Preface

Geodetic datums and geodetic systems play an important role in surveying and mapping engineering. Geodetic datums refer to the reference surfaces, reference points, and their relevant parameters in surveying and mapping, including coordinate datums, vertical datums, sounding datums, and gravity datums. They are the reference surfaces or points against which measurements are made and they provide the basis for establishing geodetic systems. Geodetic systems are the extension of different types of datums realized through establishment of the nationwide geodetic control networks, which include the geodetic coordinate system, plane coordinate system, height system, and gravimetric system.

Geodetic datums and geodetic systems, as the common foundation for every subject of geomatics and surveying and mapping, are regarded as the main topic of this book. The book is designed to be used either as a reference for teaching or for learning subjects related to geodesy, surveying engineering, or geomatics. Some specific parts are written to fill literature blanks in the related area. For instance, we have extended the terms of traditional formulae with computer algebra systems to meet the accuracy of modern geodesy and have described modern geodetic coordinate systems and so on. The framework and structure of this book are formed through decades of teaching practice. The contents are systematic and the chapters proceed in an orderly and gradual way.

In writing this book, the authors put effort into building a new textbook system, attempting to avoid piecing together bits of knowledge from different courses. Due to the rapid and continuous developments in the field, it was necessary to be selective and to give more weight to some topics than to others. The material selected is particularly well suited to university-level students in line with twenty-first century education and the training requirements for a basic knowledge of geodesy. Therefore, in this textbook particular importance has been given to the fundamentals and to applications. It is a textbook that integrates classical materials with modern developments in geodesy, and balances practical applications and pure theoretical treatments by additionally highlighting some important and cutting-edge research issues in the field. Therefore, students who intend to pursue further studies in the field of surveying engineering should also find it helpful.

The book consists of seven chapters, a bibliography, an index, and a list of abbreviations. Summaries of the individual chapters are listed below.

Chapter 1 provides an overview of the discipline's objectives, roles, classifications, history, and trends in the development of geodesy.

Chapter 2 introduces the methods and principles of geodetic data collection techniques such as terrestrial triangulateration, height measurement, space geodetic surveying, and physical geodetic surveying.

Chapter 3 discusses the concept of geodetic datums and the methods, principles, and plans for establishing horizontal and vertical control networks, satellite geodetic control networks, and gravity control networks.

Chapter 4 deals with the basic concepts of the theory of the Earth's gravity field, discusses the definition of height systems, and establishes the relationship of transformation between different height types.

Chapter 5 discusses the reference ellipsoid, its relevant mathematical properties, methods for reducing the elements of terrestrial triangulation and trilateration to a reference ellipsoid, and establishes the models to transform mutually between the geodetic coordinate system, geodetic polar coordinates, and geodetic Cartesian coordinate system.

Chapter 6 is devoted to the methods and models of Gauss conformal projection and the Universal Transverse Mercator (UTM) conformal projection and establishes the relationship between the geodetic coordinates on the ellipsoid and the coordinates on the projection plane as well as the methods for coordinate transformations. The projection of geodetic networks from the ellipsoid onto a plane is also discussed so that they can be computed in the projected plane coordinate system.

Chapter 7 considers the principles of establishing classical and modern geodetic coordinate systems, establishes the transformation models between different coordinate systems, and provides an overview of the geodetic coordinate systems in China and throughout the world.

This book has been revised and extended by Zhiping Lu and Yunying Qu based on the first edition of the book, which was published in the Chinese language in 2006. In writing and adapting the original Chinese edition, Zhiping Lu wrote Chaps. 1, 4–7; Shubo Qiao and Jianjun Zhang wrote Chaps. 2 and 3. The numerical examples and illustrations in the book were designed and constructed by Shubo Qiao, Zhiping Lu, and Yupu Wang. English teachers Yali Zhang, Wen Zhang, and Yanxia Li helped with parts of the translation of the manuscript. Ph.D. candidates Zhengsheng Chen and Lingyong Huang and graduate students Yupu Wang, Hao Lu, and Kai Xie helped sort out part of the manuscript, read the manuscript, and offered some suggestions for revision.

The three reviewers of this book are Prof. h.c. Dr. Guochang Xu of the German Research Center for Geosciences (GFZ), Potsdam; Dr. Timmen Ludger of the University of Hannover; and Prof. Dr. Jörg Reinking of Jade University, Oldenburg. Dr. Timmen Ludger also mailed and presented two books for our reference. A grammatical check and correction of English language has been performed by John Kirby from Springer, Heidelberg.

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