
REVIEWS AND NOTICES OF BOOKS

Mathematical Programming via Augmented Lagrangians. By D. A. Pierre and M. J. Lowe. (Addison-Wesley, Reading, Mass., USA), 1975 Pp. xxi + 436. Price : \$ 24.50.

This book is mainly based on the authors' own contribution on multiplier algorithms for nonlinear programming and refers to the latest development in the field. It has seven chapters and several appendices, details of which are given below. The book is self-contained and is very readable with lucid presentation. It can be used as a text book for a special course or lecture series.

Chapter 1: Deals with preliminary concepts and problem statements. Reviews the two general approaches to the constrained maximization namely, (i) the function modification followed by unconstrained optimization and (ii) Direction modification without altering the function (of which very little is available in the existing literature), the former method (i) in detail.

Chapter 2: Devotes to the definitions of differentiability, continuity, Taylor series expansion in n variables, and the necessary and sufficient conditions for constrained and unconstrained maxima. Some examples are worked out to illustrate these points.

Chapter 3: A small chapter on sensitivity in which microscopic and macroscopic sensitivity are introduced with examples.

Chapter 4: This is the heart of the book. Three new theorems (author's own theorems) are introduced. A new Lagrangian called the augmented Lagrangian L_a is defined and the above mentioned theorems prove some interesting properties of this L_a . An algorithm is developed based on L_a . A concept called Local Duality is introduced forming a basis for updating the weighting factor in L_a .

Chapter 5: Deals in detail the computer implementation of the algorithm of Chapter 4 under the name LPNLP. The main routines are given incorporating 4 different modes/options for the unconstrained minimization phase. These options are the Davidon Fletcher Powell (DFP) method, the DFP with reset, self scaling (SS) and SS with reset.

Chapter 6: 17 test problems on constrained and unconstrained are worked out using the different options of LPNLP and compared.

Chapter 7: Some practical problems like circuit, and geometric problems are formulated and solved.

About 100 pages are devoted to appendices dealing with general notation, instructions for using LP and NLP, the computer listing of the Fortran program, modified Lagrangian form, matrix operations including

programs for matrix operations and summary of unconstrained search methods.

Extensive references are also given.

B. L. DEEKSHATULU.

Techniques and Methods of Polymer Evaluation. Vol. 4: *Polymer Molecular Weights.* Part II, Edited by Philip E. Slade, Jr. (Marcel Dekker, Inc., New York), 1975. Pp. ix + 337 (287-623). Price \$ 27.50.

Part II of the book entitled 'Polymer Molecular Weights' consists of three Chapters—Chapters 6, 7 and 8. Chapter 6 deals with 'Gel Permeation Chromatography'. In the past 12-15 years this method has become the most widely used method for the determination of molecular weight and molecular weight distribution of polymers. Considerable progress has been made in developing the method, determining its limitations, and in overcoming the accompanying difficulties that arise. This chapter reviews in detail the previous work and deals at length with the theory, instrumentation and operation, and applications.

'Viscometric Methods of Studying Molecular Weight and Molecular Weight Distribution' is the topic of Chapter 7. Measurement of the viscosity of polymer systems is one of the most popular methods for obtaining information about the molecular weight and molecular weight distribution on account of the relatively inexpensive nature of the apparatus required as compared with other methods. Starting with the definition of viscosity, this chapter discusses in detail the viscosity of both dilute, and concentrated polymer solutions, experimental methods, and the extrapolation methods.

'Sedimentation Techniques' form the subject-matter of Chapter 8. Since the development of the first analytical ultracentrifuge by Svedberg and his co-workers in the twenties, the technique of sedimentation analysis has been perfected to a great extent. Although the ultracentrifuge has become a standard tool for determining the molecular weight in the field of Biochemistry, yet it is a valuable aid for characterising synthetic polymers. This chapter deals with the instrumentation, and the two types of sedimentation analysis, *viz.*, sedimentation velocity, and sedimentation equilibrium analysis.

At the end of each chapter symbols that have been used in the chapter, and references are listed. Each chapter is complete by itself, as it deals with the concerned theory, instrument design, data analysis, etc.

This, two part book, on 'Polymer Molecular Weights' deals at length with all the techniques and

the methods that are now widely used for polymer evaluation and hence forms a ready and important source of information on molecular weight measurement for polymer chemists, physicists, and all the scientists handling polymeric materials.

V. KALPAGAM

Energy: Resources, Demand and Conservation. By Chaman Kaskari (Tata McGraw-Hill Publication), 1975. Pp. 231. Price Rs. 36 00).

Energy crisis is a multidimensional global problem involving the whole human race, but it has more seriously affected the economic activity of all developing countries such as India, which have economics dependent on large quantities of imported oil. The hike in oil prices has not only sky rocketed the price of fertilizers, but has led to its non-availability in sufficient quantities in world markets, since production has been affected by high oil prices. This in turn has affected food production creating a grave situation for millions of the world's under nourished poor.

It is, therefore, not surprising that the problem of energy—its resources, demand and conservation is engaging the attention of most of the nations. Considerable amount of literature on energy has been published during the last two or three years, but the book under review is perhaps the first one to have been written from the point of view of a developing country like India.

The book has been divided into three sections: The first—"Introduction, energy resources and demand"—(Chapters 1-5) deal with the energy measuring units, the effect of energy on the economic property of nations, the pattern of energy consumption, Indian and world fossil fuel energy sources.

"Sectorial energy Demand and Conservation" form the second section (Chapters 6-14) in which, the energy problems of India, energy consumption in different sectors of the Indian economy, potential of global plants, electric power generation including nuclear power and the techniques of energy conservation are discussed.

"Other Energy Resources" (Chapters 15-21) constitute the subject-matter of the third section wherein the possibility of producing energy from waste and scrap, wind, geothermal sources and the sun are described and the techniques of saving energy by the use of total energy systems are suggested.

The book deals in a fairly comprehensive manner of various problems associated with energy in India, and I have no doubt that both technical and non-technical men interested or involved with these problems, will find the book interesting and useful.

The get-up of the book is attractive and the price reasonable.

H. N. RAMACHANDRA RAO.

Elements of Economic Entomology. By B. Vasantharaj, David and T. Kumaraswami. (Popular Book Depot, Madras), 1975. Pp. 507. Price Rs. 25 or Rs. 30. Library Edition, \$ 10 00 or £ 4.00 (Foreign).

Agricultural education in India is making rapid strides in recent years, and starting of Agricultural Universities in different States has contributed immensely for this spread. Economic entomology constitutes an important component of agricultural education and there are at present hardly any book for the undergraduate student in agriculture for his reference. In this context the present book by David and Kumaraswami is most welcome.

The 26 chapters included in the book are appropriately grouped under five parts. Part I gives a brief account of the history of entomology in India, and also of popular classification of insects.

Part II which consists of over 175 pages is devoted to pests of agricultural, forestry, veterinary and medical importance, of which crop pests occupy over 130 pages. Brief account of bionomics including diagnostic characters of important pests along with control measures and a few diagrams are provided under each crop. In addition, a list of less important or casual insects is given in the end under each crop. Some of the recent recommendations are also included in the suggested control measures, though these include applications of the more persistent insecticides, like DDT and BHC on crops nearing harvest and on vegetables and fruits. Different productive and helpful insects are dealt with in the two chapters which form Part III. Honey bees, silkworms and lac insects are treated in a fairly detailed manner. Interesting account of pollinators, parasites, predators, scavengers, etc., is also given.

Principles and methods of pest control which form the subject-matter of Part IV include among the different conventional methods, the recent tools like the genetic methods, hormones, and pheromones, and finally an integrated approach in pest control. A fairly good review of the properties and action of different groups of insecticides is provided. This chapter also includes information on tolerance limits of some of the pesticides, resistance to insecticides, pollution problems, precautions and antidotes, and a compatibility chart. The chapter on pesticide appliances gives an illustrated account of different types of equipment including aircraft application of pesticides.

Part V is devoted to brief account of different non-insect pests of crops and domestic animals. The two appendices relating to conversion of weights and measures and a ready reckoner for preparation of spray solutions from proprietary insecticides will be useful.

A revision of this book when undertaken may take note of some of the lacunae: History of Indian Ento-

entology may include a history on instruction in Entomology in Indian Universities. The figures, especially of agricultural pests serve very little to illustrate what is desired. A constancy in citing reference to names of insects is highly desirable. A few misspellings here and there may be avoided.

The book serves as a useful reference material to agricultural students and teachers, and the price fixed for a book of this size should be considered as well within the reach of the student community.

G. P. C.

Annual Review of Astronomy and Astrophysics (Vol.13)

Edited by G. R. Burbidge, D. Layzer and J. G. Phillips. (Annual Reviews, Inc., 4139 El Camino Way, Palo Alto, California 94306), 1975. Pp. 557. Price: U.S.A. \$ 15.00; elsewhere \$ 15.50.

The present volume contains fifteen review articles covering a wide range of subjects. On the observational side van de Kamp writes on astronomy while Peterson gives a comprehensive account of instrumental techniques in X-ray astronomy. The use of on-line digital computers for telescope control, data acquisition and data reduction has become widespread in observatories round the world in recent years. Robinson's article on the subject describes the various systems in use and will prove useful to workers trying to set up new control equipment for their telescopes.

Spectroscopic and photometric studies with new equipment on powerful telescopes have increased the scope of population classification in galaxies and have provided additional information on their composition and evolution. Since most of the work has been confined to the local group, van den Bergh's review on the subject concentrates on the members of the local group of galaxies although some work on extra local group galaxies has also been reported. A related article by Peimbert discusses abundance determination of the gaseous component of galaxies as obtained from the studies of HII regions and planetary nebulae. One of the basic data obtained from these studies is the helium abundance y . Peimbert's analysis of the data yields a value for the primeval helium abundance which coupled with the standard big-bang model indicates that we live in an open universe.

The young subject of experimental stellar dynamics has been reviewed for the first time in this series by Aarseth and Lecar. Starting with a general statement of the N-body problem the authors have discussed various astronomical contexts where these simulations find application, e.g., clusters of stars and clusters of galaxies.

Since the beginning of ultraviolet studies about a decade ago, the observations in this field have revealed very interesting things about stars and interstellar

gas. Copernicus, launched three years ago has provided a wealth of information regarding abundances and the state of ionization of the interstellar medium. Spitzer and Jenkins discuss and interpret the data analysed to date and point out significant difference with existing ideas derived mostly from radio observations.

The late stages of stellar evolution are beset with many uncertainties and one of these is a correct evaluation of the effect of neutrinos on the physics of stellar interiors. It appears from Barket's review that theoreticians are now taking the hypothetical electron-neutrino coupling more seriously, and most models of the late phases of stellar evolution include and discuss the role of neutrinos. His review has the necessary skepticism, but still covers all the probable situations where these massless fermions make their presence felt.

Beyond the late phases of stellar evolution is the eventual demise of a star and one of the final configurations, a star may reduce to, is a black hole. Eardley and Press have described the formation of black holes from stellar collapse and the subsequent interaction of the hole with its environment. This article also includes a section on black holes in binary systems and possible identifications, e.g., Cyg X-1. Canuto's sequel on the equation of state at Ultrahigh densities (the first article was published in *Ann. Rev.* Vol. 12), is relevant again to interiors of stars in very advanced stages of evolution and the density range covered in the present article ($\rho \geq 10^{14}$ gm cm⁻³) is only important in the case of neutron star matter. Canuto has summarised the equation of state in various density ranges in the form of tables which can conveniently be used when calculations on very dense interiors are undertaken.

The problems of star formation and pre-main sequence evolution are as fundamental as those in the later phases of evolution. With the advent of infrared astronomy and the extension of radio observations, significant progress has been made in our understanding of very young objects and their association with the interstellar medium. Detailed theoretical calculations have also been started to trace the early life of stars. The article by Strom *et al.* gives an excellent overview of both the theoretical work and the present state of observations. As they have rightly pointed out our knowledge is particularly lacking in the prestellar physical processes, and empirical insight rather than theoretical speculation should prove rewarding.

Besides the ones described above, this volume includes articles on radio surveys, high velocity neutral hydrogen, the emission mechanisms of pulsars and a sequel by Fowler, Caughlan and Zimmerman to their first article on thermonuclear reaction rates published in this series in 1967.

D. C. V. MALLIK