. The book is highly recommended reading for everybody who is curious to know the future of AI.

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**Electronic devices and linear circuits** by G. N. Garud and L. C. Jain. Tata McGraw-Hill Publishing Company Ltd., New Delhi 110 002, 1983, pp. xiii + 403, Rs. 33.

The present day B.E. programme in electrical, electronics or telecommunication engineering invariably has a course on basic electronics. And rightly, the emphasis in this course is on solid-state electronics devices, linear and digital circuits. With the advent of integrated

circuits, it is now necessary that every student has a good command on these topics, so as to exploit the use of ICs in engineering applications. This calls for a good text-book which covers not only the physics of semiconductors, but also the relevant theory of semiconductor devices-whose variety and diversity are steadily expanding, together with important aspects of their technology followed by circuit analysis and applications. The book under review meets these expectations to a large extent, as it covers many aspects of semiconductors and devices together with linear circuits based on these devices. The book is written in a clear and simple style to facilitate even the average student to gain competence in this subject.

The book is organized through eighteen chapters, in which the subject matter is covered in detail. All the chapters are well written, with the figures neatly drawn. The required mathematics is kept to the barest minimum, whereas clarification of underlying concepts is considerably emphasized. This is particularly so in chapters 1-3, which cover 'Electrical conduction in solids', 'Electron-hole statistics' and 'Conservation and motion of charge'. In the following three chapters, not only the underlying principles of device operation, *viz., pn* junction diode, junction transistor, FET, tunnel diode, SCR, triac, CCD, optoelectronic devices are well explained, but also the student is introduced to typical characteristics and specifications of popular devices. The important aspects of semiconductor technology including all the process steps for IC fabrication are then described in chapter 7, making the student aware of the current trends. The concepts of AC analysis, equivalent circuits, etc., are introduced in chapter 8, for diodes and junction transistors. While the coverage here is lucid and includes also a comparison of different models of the junction transistor, the reviewer would have been happier if the FET equivalent circuit was also introduced at this stage and compared with junction transistor models. Various aspects of junction transistor circuits, such as, low-frequency amplifiers, DC biasing, wide-band, frequency selective and power amplifiers, role of feedback in amplifiers and electronic oscillators are covered in detail in the later chapters. Here circuit analysis, practical realization and quantitative values are introduced to the student. A chapter on FET circuits is then separately included, followed by a detailed account of the operational amplifiers. Here, the student is introduced to the latest trends in IC OPAMPs, their properties and applications. The last chapter covers DC power supplies, and the student is introduced to IC regulators. Each chapter is self-contained, including illustrative examples, references to published literature, review questions and a set of problems for being worked out by the student. Two appendices at the end of the book cover theoretical background on Avalanche breakdown and Tunnel effect, which are important in semiconductor devices. The authors also have given a chronological development of electronic devices. While this makes interesting reading, this could have been made more complete and up-to-date.

On the whole, the book is well written, and, in its present form, can be used as a text-book for B.E. courses in electronic devices as well as linear circuits. In addition, students of M.Sc. (physics) with electronics specialization will also find this book useful. This book can also be used by Grad. IETE and AMIE students. The publishers should be complimented for bringing out this book in the low-cost University edition, for the benefit of the student community.

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**Fuels and combustion** by S.P. Sharma and Chandramohan. Tata McGraw-Hill Publishing Co. Ltd., 12/4, Asaf Ali Road, New Delhi 110 002, 1984, pp. 560, Rs. 48.

The book intends to fulfill a need to present a broad survey of the field to students of different disciplines. The first four chapters covering about 10 per cent of the pages in the book treat the energy scene and the various fuels, and their characterisations. This part seems well covered, though the information on Indian coals seems ignored. The fifth-chapter largely on combustion stoichiometry is a necessary part of any book on combustion. The sixth and seventh chapters devoted to chemical kinetics and its implications is a standard material presented in a routine manner. The material is essentially similar to the ones presented in chemical engineering text-books and has less relevence to problems of combustion dominated by the Arrhenius temperature dependence.

Some nonclarity appears clearly from p.79 onwards; the rate of reaction is written down directly without reference to any principle and on p.165, the law of mass action has been invoked. The latter is appropriate and covers the former as well. As such the law of mass action could have been used even earlier. The portion on Thermodynamics of combustion is well written and the reader will benefit by reading this part.

The subject of laminar flame propagation has been given great attention, partially because of the authors own work in this area.

The next few chapters on Turbulent flame propagation, Flame stability, Diffusion flames essentially cover the subject known till 1970. The subject of detonation waves in gases sounds an inhomogeneous introduction between diffusion flames and ignition which also is given a substantial treatment. The subject of Combustion of liquid and solid flows as well as Combustion applications seems to have been hurried through. There is also a chapter on Air pollution at the end.

The book does provide benefits of understanding to a new reader through several of the 18 chapters though most of the work put together is prior to 1970.

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**Solar energy: Principles of thermal collection and storage** by S.P. Sukhatme. Tata McGraw-Hill Publishing Co, Ltd., 12/4, Asaf Ali Road, New Delhi 110 002. 1984, pp. 270, Rs. 27.50.

A large number of books on solar energy have been published in the last ten years. Most of these books have been written with an emphasis on solar energy applications in USA and Europe. In India, faculty teaching courses on solar energy have felt the need for a book on solar energy with emphasis on applications in India. The above book fulfils this need admirably.

The book has eight chapters. The first chapter is devoted to the delineation of the various energy sources available in India and abroad. This chapter presents an overall view of the availability of renewable and non-renewable energy sources. The second chapter is con-

cerned with various possible applications of solar energy. The author has considered both thermal and photovoltaic applications. He has also discussed the indirect use of solar energy like wind energy, energy from biomass and ocean thermal energy conversion. In chapter three, the author takes up the detailed study of solar radiation. Instruments for measurement of solar radiation, solar geometry and empirical equations for prediction of solar radiation have been discussed with great clarity. The author has also presented empirical correlations for estimation of solar radiation in 17 Indian cities. In chapters 4 and 5 there is a detailed discussion of the performance and testing of liquid flat plate collectors and air heaters respectively. There are well-chosen numerical examples (in these chapters) to illustrate the use of theory. Chapter 6 is devoted to concentrators. These include flat-plate collectors with mirror boosters, cylindrical parabolic collectors, compound parabolic collectors and central receiver collectors. There are many numerical examples in this chapter which illustrate the efficiencies that can be achieved with concentrators. In chapter 7 the author takes up thermal energy storage. He discusses sensible, latent heat and thermo-chemical storage. The last chapter in the book is devoted to solar ponds. There is a detailed presentation of the performance of solar ponds and operational problems. Problems are given at the end of chapters 3 to 8. These should be extremely useful for teachers and students. There are many photographs showing the various solar energy installations in India.

This book is written in a lucid style and is available at a very reasonable price. Teachers offering courses in solar energy and students taking it will find this book to be of immense value. Engineers working in the industry and looking for an objective assessment of solar energy as a resource should find this book useful.

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