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BOOK REVIEWS

The human quest in space edited by Gerald L. Burdett and Gerald A. Soffen. American Astronautical Society, 1987, pp. 312, $ 55. Orders to Univelt, Inc., P.O. Box 28130, San Diego, CA 92128.

This volume contains the proceedings of the 24th Goddard Memorial Symposium held on 20–21 March 1986. As less than two months had passed after the Shuttle disaster of 28 January, there is an understandable note of gloom as the proceedings begin. The text is based on recordings made at the symposium, and faithfully reproduces all the numerous welcomes and introductions, the questions that were inaudible or incomprehensible, and the remarks made when the keynote speaker (the harried Acting Administrator of NASA) was away answering the telephone. All that was needed was a reference to coffee and donuts at the back of the hall for the reader to feel that he was right there at Goddard during the Symposium!

The volume is in three sections, respectively titled What happens after space station, Visionary technologies, and the Human role in the quest in space. The latter two sections are nearly equal in length (about a hundred pages), and the first is somewhat shorter. It becomes quickly clear that the central issue at the symposium was U.S. Technology policy for space. Several speakers quote Robert Goddard on how "It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow", but hard questions remain. Should the country go for manned or unmanned missions? Should they be national or international projects? What are the technologies available or feasible? Which of the feasible ones are worth developing? How do we decide what is worthwhile? And so on. No simple answers emerge to these questions.

The Administrator of NASA considers that "the doorway to most of our future progress is the permanently manned space station". Various arguments supporting this assertion are made, but he eventually falls back on the words of the Spanish philosopher Ortega Y Gasset, "Nations are formed and are kept alive by the fact that they have a programme for tomorrow". The President of Martin Marietta believes that there are only a few more years in which there will ever be a time when space is devoid of human occupation. Others do not see the matter as being so simple. Industry is not enthusiastic about materials processing in space. The well-known scientist and writer Carl Sagan declares that NASA is a sequence of capabilities, with no focus or goal. He points out that much of the electromagnetic window has now been opened, and the pioneering days are over; it is significant that the first scientist to land on the moon was also the last astronaut to do so. Sagan feels that there are many interesting unmanned things to do, but somewhat inconsistently goes on to argue that there should be an international *manned* mission to Mars, chiefly for political reasons (promote international goodwill).

The strong political interest in the space programme is highlighted in an address by the senior Senator of Utah, an astronaut who flew on the Shuttle in 1985. He likens the critics after the Shuttle disaster to the lynch mobs and posses of the Wild West, and tells the assembly they just have to "live through it". To him a major reason for undertaking the space programme is to change people's minds and hearts – he even suggests that the space programme might eventually help to feed the hungry in Ethiopia!—the only limiting factor being the Congress of the United States. A scientist from Los Alamos asserts that "the lure is not the science, not the technology, not the economic potential – but the hopes, the ambitions, the dreams, and the pride of the people".

So the romantic view of space is not yet dead.

The last two sections lay out a wide variety of glittering technology. Among the possibilities are a national voting system using wrist watch radios and satellites, which will enable the whole country to be polled in one hour; generating electric power; building a Mars habitat; automation through intelligent computers; and so on. A Boeing Vice-President repeats Archimedes's boast about moving the whole earth given a lever and a fulcrum, only the computer is now the fulcrum and information the lever; and the growth of computer technology that sustains the boast shows "flamboyant capitalism at its best".

Also on display are several medical and biological projects connected with man and life in space, including one for Biosphere II which would be "a materially closed, energetically and informationally open, complex, stable, and evolving life system".

These and a variety of other ideas are tossed around, discussed, promoted or criticised. Most of them do not seem relevant to India at the present moment. There is, however, something very interesting in what this volume shows: it is the American system thrashing out its technology policy, with engineers, scientists, businessmen, politicians and academics all having their say.

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R. NARASIMHA

Reactions and reaction engineering edited by R. A. Mashelkar and R. Kumar, Indian Academy of Sciences, Bangalore, 1987, price not stated.

This volume has been published in honour of Dr L. K. Doraiswamy (LKD), Director, National Chemical Laboratory, Pune, on attaining the ripe young age of sixty! It contains eighteen invited research papers from eminent reaction engineers from all over the globe. It is a delightful and fitting tribute to a person who has contributed his all to the profession very consistently and significantly, and has brought a good deal of international esteem the way of India.

The volume begins with a discussion by Song and Aris on the pitchfork bifurcation associated with Kondepudi's reaction carried out in CSTRs, a system somewhat related

to LKD's recent work on stochastic effects in reactors. A set of four papers on fluidized bed reactors follows. Bukur discusses his experiences with different numerical techniques applied to Fryer and Potter's countercurrent backmixing model for such reactors, as well as on model modifications. Ramakrishna *et al* present an extension of their earlier population balance model and use the Monte Carlo technique to study these reactors. The other two papers are experimental: one gives some preliminary results on heat transfer in a fully instrumented reactor, and the other reviews work done at UA-CNRS in France on desulfurization of gas mixtures using cupric oxide. Hughes *et al* study coking and regeneration in fixed bed reactors using the nondestructive technique of neutron beam attenuation. Ananth and Jalan study desulfurization of simulated coal gas mixtures using CuO/ZnO and find that the model of Ramachandran and Smith best explains their experimental results. Transients in noncatalytic solids undergoing structural changes by sintering are modeled by Shah *et al*. Morbidelli and Varma summarize their recent results on parametric sensitivity of various kinds of reactors, including polymerization reactors, using their generalized sensitivity criterion and technique. Butt *et al* present recent experimental results on Fischer Tropsch catalysts to study the role of olefin insertion in the chain growth mechanism. Gaikar and Sharma discuss separation of close boiling compounds using reactions, and present a wealth of information. Villadsen *et al* discuss model dispersion of liquids in supported liquid phase catalysts while Silveston reviews the experimental work indicating the benefits of periodic operation. These are followed by two papers by Yoshida *et al* on three phase reactors, and of Ramachandran *et al* on trickle bed reactors. Bischoff and Coxson present some new information on lumping using cluster analysis to study complex reactions. The reviewer wonders why the work of Wakao and Funazukuri on supercritical extraction of Chinese shale is included, though a justification has been offered by the editors.

The above discussion should give an idea of the breadth of coverage of this volume, particularly in areas where LKD himself has been active. This special issue of Sadhana should prove a very useful addition to the bookshelves of workers in this area since it gives a panorama of current research in several sub-areas of reaction engineering. The authors are to be complemented on their efforts.

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The internal combustion engine in theory and practice, Volumes 1 and 2 by Charles Fayette Taylor. The MIT Press, 28, Carleton Street, Cambridge, Masschusetts, 02142, USA, 1985, pp. 574 and 783, $ 20.70 and 22.43. Indian orders to Affiliated East-West Press Pvt. Ltd., 6, Roselyn Garden's Apartments, 20/1A, Barnaby Road, Madras 600 010.

The two volumes constitute a masterly treatise, a veritable storehouse of knowledge on the subject of internal combustion engines founded on many decades of research work at

M.I.T. by the author and his associates. Being comprehensive in scope and clear in exposition the earlier edition of this work has, ever since its publication, been used extensively by the student, academic and practising engineer alike.

The distinctive feature of the book is the logical manner in which the basic theories of thermodynamics, fluid flow and combustion (as applied to I.C. engines) on the one hand and the practical information flowing from research and development work on engines and fuels on the other, are combined to formulate procedures for computing the engine performance and to lay down the broad design features necessary to meet the particular requirements of a given engine application.

The mechanical design of various engine components and integrating the design is facilitated by the fund of information provided on topics such as Engineering materials, Design of machine elements, Engine balancing and Vibration and the large number of illustrations of current designs which indicate good practice. Numerous worked examples are given which would help the student to understand the procedures involved in performance calculations and in the design. The extensive bibliography at the end comes in handy for further reading. The wealth of information contained in these two volumes enables even a beginner to arrive at a viable design for a given application.

While retaining the basic structure of the earlier edition, changes have been introduced in the new edition to clarify a point or to revise and add fresh material in the light of new developments that have taken place. It is remarkable that so few changes or revisions were found necessary – a tribute to the soundness of the original concept.

Notable among the many changes which have been introduced are: (i) The complete revision of figs. 4–5 (Vol. 1). (ii) Characteristics of constant volume combustion fuel-air cycles in the light of more recent data. (iii) New material on engine emissions and emission control in S.I. Engines. (iv) Updating of design data given in various figures and tables.

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Gas-insulated substations: Technology and practice edited by S. A. Boggs, F. Y. Chu and N. Fujimoto. Pergamon Press, Headington Hill Hall, Oxford OX3 OBW, England, 1986, pp. 580, $ 120.

The developments in the technology and practice of gas-insulated substations (GIS) over the last decade have had far reaching influence on the contemporary practice of bulk energy supply to high density load centres in big cities. The book, under review, contains the proceedings of an international symposium held on this subject in September 1985. All aspects of technology and practice of GIS including acquisition, manufacture, testing and maintenance are discussed by the users and the equipment manufacturers. They are divided into eight topics which are followed by extensive discussions by five different groups.

Sulphur hexaflouride (SF_6)-gas-insulated substations at voltages up to 525 kV in various station configurations and with various performance requirements have been installed all over the world in increasing numbers over the past 25 years; the first substation at 800 kV is being delivered. Considering the overall costs, it is now generally accepted that GIS is a viable economic solution for substation applications, particularly for special cases with restricted space availability, aesthetic and seismic considerations.

Three cases of 230 kV and 500 kV GIS are discussed with regard to the experiences of construction and commissioning. The merits and demerits of in-door and out-door installations of GIS and their costs are debated. It was observed from the Japanese experience that the equipment cost is 6 to 8% cheaper for in-door installations. The deciding factors in the choice of the installation are apparently the user preference, climate, relative cost, concern for safety and trouble-free maintenance. For the foreseeable future user preference will probably be the deciding factor and be applied on a case-to-case basis.

GIS have different aspects compared to open-air substations from the insulation coordination point of view. GIS is generally considered as a single self-protected equipment. However, the distribution of impulse voltages within a GIS is not even and has a complex profile due to internal reflections. A careful study of this subject, probably with the application of modern dead tank type metal oxide arresters, may suggest a good possibility to apply reduced BIL to GIS. The possibility to apply reduced BIL and the influence of the level of BIL on the size and cost of GIS are discussed. Though these discussions are quite useful, the current understanding of the subject does not permit any decisive conclusions.

Regarding the design and type-testing of GIS, it has been unanimously agreed that universally accepted standards for GIS are highly desirable to avoid wasted effort of special tests demanded by various customers.

Various problems connected with the maintenance of GIS have been added. They include : (a) testing and handling of spark-decomposed SF_6, the compatability between various solid materials and SF_6 gaseous by-products, the toxicity of SF_6 gas by-products and the health hazard they represent, equipment or procedures that have been developed to facilitate proper maintenance of GIS equipment, etc. However, more work needs to be done on these various aspects so that many of the problems faced by the users in the maintenance of GIS could be eliminated or at least minimized. Extreme caution is necessary in testing and handling of sparked SF_6 in the field.

On the whole, the book brings out an exchange of users' experience and the manufacturers' needs and, thus brings the user needs and engineering developments closer together, to the benefit of all. It is a useful addition to the literature on this very important area of SF_6 technology.

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Communicating in science : Writing and speaking by Vernon Booth. Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, UK, 1985, pp. 68, £ 3.95.

This is an excellent book; every aspiring graduate student, and many faculty members, could profit from it. Reviewing another book with similar objectives, I remarked in this journal two years ago that scientists and engineers will have no patience for a treatise on how to write or speak: they need a short, imperious cook-book with plenty of sensible examples. Dr. Booth has produced just such a book. Its 60-odd small pages are divided into seven chapters, respectively titled Writing a scientific paper (a 27-page essay which won a prize for the author), Preparation of the typescript and figures, Speaking at scientific meetings, Addressed to those for whom English is a foreign language; An appeal to North Americans and Preparation of a doctoral dissertation or thesis.

Most Indian scientists and engineers, particularly the latter, suffer acutely from what the author calls "paper labour" whenever they have to write something for publication. Furthermore, the offspring from that labour usually ignores elementary principles of communication. It is a puzzle why this happens in a country where for ages writing clearly and concisely has been considered a great virtue. After all, Kautilya devoted a chapter of the *Arthasāstra* to the subject (it is another matter that his sound instructions are not followed even two thousand years after their issue, especially by the civil servants for whom they were chiefly intended!). As for brevity, it was a passion among our ancient grammarians, of whom it has been said that if they saved half a syllable, they celebrated it like the birth of a son (*ardhamātra lāghavenāpi putrotsavam manyante*). These virtues seem largely forgotten today.

It is possible that one reason for our paper labour is that we are so often writing in a foreign language (barring those few Indians for whom English is nevertheless a first language). It is therefore particularly endearing that Dr. Booth dedicates his book to "Th. M'Fline", standing for The Man whose First Language Is Not English. Dr M'Fline's interests figure frequently and prominently in the book: for example, every author is urged to ask himself "Would M'Fline understand what I write?"; in choosing between British and American versions of anything, the criterion proposed is what M'Fline would find easier.

An important feature of the book is the stress it correctly lays on how to speak; at several places the key role that a talking tea club can play in every laboratory is commended. The author's advice is summarised (or anti-summarised?) in a set of hilarious directives on how to lull an audience to sleep.

The only rival this book could have is probably Strunk. Booth has the advantage where he addresses scientists, emphasises skills in speaking as well as in writing, and keeps the non-Anglo-Saxon constantly in mind. He cannot however quite match (understandably, perhaps) the punch of Strunk's examples. The chapter addressed to M'Flines is probably the weakest part of the book as far as Indian readers (who must form a rather special category anyway) are concerned; for the advice offered here does not seem particularly

useful to them. Some adventurous Indian should perhaps produce a version of Chapter 4 for his countrymen.

Nevertheless, this is a book that I would very strongly recommend to every scientist and engineer in this country who wants to speak or write.

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