

BOOK REVIEWS

Science fiction and space futures, past and present (AAS History Series Vol. 5) edited by Eugene M. Emme, American Astronautical Society, 1982, pp. 270, \$ 25. Orders to Univelt, Inc., P.O. Box 28130, San Diego Ca 92128, USA.

Does Science Fiction (SF) give indication of space futures ? Did the idea of space travel emerge from SF or is it the other way around ? How different is SF from reality ? Why is SF so popular in the U.S.A. ? What goes on behind a multimillion dollar SF movie making ? What are the possible space ventures that can be exploited in the near future ? Will private industry be interested in solar-powered earth stations and space manufacturing ? Will mankind need a new religion for space age ? If so, what could be its nature ?

These are some of the topics discussed in the Third American Astronautical Society (AAS) History Symposium (1981) on Science Fiction and Space Futures --Past and Present, whose proceedings have been compiled in the present volume. The participants of the symposium are aerospace historians, scientists, engineers and SF writers. The symposium theme is divided into three parts : Part 1 covers six survey papers on the History of Space Fiction, Movies and arts, Part 2 presents a panel discussion on Space Science Futures and Part 3 presents three papers under the title Beyond Science Fiction.

The survey papers review the history of SF pertaining specially to spaceflights, space fiction movies and space art. These papers have been illustrated with a number of photographs. The chronological survey makes interesting reading and points to an important conclusion that the genre of space fictions, movies and arts depended much upon the prevailing technology of that time. For example, the mode of space travel was totally unknown in the earlier SF. Gonsales (1658) in 'Men in the Moon' is carried to the Moon by migrating birds, even Jules Verne could imagine only of balloons to reach the Moon ! It is with the advent of space technology largely in the present century, could the SF writers think of sophisticated propulsion systems. However, despite this the SF has greatly inspired the pioneers of space flights. The SF created by modern writers like Clarke, Asimov and Sagan is more realistic essen-

tially because these authors themselves are trained scientists. Even then there is little evidence that SF reflects accurately foretelling of space future. This is essentially because a real system is constrained by various factors such as technology, natural laws, time, budget, etc. SF has no such limitations. An opinion poll conducted to evaluate contemporary relationship between SF and attitudes towards science and technology indicates that SF helps promoting technological advances, in general.

The most outstanding space fiction movies starting from 'Frau im Mond' (1929) to 'Star Trek' and 'Black Hole' (1979) are reviewed from the point of view of their technological, and pure adventure contents. An unduly lengthy account (60 pages) of the activities during the production of '2001 : A Space Odyssey' is presented as a separate paper.

A lively but rather non-serious discussion on space science in the near future covers various aspects of possible ventures in terms of economics, costs, incentives to private industry, news media projection, etc. The discussion centres around basically three service areas : space manufacturing, communication, and energy—using solar power satellite.

There are two papers on the religions and ethics of the future. A rather far-fetched and utopian idea of galactic religion is mooted to motivate the society to achieve Interstellar colonization. It is further argued that the candidate religion can in fact be generated by SF. On the other hand, the other paper advocating the emergence of a 'new humanism', as a result of the developments in space technology, is more sound. According to the author the 'new humanism' should reflect both the physical material and the mental/spiritual evolution of mankind.

To SF lovers the book may be interesting for yet another reason as it gives an elective bibliography on the history of space future. However, considering the participation of people from multi-disciplined areas in this symposium, the outcome has not reached the expectation. Excepting in a few papers, the topics have been dealt without much serious consideration and the views expressed therein reflect individual fancy rather than scholarly work. The book is clearly and simply written and has adequate bibliography. It should be useful to the students of history of science and is recommended as interesting reading material for SF fans.

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Spacelab, space platforms and the future (Advances in the Astronautical Sciences' Vol. 49) edited by P. M. Bainum and D. E. Koelle. American Astronautical Society, 1982, pp. xii + 489, \$ 45. Orders to Univelt Inc., P.O. 28130, San Diego Ca. 92128, USA.

The volume presents the proceedings of the Fourth AAS/DGLR Symposium and the 20th Goddard Memorial Symposium organised by the American Astronautical Society and the Deutsche Gesellschaft für Luft und Raumfahrt, held during March 17-19, 1982 at Washington D.C. The objective of the meeting was to provide a forum for industry, government and the academic/scientific community to exchange information and suggest requirements for the next generation of civil space missions. The technical sessions included Spacelab Mission Plans, Space Platforms and Stations, Space Science Mission Plans, Earth-oriented Activities, Space Transportations and the Annual History Program. Out of the 46 papers presented at the meeting 30 are included in the volume.

In the inaugural address entitled 'National science policy and the space programme', George Keywath finds the space programme of US to be strong, realistic and visionary. A need for co-operation of everyone in the space community is emphasised to ensure success. The next three papers present a general overview of the Spacelab capabilities, its status and future developments and mission plans for its utilization. Overall system details and facilities for experiments using the Spacelab aboard the Space Shuttle are briefly discussed. A comprehensive survey of the German activities in the area of material processing in space is the subject of the fourth paper. Essential design features of the Instrument Pointing System are presented next. The last paper in the session on spacelab mission plans deals with OSTA-1 scientific payload and includes a few results from the Shuttle flight.

The Space Shuttle now provides an opportunity to launch space platforms which can be retrieved or periodically replenished for a variety of missions. Using this idea a number of systems are being designed and developed. The section on Space Platforms and Stations presents four papers dealing with ESA Microgravity platforms and experiments, the Astroplatform, requirements for a space station and ATLAS-C Cartographic free-flyer system. Essential requirements and uses are discussed in these papers. The next section focusses attention on space science mission plans. The objectives of the experiments using Voyager spacecraft which will encounter Uranus in 1986 are summarised. The next two papers present the Space Telescope design status and some details of the Faint Object Camera for the Space Telescope. The last paper in the section describes Röntgensatellit, the German X-ray satellite.

Earth resources observation using satellites has been receiving increasing attention throughout the world. In this meeting as many as 10 papers were presented on the subject. The topics covered include microwave imaging, multispectral imaging, advanced operational earth resources satellite system, remote sensing data and services, advanced

technology for earth observation data processing, modular optoelectronic multispectral scanner, and solid-state instrumentation concepts for earth resources observations. The papers briefly present system description and capabilities. It is interesting to note the trend towards making more data with higher resolution available at lesser cost.

A projection of the launch systems evolution in the US and in Europe is presented on the section on Space Transportation. The authors predict development of very heavy reusable/partially reusable vehicles. A paper on the estimation of costs for launch development, fabrication and operations is also included. The next paper discusses data management and mission simulation for Spacelab projects.

The volume concludes with two interesting papers ; one dealing with the development and experience of the astronaut manoeuvring units and another on Harold Urey's work on the origin of the Moon. The question on the Earth-Moon relationship, ranging from Mother-daughter, Little sister, husband-wife to adopted sister is discussed well by S. G. Brush. The question remains unsolved.

In a meeting of this type it is difficult for any author to go into technical details. Most of the papers are therefore like progress reports. The design details of the systems wherever included should be of value to the users of these systems and space technologists, in general. Like most other recent volumes in this series, the present one is also well presented with excellent printing, photographs and figures. It is a welcome addition to the literature on Space Technology.

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SHASHI KANT SHRIVASTAVA

Applied engineering mechanics : Statics (2nd Edition) by Aldor C. Peterson. Allyn and Bacon, Inc., 1981, pp. 285, \$ 16.95.

This is a standard text-book like many other books on the subject. The discussion proceeds on a fairly easy reading pace. The level is at an introductory level which is suitable for students of architecture and of technical institutes, but not as a university text-book. Contents are also standard with no interesting deviations. Though a large number of problems are given as examples most of them are straight-forward without demanding on the part of the student any analysis. In mechanics, analysis plays a very important role emphasising the basic concepts. This also enables a student to appreciate the free-body diagram fully. Unfortunately, the book lacks in these. Though the importance of free-body diagram is stressed, enough number of supporting examples are not given. A book with the adjective 'Applied' should have problems drawn from seemingly realistic situations. Not enough justice is done in this respect.

A serious omission is a discussion on the principles of virtual work. Nothing has been mentioned on this important topic.

The summary of the contents of each chapter given at the end of each chapter is good. It provides an opportunity to recapitulate the principles discussed.

The method of sections to analyse framed structures is covered in detail which will be of interest to students of architecture and civil engineering.

The use of vectors is very minimal. There is absolutely no discussion on fluid statics. It is desirable that a book on statics contain some discussion on this.

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L. S. SRINATH

Applied engineering mechanics : Strength of materials (2nd Edition) by Aldor C. Peterson. Allyn and Bacon, Inc., 1982, pp. 385, \$ 16.95.

This is a standard text-book written for use in junior technical institutions. The contents follow the traditional pattern involving discussions on : Stress, Strain, Stress-Strain relations, Torsion, Shear and Bending moments, Flexure, Deflections of beams, columns, etc. The discussions on these follow the conventional style. A chapter on Dynamic and Repeated Loads is included. This is a good addition and introduces the reader to this important aspect. Also a separate chapter on Connections which covers discussions on riveted joints and welded joints is included. A fairly large number of problems are given in each chapter emphasising the principles and contents.

In the treatment on Deflections of beams, only Moment-Area method is discussed in detail. It would have been nice if Double-Integration method (without introducing singularity functions) had also been discussed briefly, at least for simple loading situations. Another notable omission is a discussion on energy. Work done by the external loads during the deformation process and its equivalence to the elastic energy stored could have been included. A discussion on this can be followed fairly easily by the reader. Though the book carries the title 'Strength of Materials', enough discussions are not found on the strength aspect or the load carrying capacity of the members. A brief discussion on the mechanical properties of engineering materials would have added value to the book.

The book as a whole forms a good introductory text suitable for junior technical colleges.

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Engineering soil testing (2nd Edition) by Shamsheer Prakash and P. K. Jain. Nemchand and Bros., Roorkee, India, 1981, pp. 91, Rs. 12.50.

The book has been written at an elementary level to 'familiarize the engineers and the engineering students with the technique of soil testing'. It contains eleven experiments covering consistency limits, particle size distribution, permeability, unconfined compression test, direct shear test, compaction and field density determination, as per Indian Standards. General background, description of apparatus, test procedure and calculation details are provided for each test. A number of short questions are also given at the end of each experiment to help the students get better grasp of the subject-matter. It is, however, doubtful whether the student can answer all those questions from out of what is contained in the book alone.

Books are available on soil testing at advanced levels dealing in depth with theory, applications and interpretations, but the beginners often get little help from them. Viewed from this angle, the authors have produced a useful laboratory manual for the diploma and undergraduate students and also practising engineers who are often involved in testing and quality control of soil engineering works.

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Structural engineering through objective questions by Pasala Dayaratnam. Tata McGraw-Hill, New Delhi 110 002, 1981, pp. 332, Rs. 48.

Objective questions have come to stay as an integral part of competitive examination system. The UPSC have devoted roughly a third of the total marks for this type in Central Engineering Services examinations. An essential ingredient of student training process is to equip them with knowledge directed towards such employment-oriented examinations. Hence the relevance of the present book, a pace setter in this type in Civil Engineering, is quite obvious.

The subject of structural engineering in this book is divided into nine chapters comprising materials, mechanics, design and construction. Each chapter in turn contains about eight sections each of which is devoted to a particular topic. The questions broadly cover concepts, fundamental theories, assumptions, design details relevant to practice, data from experimental results and codes of practice as well as engineering judgement on the basis of knowledge and experience.

The explicitly spelt out objective of the book is to train in logical learning and evaluating knowledge in the broadly delineated fields associated with structural engineering. It is stated in this context that the success of objective evaluation depends on the

listing of answers which will elucidate with clarity the correct concept among plausible alternatives with veiled but built-in defective components. If on the contrary jumble of irrelevant answers form the solution, it will fail to train the mind in the logical learning process. This criterion helps to distinguish between the commercial guide and self-educative book.

The book under review covers a wide spectrum of knowledge and on varied aspects of several topics. Professor Dayaratnam has indeed embarked on a very formidable and stupendous task and the results produced are highly commendable especially since there are no fore-runners. The book is extremely useful for students preparing for competitive examinations provided the answers are critically evaluated realising the limitations of their applicability.

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B. V. RANGANATHAM

A brief course on the theory of buckling by L. M. Kachanov. Solid Mechanics Division, University of Waterloo, Waterloo, Ontario, Canada, 1981, pp. 100, \$ 15.00.

The book is formed out of the notes prepared by the author for graduate students. In these notes, the author has tried to define the main problems of the theory of buckling and suggests the mathematical apparatus which can be applied to different problems. The book contains 6 chapters. Chapter 1 contains an introduction to concepts of stability and Euler's nonlinear problem. The theory of thin curved rods, introduced by Kirchhoff and Clebsch, is described in Chapter 2, and using this apparatus, the author introduces in Chapter 3 a general system of linearized stability equations for thin curved elastic rods, which makes it possible to consider various problems of stability of rods in a uniform way. Chapters 4 and 5 deal with stability phenomena in the presence of plasticity and creep respectively. Chapters 2 to 5 deal essentially with the stability phenomena in rods. In Chapter 6, application of the theory of thin curved rods is given to some problems of the buckling of shells and plates.

The approach to the topics covered is original and the topics would be of interest and use to students of stability.

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Buckling of thin-walled rods by L. M. Kachanov edited by H.H. E. Leipholz. Solid Mechanics Division, University of Waterloo, Waterloo, Ontario, Canada, 1983, pp. 64 price not indicated.

This booklet deals with the problems of elastic and plastic buckling of thin-walled rods. It has 3 sections.

In the first section, a brief presentation of Vlasov's theory of torsion and bending of thin-walled elastic rods of open cross-section is made. Using this theory, the problem of buckling of thin-walled elastic rods is discussed in section 2. In section 3, the author gives a simple solution to the problem of plastic buckling of thin-walled rods using the basic ideas on deformation of thin-walled rods of open cross-sections.

The treatment given is very refreshing and useful to students of stability of rods.

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Plastics uses in cars and commercial vehicles, VDI-Verlag GmbH, Dusseldorf, 1982, pp. 198, DM 98.

Ever since the oil crisis of the seventies the motor car industries have increasingly turned to the use of plastics to bring down fuel consumption by pruning vehicle weight. The importance attached to this effort can be gauged by the fact that some countries have adopted definite targets for fuel economy. In the U.S., for example, 1985 has been set as the limit by which fuel consumption has to be reduced to an average of about 11.7 kilometres per litre. The goal calls for not only development of more lightweight and resistant materials and substituting them for metal in the car body but also embracing new design philosophies, keeping up with the new materials and newer trends in styling. In this respect, the book under review is an admirable contribution presenting, as it does, a harmonious blend of both aspects of material development and design advances. Like other books in the VDI-Verlag series, this book also comprises a number of contributed articles by specialists from leading industries.

One finds in the book an authoritative account on plastics usage and applications in several leading automobile industries in the world, such as General Motors, Volkswagen and the Alfa Romeo. Developments with regard to plastics in the field of commercial vehicles have, for obvious reasons, followed a different pattern than in the car field. While the need to conserve energy has led to an increase in the number of lightweight plastic components in buses and coaches, the long working life of such vehicles (12 years in Europe, 20 years in the U.S.A.) has necessitated special attention to be paid to the long-term performance of such plastics. Two articles are devoted to these aspects of plastics application in commercial vehicles. In addition, there are two big

articles devoted exclusively to the development of a car front end with plastics so as to achieve smart appearance besides improved aerodynamics.

Generously illustrated with photographs and line diagrams and enriched with valuable technical data, the book should prove to be interesting and useful to R & D personnel in the automobile industry.

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MANAS CHANDA

Filtration of polymer melts, VDI-Verlag GmbH, Dusseldorf, 1981, pp. 221, DM 105.

Melting is an essential intermediate step in the processing of polymers to end products. The presence of foreign particles and other contaminants in such polymer melts can cause interference to varying degrees, depending on their size and quantity, during processing and/or when the end product is being used. For example, such contaminants can cause tear in extruded filaments, cloudiness in films and changes in resistance in cable insulation. While contaminants may be introduced into the polymer melt from different sources, such as impurities in monomer or catalyst residues, and at different stages during polymerisation and processing, the removal of these contaminants, ranging from about $5\ \mu\text{m}$ to a few millimetres, is usually always achieved by filtration. Besides the paramount importance of filtration in achieving high quality of processed plastics the filtration of polymer melts also merits special consideration by virtue of its technical features and varied problems associated with the process. It is therefore heartening to find the present book devoted entirely to filtration of polymer melts covering all aspects of filtration technology as applied to polymers. The book consists of sixteen contributed articles by specialists and covers a wide spectrum of topics relating to polymer melt filtration.

The most widely used filter arrangement in an extruder for thermoplastics consists of a set of several screens (screen pack) and a breaker plate to support them mechanically. Lay-out and design of breaker plates and screen pack, their calculation principles, mathematical theorems, geometric condition, and method of optimising, besides other aspects, have been thoroughly treated and supported by a large number of original and recent literature reference. With increasing demands being made on the purity of the polymer melt in many plastics processing operations, processors are increasingly being forced to use fine-mesh filter elements, usually several layers of them, giving rise to considerable pressure loss or excessive back pressure in the machine which may lead to the fine screens bursting through the breaker plate hole; or the polymer melt being forced along the screw through an upstream vent. Evaluation of pressure losses when designing filter elements is therefore very important. However, pressure decreases in filter elements cannot be calculated without determining a filter constant or similar

quantity experimentally. In view of this, the inclusion of an article dealing with theory and experiment for determination of pressure losses of various screen fabrics is particularly welcome. In addition, the book contains several informative articles dealing with slide plate systems with mechanical seals, thermally-insulated slide bar systems, screen changing systems with hydraulic seals, slide bar systems with stuffing box or slot seals and cassette systems which are of special importance with regard to the screen changer.

The main objective in the design and process developments in melt filtration systems has been to provide for continuous operation under uniform extrusion conditions, that is, to maintain a constant pressure drop across the filter pack. The development of 'autoscreen' with its single screen and twin screen versions is in this respect a significant landmark. An article, though rather brief, focusses attention on this development. The book also presents a wide range of technical data relating to different types of wire gauzes and fabrics used in screens for filtering polymer melts.

Profusely illustrated with line diagrams and photographs, and well documented with extensive bibliographic coverage on the subject, the book with its unique blend of theory and practice should prove useful to those who are engaged in plastics processing as also those who are engaged in research and development in melt filtration devices.

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Electrical transport in solids (with particular reference to organic semiconductors). K. C. Kao and W. Hwang (Vol. 14 in the International Series in the Science of the Solid State), Pergamon Press, 1981, pp. 660, \$ 120.

This book deals with electrical and optical properties of semiconductors and insulators in so far as they are determined by charge carriers. Many books have been written on covalent semiconductors (e.g. silicon), but detailed accounts of transport properties of molecular solids like organic semiconductors, which have large band gaps and low mobilities, are not available in similar numbers. Hence the publication of this book fills a very important need not only for the active researcher in the field of transport properties but also to the beginner in the field and specialists in other areas of condensed matter physics who wish to acquire the essentials of the special characteristics of this field of study.

The book starts by giving a very clear account of the difference between organic semiconductors and the other materials well known to physicists. One is shown that the band model is not necessarily the only way to look at properties of conductors in insulating solids. The first chapter is thus of interest to all condensed matter physicists.

The book then proceeds to go into details of measuring conduction under various specific conditions of carrier injection. Each situation is carefully described in detail with many figures. Comparison of calculations with experimental measurements is invariably given.

The last two chapters describe photoelectronic processes and luminescence. Both topics have been developed with a basic approach and introduction.

Throughout the book, reference to literature is fairly copious, although it is not claimed to be exhaustive. The reference list includes the titles of papers, and this is very useful.

Altogether, the authors, who are active workers in the field of transport properties in organics have written a very useful book for the workers in the field. The book will remain useful for several years in spite of the rapidity of the advance of frontiers of research in this field, because of the sound introduction provided throughout.

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Computers in society : The wheres, whys and hows of computer use by Donald D. Spencer. Hayden Book Company, Inc., Rochelle Park, New Jersey, pp. 196, \$ 8.35.

The publishing industry, in the field of technical literature, is dominated by books on computers. Most of these books are intended for the computer specialist or would-be specialist ; the language manuals predominate. The book under review falls into a different category ; although it does hold an interest for those in the computer field, it is intended primarily for the layman.

After a brief introduction on the operation of the computer, along with the clearing up of a few popular misconceptions, the author moves into the area of applications. There are chapters on computer usage in medicine, the arts, education, the law, business, control and transportation. The treatment of these topics is crisp, clear and comprehensive. The author ventures to make predictions regarding developments in the field ; given the rapid developments it is not surprising that the forecast errs on the side of conservatism. In particular, the advent of the personal computer, with its many applications, completely alters the picture.

This publication comes at a time when the availability of computers has become widespread in this country, and there is a thrust towards utilizing their potential to the maximum extent. However, usage has been limited mainly to payroll operations in business houses, and research activities in universities, laboratories and large industries,

Extension to other areas has been constrained by the lack of computer experience of many of the leading specialists. The gap can be bridged if these experts could be informed of the extent to which their counterparts elsewhere have been able to exploit the advantages of the computer; this would not only encourage similar usage here, but also give rise to innovative applications that are peculiar to the Indian context.

A major strength of the book is the style of presentation. It is remarkably free of jargon which makes it readable, and less forbidding to the neophyte. At the same time, the pitfall of over-simplification has been avoided. Cartoons and humorous examples are employed to enliven the presentation and to illustrate concepts. The reader may have difficulty in obtaining access to the referenced background reading matter, since it consists of books that are not easily available in this country.

This book is recommended reading for administrators in education, health care and the police departments, decision-makers in government agencies, and management personnel in industry and the service sector. It will also prove of interest to students in non-technical university courses, and provide them with some exposure to computers which will be of value in their careers.

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LAWRENCE JENNY

FORTTRAN programming by Ashok K. Jain and M. N. Keshava Rao. Nemchand & Bros., Roorkee, India, 1982, pp. 270. Rs. 35.

In the last decade, the availability of computation facilities, both mainframe and micro, have increased enormously, and the corresponding demand for trained programmers has outstripped supply. Apart from these professionals, many others also need to acquire computer-related skills; for most practising engineers, programming is as basic as slide-rule manipulation used to be. The need of the hour is a text-book that enables one to become a proficient computer user, either by self-study or with the aid of a few introductory lectures. The book under review has been written from this point of view.

Although related topics have been touched upon, the bulk of the book is devoted to FORTRAN, which is the most widely used language for scientific applications. Many aspects of the language are dealt with, the different types of statement are clearly explained, and their usage illustrated through examples. The terminology has been kept simple, which makes for smooth presentation and easy assimilation; this is a major strength of the book, which is intended for the lay reader, rather than the computer specialist.

Apart from FORTRAN, brief chapters on computer organisation, multiprocessing, magnetic tapes, file editing and numerical methods are included. These enhance the utility value of the book. The chapter on numerical methods, in particular, is well written, comprehensive and of relevance to a book dealing with a science-oriented language.

The book is to be recommended as an introductory text-book for fresh computer-users, as well as a reference for more experienced programmers. It is moderately priced, and should prove popular.

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LAWRENCE JENKINS

Android design (Practical approaches for Robot builders) by Martin Bradley Weinstein. Hayden Book Company Inc., Rochelle Park, New Jersey, USA, pp. 248, \$ 11.95.

At the outset the author defines several terms : Automation, Robot, Android, Cyborg, Mandroid, Bionic, Mechanoid and Robotoid, in order that one can be very specific about what is being considered. The author finds this necessary because there is "... a mountain of reference materials, ... yet to find a single, definitive family of descriptions and definitions that isn't absolutely contradicted by some alternative source". The following is the definition the author presents for an Android.

Android : A mobile mechanism capable of manipulating objects external to itself under the constant control of its own resident intelligence, operating within guidelines initially established and occasionally updated through reprogramming by a human, a computer or other external intelligence. It is capable of adapting its actions according to decisions governed by its programming and by the observations of the objects it manipulates. It is capable of limited self-direction and initiative when not involved in program-mandated tasks.

The topic of the book is *Android design*.

In the third chapter entitled 'The End', the author gives the reader a peak at what lies at the end of the design task—a finished functional android. The author says : "... it is an entirely *feasible* description, with current technology ... if we had infinite money and assistance, we could build this android with off-the-shelf components."

The fourth chapter is devoted to some philosophical considerations. It proposes the first three laws (rules) for android design based on the three laws of robotics proposed by Asimov.

In Chapter 5, the author talks about 'obstacles in the human environment' and how the obstacles can be avoided. Again this chapter is philosophical in a sense.

In the next few chapters the author discusses the special problems of stairways and the design of mechanisms for climbing stairways. Described are the wheeled mechanism, the track mechanism, and their design including the main motor drive and the battery.

Also discussed in the book are several other motors required for designing manipulators with model shoulder swivel motion, elbow motion, wrist and finger movements.

Then follows a discussion on 'noncontact collision avoidance' (as opposed to collision detection) using diode lasers—single heterostructure (or SH) lasers.

A separate chapter is devoted for a discussion on 'fingers'. The next chapter discusses vision by Ramera. This is, according to the author the most talked about chapter in the book. The 64×64 pixel digital camera is called a 'Ramera' because the active imaging element is a dynamic RAM memory chip. With the help of the Ramera, the android will be capable of obtaining an image and reducing it to its outlines.

In the succeeding chapter the author describes how the Ramera can be used to provide a 'map' of the environment, say the things present in a room. This can be done by the use of a Map data code.

The next two chapters give a detailed account of the voice box of the android—the speech synthesizer, the vocabulary, and verbal literacy. The author is quick to add that speech recognition is a relatively undeveloped technology despite much work already done.

Then follows a discussion on brains—how intelligence can be provided to the android.

A good feature of the book is that the appendix gives a list of references on speech synthesis and speech recognition.

A valuable feature of the book is that it gives addresses of companies which can supply the various components that are recommended for use in the several designs proposed in the book. Many a time the price of the component is also included.

The book examines what an android is and what can be expected of it. It provides an insight into the design requirements and techniques for the design of an android. The reviewer finds it worth to repeat the author's caution to the reader. "If you think this book is going to answer all questions (about an android) for you, forget it. At best, we will be able to give you a slightly higher grasp on the details and implications of each question and may be some options—strictly as a starting point, to help you make your own decisions."

The author says : ' The probability that later editions of the book will be expanded and updated suggests that we develop an open forum for thinking on the subject of android design. You (the reader) are invited to forward your thoughts to the author.'

The author admits to the reader : " Chances are that you won't be satisfied with this book. It tries to explain or describe so many items of interest that it can't do a thorough job with any of them. That is why there are so many company names and addresses. Write to them for information. . . . From the very first this text has been intended to give you hints, ideas and information that can help you to design your own android. It is not a do-it-yourself book of plans, not a step-by-step construction guide, . . . This is the beginning. And with these words, I leave you on your own.' With these statements the author has simplified the work of this reviewer.

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How to build a computer-controlled robot by Tod Loofbourrow. Hayden Book Company Inc., Rochelle Park, New Jersey, USA, pp. 132, \$ 9.75.

'Robotics' is a very interesting branch of multidisciplinary science and technology. It is gaining popularity all over the world. At this present juncture a book on how to build a robot such as the one under review is certainly to be welcomed by any one in general and by an amateur in particular. According to the author 'the robot, detailed in this book, uses the ultimate in current hobby computer technology. Despite the robot's complexity it is well within the budget of the average hobbyist'.

The robot called 'Mike' can be built in three stages, stage I to give mobility, stage II independence and stage III advanced sensory systems.

The book can be thought of as a manual for the construction of 'Mike'.

The author describes in detail how to build (a) the basic framework, (b) power supply, speed control and directional control circuits, (c) secondary circuits, the micro computer and software. The microprocessor can be used to serve as the robot's 'brain' controlling and overseeing all its functions and reflexes. To provide this ability several secondary circuits are suggested. The robot can be controlled with a joystick, (d) impact sensory circuitry : The robot's sense of touch comes from eight impact sensors. Through these the robot can be enabled to detect and avoid obstacles during its ambulatory activities, (e) ultrasonic detection circuitry : The purpose of this circuit is to provide the robot ability to detect objects in its path, (f) Voice recognition circuitry. The goal is to provide the robot ability to recognise and respond to voice commands.

A valuable feature of the book is that it provides a *parts list* at each stage, details of drawings, figures and photographs which explain the assembly at each stage, schematics, circuits, flow charts and computer programmes.

The author also talks about the experiences during the building of 'Mike'.

The appendix gives the addresses where at certain components such as, motorized wheels, direction control motor, microcomputer, ultrasonic transreceiver, etc. are available.

The book is well written and contains sufficient details to enable one to build a computer-controlled robot. The reviewer tends to agree with the author when he says "the only technical requirements to build 'Mike' are the ability to read and understand an electronic circuit diagram, and a reasonable mechanical ability".

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Science and technology centres by Victor J. Danilov. MIT Press, 28, Carleton Street, Cambridge, Massachusetts 02142, USA, 1982, pp. 416, \$ 46.

In the words of the author 'this book traces the evolution of science and technology centre movement, describes the characteristics and operations of many such museums'.

There is a long-felt need for this kind of publication and it would surely meet the demand. We were sanguine about Alma Wittlin's 'Museums—In search of a usable future', but it disappointed the professionals as it dealt with only traditional museums and not science and technology centres which were probably coloured and were out of the domain of her book! It is a boon in disguise; otherwise we would have been deprived of this useful publication by Danilov. This again is a starting point to review the very concept of science and technology centres.

Danilov has treated the sociology of science and technology centres very ably throughout the book. He took considerable pains to collect a large amount of data not only from science and technology centres in the USA but also from various parts of the world.

The planning process of a country is for social change thereby orienting and updating social attitudes. The unique attribute of science and technology centres is that they are the appropriate bodies to bring about the desired change by its socio-participatory approach. The author has highlighted this aspect in this book.

In the first of the three parts, Danilov defines S and T centres and the contemporary movement with evolutionary perspective. Here he refers to a majority of S and T

centres and science museums from the USA and also from Canada, France, Germany, Holland, India, Japan, Korea, Mexico, Singapore, Taiwan and Thailand. However, the omission of the health education-oriented Hygiene Museum, Dresden, and the Polytechnic Museum, Moscow, is conspicuous.

Although Danilov classifies the S and T centres based on the services they render at present, he feels that this stress will orient towards the goal of informal education the world over. As such he believes that 'the emphasis will shift from ... comprehensive centres to a network of small and medium sized centres. In the process the government will assume a greater share of funding these institutions'. In the case of the Asian countries, this is very true. Specially in India, the government has taken keen interest in establishing a network of satellite centres in rural areas to be managed by the urban centres.

Starting a science centre is not an easy job. If enough preparations are not made, it '... is doomed to failure, plagued by problems'. The author clearly mentions all the necessary steps needed to be taken to start the centres. Starting from site selection, type of building structure, staffing pattern, programming, funding, management and the planning process. He does not miss to caution the organisers by mentioning the various problems that crop up during the setting up of the centres.

The second half of the book is devoted to organisation and administration. Nine chapters cover this heavy material. The author very religiously explains the various methods of fund-raising processes and the accounting systems and I feel such an elaborate treatment of the subject is quite justified as funding is vital for proper growth of any organisation, more so for public-spirited ones. The author would have done well to include some case studies for the benefit of freshers whose requirements also he expects to meet.

The third and the last part of the book deals with exhibit and programmes under the following chapters: collection, permanent exhibition, temporary and travelling exhibitions, educational programming, etc. Danilov also deals in detail, in this part, with methods of accession and registration philosophy of the participatory exhibits, its content, approach, design-fabrication and evaluation methods.

The area of design fabrication of participatory exhibits requires more technical details to facilitate better understanding to avoid underestimation of the total process. Treatment of this subject again demands case study for appropriate elucidation and its interpretation of the whole concept. Considering the importance of this book, I do not feel that this expectation is far-fetched. Blank formats of registration and loan cards, and the like and a format for evaluation of techniques with examples, would have made the volume exhaustive and self-contained.

With the exception of a few, the author has provided a list of representative Science centres and agencies offering travelling exhibit services. Bibliography and the reference data in the appendix are quite exhaustive. I trust that this title would serve as a reference source for those who desire to serve science centres and also the students of museology as an interdisciplinary source material.

There was enough scope to make the cover design more exciting considering the scope of the book. The MIT Press should be congratulated for excellent printing and binding. However, considering the size of the volume price factor appears to be a little high.

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