

## BOOK REVIEWS

**Microwave Remote Sensing: Active and Passive Volume I: Microwave Remote Sensing Fundamentals and Radiometry:** by Fawwaz T. Ulaby, Richard K. Moore and Adrian K. Fung. Published by Addison Wesley Publishing Co., U.S.A. Pages xviii + 456. Price \$46.50.

Remote sensing is fast emerging as a powerful tool for monitoring the Earth and its environment. Detection and measurement of the reflected, emitted and scattered electromagnetic radiations at visible, IR and microwave frequencies from the Earth's land and water surfaces and from the atmosphere have potential applications in areas such as inventory of crops, forestry, water, marine resources and minerals as well as in studies relating to sea surface phenomena, ice coverage and pollution monitoring. Whereas sensors in visible and IR regions of the spectrum operating from space platforms such as LANDSAT A, B and C and more recently from LANDSAT-D, have served to demonstrate the usefulness and evolve the associated methodologies in respect of many of the above applications over the last decade, the corresponding developments at microwave frequencies are at best only in the beginning phase. This is in spite of a large number of passive radiometers already flown on several satellites and the interesting, albeit limited imagery data returned by the L-band Synthetic Aperture Radar (SAR) onboard SEASAT-A, during its first 100 days in the orbit. The currently available text books in remote sensing in a way also reflects this situation by heavily biasing the treatment of the subject towards optical remote sensing.

The book under review which is the first of a series of three volumes on the subject of microwave remote sensing, in the opinion of the reviewer, represents probably the first major step to correct the above situation. The authors of the volume, Professors Fawwaz T. Ulaby, Richard K. Moore and Adrian K. Fung, belonging to the Remote Sensing Laboratory at the University of Kansas are well known for their pioneering and fundamental contributions to the subject of microwave remote sensing. It will not be an exaggeration to state that the evolution of the modern microwave remote sensing is closely coupled to the research work of the present authors and their colleagues at the Kansas University.

The fundamental and radiometric aspects of the microwave remote sensing that form the material content of this first volume of the series are presented in six chapters. The first chapter provides a comprehensive introduction to the subject including a useful

overview of its historical development and first principles and applications of radar, radiometer, scatterometer, altimeter, side looking airborne radar (SLAR) and SAR. An introductory treatment of the propagation of electromagnetic waves is given in Chapter-2 by discussing the different properties of plane waves in lossless and lossy media including their reflection and transmission characteristics and accounting for the polarization effects. The third chapter provides an excellent treatment of the antenna systems used in microwave remote sensing and takes the reader through several useful details of basic antenna parameters and pattern calculations and such important concepts as arraying, scanning and pattern synthesis. The radiometric aspects, a major topic of the first volume, is introduced in Chapter-4 by describing the radiometric quantities of interest and the problems of their measurement. Specific discussions include those relating to black body radiation, radiative transfer as well as emission and scattering properties of terrain and atmosphere. The radiative transfer theory developed in Chapter-4 is further applied to the treatment of emission, absorption and scattering of microwaves in the atmosphere medium as well as in clouds, fog, rain and snow in chapter-5. The concluding chapter on Radiometer Systems deals with characterization, operation and performance aspects of different types of radiometers as well as their calibration and imaging considerations.

The treatment of the subject matter is rigorous and presupposes a sound knowledge of the electromagnetic theory at an advanced level. The book has several noteworthy features that serve to enhance its value beyond its mere use as a standard text for teaching the subject. Among other things, this includes extensive incorporation of a large number of graphical plots and monograms providing numerical relationships between different physical and engineering quantities of relevance to the design of systems and data interpretation that should prove valuable to research workers and design engineers.

The problems given at the end of each chapter are carefully formulated to enable the reader to gain further insight into the applications of the different basic principles and the use of the monograms. The references included in the book under each chapter are reasonably exhaustive and up-to-date. One could have expected a better reproduction of the photographs included in the first chapter.

On the whole, the book is elegantly written and should be of immense value to the students, research workers as well as design engineers. Considering the

ambitious plans for orbiting active microwave systems in space by USA and Europe, with the attendant expected accelerated pace of the developments in the field of microwave remote sensing in the current decade, the publication of this book and its successor volumes is timely.

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**The Warabandi System and its Infrastructure**—by Sri. S. P. Malhotra, Publication No. 157 of Central Board of Irrigation and Power, New Delhi, 1982, pp. 78. Price: Not given.

Huge investments made on major, medium and minor irrigation projects would give returns only when water is used by the farmers economically. One way of better utilization of limited canal water in command areas is sharing it on equitable basis. The Publication No. 157 brought out by the Central Board of Irrigation and Power under the title "The warabandi system and its infrastructure" highlights the most suited method of distribution of irrigation water to Indian farmers. Each farmer whether he is at the tailend or near to the outlet point on a water course gets his share under this system. In the publication, the author has reviewed the past and the present practices of water distribution in command areas including the advantages and disadvantages of each. The Infrastructure of warabandi system and that of an improved warabandi system called warimetric method of distribution of water are explained with specific data concerning a few distributories of an irrigation project in Haryana State.

Warabandi system has been defended as against other methods of distribution of irrigation water scientifically and taking into account the social aspect of an Indian farmer. Under this system a high efficiency of water use is attained by imposing water scarcity on each and every farmer. A few conflicting concepts and criticisms discussed in Chapter 7 of the publication have further clarified how sound the warabandi system is. The concept of equity, adequacy and coverage have been elucidated. It is emphasised that protective irrigation for many rather than intensive irrigation for a few has been the entire theme on which warabandi system is planned and designed.

The publication includes another system which is an improvement over Warabandi system and is called as Warimetric method of charging for irrigation. This method is evolved by synthesising good points of

Warabandi system and the good points of volumetric assessment. It is almost a substitute for a volumetric method with none of its disadvantages. The likely exploitation of cultivator by irrigation booking clerk vested with tremendous authority in a Warabandi system is overcome in the newly suggested Warimetric method of charging for irrigation.

A few more elucidations on Warabandi to Haqbandi for hilly areas, and the legal aspects of Warabandi system of irrigation water distribution, discussed in the publication have further added to its value as an only authentic literature on economic use of water, accomplished by equitable distribution. This publication has been brought out in right time when there is so much competition between farmers, for the limited water available in irrigation commands. The publication would be of great use to field workers and administrators.

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**Selected Physical and Chemical Data in SI Units:** by K. D. Chandrasekaran and D. Venkateswarlu, 1982, Chemical Engineering Education Development Centre, Indian Institute of Technology, Madras 600 036. Pages: xvi+239. Price: not given.

It is over two decades ago that a new system of measurement—the International System of Units (Abbreviated SI) was adopted (1960) throughout the world. As is well known, this system is a modernised version of the MKSA (Meter, Kilogram, Second, Ampere) system and its details are published and controlled by International Treaty Organisation, viz., The International Bureau of Weights and Measures. The Standards of Weights and Measures Act 1976 of India prohibits the use of non-metric measurements in all sections of economy and provides penalty for its non-compliance. It has, therefore, now become imperative to use SI Units in all fields of engineering, science and technology including education and training of scientists and engineers.

The Chemical Engineering Education Development Centre took early steps in this direction and brought out a publication "SI Units in Chemical Engineering and Technology" in 1974 (which is out of print) and another in 1979 under the title "SI Units in Engineering and Science" to facilitate the use of SI Units in teaching and research in India. The same authors have now brought out the present volume under review. The data have been carefully chosen

from the extensive technical information widely scattered in the literature. Over 220 items have been listed under the following seven sections. (1) General data(7), (2) Properties of solids(28), (3) Properties of liquids and solutions(103), (4) Properties of gases and vapours(46), (5) Thermochemical and equilibrium data(26), (6) Properties of air(10) and (7) Properties of steam(4). The book is complete with selective bibliography (40 references), Index and Corrigenda.

There is a no need to emphasize the importance of readily accessible basic physical and chemical data to students, teachers, research scholars and professional experts. While this publication is no substitute for a good hand book, it is likely to be quite informative and serve a useful purpose for all the professionals. The centre has added one more feather by bringing out this 26th publication to its crown which has already enjoyed its well deserved appreciation over the years. It is quite certain that this ready reference will find its rightful place in the scientific and technical literature and also in the laboratories and libraries.

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**The Last Dinosaurs:** By I. R. Croft, published by Elmwood books, 3, Elmwood, Chorley, Lancashire, PR 7144. Pages 80. Price £2.25.

Perhaps the most famous crisis in the history of animals on this earth occurred around 65 million years ago. Towards the end of the cretaceous a catastrophe of calamitous dimensions, befell; about 70% of the animal and plant species died out. No land animals heavier than 25 kilograms is believed to have survived. The dinosaurs, which had roamed the earth for about

150 million years disappeared with a startling suddenness leaving not a single species behind them.

Several explanations have been put forward over the years, some quite serious and scientific but several ludicrous and crack-pot. Changes in climate and atmosphere have been cited, cosmic catastrophes have been blamed. Nutritional, physiological and pathological causes have been assigned. Even that they committed suicide has been advanced.

Dr. Croft in this little book has suggested yet another possible reason for their total extinction, that dinosaurs developed lens cataract in their eyes, became blind and so succumbed.

The basic phenomenon around the end of the cretaceous was a significant rise in temperature in the environment. Solar radiation increased, and in addition to causing thermal damage to male reproductive organs, caused loss of lens transparency (cataract) and visual acuity. The blindness thus induced made the dinosaurs not only helpless but also vulnerable to attacks by predators, particularly the mammals, resulting in their extinction.

Dr. Croft, after an analysis of the protein composition of the reptilian eye lens finds predominance of gamma-crystallin which is affected by sunlight unlike beta-crystallin present in the warm blooded birds and mammals. Indeed, he is of the opinion that the evolution of birds and mammals from reptiles was associated with a change from gamma- to beta-globulin.

It is now acknowledged that rise in atmospheric temperature occurred around the end of the cretaceous. That the cold-blooded dinosaurs were affected in several ways is also clear. That the eye was one of the organs impaired is among the possibilities of this temperature rise.

We don't know why the dinosaurs became extinct, and probably never will, in spite of Croft and company.

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