Book Reviews

Geodesy's New Tool

Introduction to Satellite Geodesy. Ivan I. Mueller. Ungar, New York, 1964. xxii + 415 pp. Illus. $15.

The general field of theoretical and practical geodesy is experiencing revolutionary changes. To a considerable extent, these changes are the result of the technical progress in rocketry—specifically, of the ability to launch close-to-earth artificial satellites. Such satellites provide geodesy with a new tool.

The revolutionary importance of geometrical satellite geodesy must be assessed on the basis of the fact that a strictly geometrical solution provides geodesy, for the first time in its history, with the means to create a three-dimensional, worldwide reference system, with a minimum of a priori hypothesis—in particular, without reference to either the direction or magnitude of the force of gravity. In addition, the corresponding three-dimensional triangulation is oriented in a dependable and uniform manner with respect to the direction of the rotational axis of the earth. This is accomplished by replacing the classical, two-dimensional Laplace condition, which, for practical reasons, is only sporadically executed, by three-dimensional celestial orientation for each line of observation.

In gravimetric geodesy, satellite orbits provide the means for sampling, in a systematic manner, the potential field beyond the physical earth. This is achieved by determining the geometry of orbits, which in turn can be considered instantaneous and continuous analog presentations of certain characteristics of the potential field of the earth.

The two approaches will eventually provide geodesy with the information necessary to establish a uniform, worldwide reference system that is representative of the geometry of the physical surface of the earth and of the gravitational vector field associated with its mass distribution. These geodetic applications of artificial satellites, and to a lesser extent of the moon, are discussed in chapter 2.5 of *Introduction to Satellite Geodesy*. This chapter, which contains a condensed presentation of the subject matter, is an excellent introduction to satellite geodesy.

Mueller provides not only a textbook for students who seek formal instruction in modern geodesy, but equally significant, he provides the necessary fundamental information, and sufficient references, for those who wish to pursue their studies in depth, an increasingly important service in view of the recently initiated U.S. Geodetic Satellite Program.

In the first section, the author treats solar eclipses and occulations. The rather detailed presentation, approximately one-third of the book, is written mainly in support of the curriculum at Ohio State University where the author is associate professor in the Department of Geodetic Science. Little practical geodetic significance is associated with these methods today. Nevertheless, the theory of eclipses reveals interesting geometrical principles and serves as a worthwhile introduction to the more important second section of the book which deals with the gravimetric and geometric principles on which the geodetic use of close-to-earth artificial satellites is based.

A review of close satellite theory is presented in terms of Newtonian laws of motion and dynamics as they pertain to a central spherical field. Perturbations, especially asymmetries of the gravitational field and atmospheric drag, are treated as forms of disturbing functions leading to intermediary orbits. The presentation, in its analysis, closely follows Kaula's approach.

In chapters 2.3 and 2.4, observational techniques and some generalities about corresponding data reduction principles for artificial satellites are described. Mueller discusses the visual methods applied by the Moonwatch Program of the Smithsonian Astrophysical Observatory and then considers the more precise photogrammetric instrumentation systems, including theodolite-type and still cameras. Electronic methods described include equipment based on the interferometry principle and on the Doppler effect and various ranging systems based on the phase-shift effect of electromagnetic wave modulation.

A summary of the contents is best accomplished by quoting the author: "Originality in the wider sense is not to be expected, and indeed, would defeat the object of the book, which aims at making it easier for the student to read with profit the numerous more technical treatises listed in the Bibliography." The extensive bibliography lists more than 500 references.

In general, the book presents the fundamentals of the new branch of satellite geodesy and will enable the reader to acquire a background of the calculus and physics necessary to combine the numerous disciplines involved in the exploitation of artificial satellites for geodesy.

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Mathematics

Philosophy of Mathematics. Stephen F. Barker. Prentice-Hall, Englewood Cliffs, N.J., 1964. xvi + 111 pp. Illus. Paper, $1.50.

This small but very compact book is one volume in the Foundations of Philosophy Series edited by Elizabeth and Monroe Beardsley. The aim of the series is to exhibit some of the main problems in the various fields of philosophy, as they stand at the present stage of philosophical history. *Philosophy of Mathematics* achieves the goal of the series with remarkable success. The main current philosophical problems in mathematics are clearly presented, and the various solutions are critically evaluated.

The book consists of five chapters. In the first chapter, the author, Stephen Barker, develops the distinctions made in Kantian philosophy between *a priori* and *empirical* (*a posteriori*) knowledge and between *analytic* and *synthetic* knowledge. He then examines