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Geodesy - Introduction to Geodetic Datum and Geodetic Systems

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BOOK REVIEW

Geodesy – Introduction to Geodetic Datum and Geodetic Systems, Zhiping Lu, Yuning Qu and Shubo Qiao, Springer-Verlag Berlin Heidelberg, 2014, 401 pp., A\$153.95, ISBN 978-3-642-41244-8, ISBN 978-3-642-41245-5 (ebook)

In this book *Geodesy – Introduction to Geodetic Datum and Geodetic Systems*, Lu, Qu and Qiao weave a series of seven chapters to cover the entire fields of the coordinate system and terrestrial reference system in geodesy. These chapters integrate classical materials and modern geodetic developments, providing a systematic overview of fundamental theories, geodetic datums and coordinate systems, spatial and terrestrial measurement methods, and map projections. It also introduces readers to Chinese geodetic datums, geodetic control networks and coordinate systems.

The first chapter introduces geodesy's objectives, applications and history. It begins with the objectives and classifications of geodesy. It describes the major applications of geodesy in the fields of engineering, space technology, geoscience research, and environmental and climate monitoring. A brief history and future development of geodesy are also presented. The second chapter provides basic concepts and techniques that are used to collect various geodetic measurements, including those from traditional terrestrial triangulation, height, and space geodetic and gravimetric surveys. In addition, the observation accuracy achieved by these techniques is discussed.

Chapter 3 mainly introduces the reader to Chinese geodetic datums and control networks. It covers the definition of the geodetic datum and a brief history of how these datums were designed and realised in China. It begins with the regional horizontal and vertical datums and their relevant control networks

before the GPS era, and follows with the geocentric datum from GPS control networks connected to the global reference system. The continuously operating reference system (CORS) concept is also briefly described in the chapter. Finally, it provides information about the Chinese gravity datum and its control network. This is an interesting chapter as readers may be unable to find other books in English that provide such systematic and detailed information about geodetic datums in China.

Chapter 4 shows the basic concepts of the Earth's gravity field and height systems. Chapter 5 describes approaches for the reduction of terrestrial measurements to a reference ellipsoid and transformation of geodetic coordinates between different systems. The chapter details theoretical concepts involved in spherical trigonometry, reference ellipsoid, radii of curvature, lengths on the ellipsoid, and then presents reductions of horizontal measurements (e.g., angles and distances) to the ellipsoid. The relationship between geodetic coordinate systems and polar coordinate systems is given. Formulas and computations on the ellipsoid are shown in detail for both direct and inverse solutions of the geodetic problem. Chapter 5 (about 100 pages) serves as the major part of the book that provides both theoretical and practical fundamentals of geodetic coordinate systems.

Chapter 6 describes two conformal map projections and the relationship between the geodetic coordinate system and plane coordinate system. The two map projection methods

introduced are the Gauss projection and Universal Transverse Mercator (UTM) projection, which are commonly used in geodetic surveying practice. Reduction of geodetic measurements, which have already been reduced to the ellipsoid by methods in chapter 5, from the ellipsoid to map grid (or vice versa) is also covered. Since the context presented in this chapter is usually not included in geodesy books, it will be highly beneficial to surveyors and engineers who conduct geodetic surveying over large areas.

Finally, chapter 7 discusses the principles of establishing classical and modern geodetic coordinate systems, transformation models between different coordinate systems, and then provides an overview of geodetic coordinate systems in the world including China.

Overall, the book provides a basis for the field of geodesy, and guidelines for geodetic surveying practice. It covers in detail the

fundamental theories and formulas in geodesy. It also adequately reflects the tremendous changes that have occurred in geodesy in the past decades, where space geodesy is now the predominate tool for positioning and gravity field determination. The past and present states of geodesy are illustrated by selected examples of geodetic datums and coordinate systems around the world, especially in China. This comprehensive book can serve as a textbook for graduate students, as well as a reference for researchers and engineers in the fields of geodesy, surveying engineering and geomatics.

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