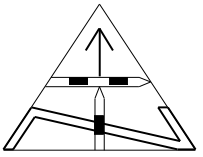
SURVEYING

FOR ENGINEERS

SECOND EDITION

Dr. Najeh S. Tamim

College of Engineering
An-Najah National University
Nablus, Palestine



December 2006

Surveying for Engineers: Second Edition.

The first edition of this book has been refereed through
The Deanship of Scientific Research
At
An-Najah National University.

الطبعة الأولى لهذا الكتاب تم تحكيمها واعتمادها من خلال
عمادة البحث العلمي
في
جامعة النجاح الوطنية

PREFACE

This book aims to provide the reader with a concise modern book on surveying principles, techniques and equipment. Many books around the world have been written which deal with the subject of surveying; however, two main factors have given me the motivation to add another book to the library. First, the need to re-present the material in a way that copes better with the recent developments in surveying instrumentation, computer technology and surveying practice. As an academic and a licensed surveyor with more than six years of practical field experience, I included a description of several easy and some new techniques for performing surveying operations that I did not see in other surveying books (example: layout of transition-circular-transition curves in section 9.2.2.5). Second, the realized need to provide the surveying and engineering students at the Palestinian and Arabic universities with an accessible inexpensive surveying book written in the English language, given that the teaching language in engineering in most of these institutions is still English. Students, especially in Palestine are not capable of supporting and buying an imported expensive book due to the difficult economic situation. Moreover, this locally written book is more oriented towards the practice and application of the surveying profession, laws and units of measurement in these countries.

The subject material of this book is divided into thirteen chapters. Chapter one gives an introduction to surveying and explains its importance to people. It also discusses the historical connection between surveying and civil engineering, figure of the earth, units of measurement, scales of surveys, as well as, the basic geometric principles of traditional surveying.

Due to the harmful nature of measurement errors, and the dangerous effects that they might have on the results, it is very important that the reader learn about them so that these errors might be avoided, corrected or minimized. Therefore, this subject is dealt with early in the book in Chapter 2. Consequently, the reader is made aware of the different types of measurement errors that might occur in the measurements that are explained afterwards.

Chapters three, four, five and six discuss the different types of ground surveying instruments and techniques starting with the basic use of the chain, going through the use of tapes, levels and theodolites, and ending with the use of the sophisticated total stations, as well as, their applications in making planimetric and topographic maps. Chapter seven deals with coordinate geometry and traverse surveying. It describes the different techniques and procedures used to calculate the position (coordinates) of points from measurements done using theodolites and electronic distance measuring equipment, as well as, other basic surveying instruments. Chapter eight explains the most commonly used methods for area and volume calculation, both computational techniques and mechanical ones using the planimeter. Chapter nine deals with route surveying. This includes the planning, design and layout of both vertical and horizontal curves (circular and transition). Chapter ten discusses the subject of horizontal control surveys and methods used to provide and establish horizontal control points. Chapter eleven gives an introduction to photogrammetry and its importance in topographic mapping as an alternative way of surveying. And finally, this second edition has an additional two chapters: global positioning systems – GPS (Chapter 12) and geographic information systems – GIS (Chapter 13) which are considered very hot subjects and advancements in the area of Geomatics. GPS deals with position measurement and mapping using satellite technology, while GIS deals with the computerized input, manipulation, analysis and presentation of spatial data.

In addition to the two new chapters (12 & 13) to this second edition of the book, several major revisions have been made. These include fixing typing mistakes, rephrasing many sections to become simpler and easier to read and understand, and adding new solved examples, illustrating figures and pictures as well as adding new problems at the end of most of the chapters. The word civil has been dropped from the previous title of the book given that it is suitable for all engineers who need to deal with surveying at some stage and not only civil engineers.

As a textbook, and from the author's perspective and teaching experience, this book is recommended to be taught in two undergraduate level courses. The first course includes chapters one through eight, while the second course includes the remaining five chapters.

I specifically tried to make this book as concise and easy to read and understand as possible. I hope that it will be useful to the readers and certainly welcome any comments that will help improve it in the future.

The author

CONTENTS

CHAPTER PAGE

3. CHAIN SURVEYING (TAPE MEASUREMENTS)

4. LEVELING

5. ANGLES, DIRECTIONS AND ANGLE MEASURING EQUIPMENT

8. AREAS AND VOLUMES

9. ROUTE SURVEYING

12. GLOBAL POSITIONING SYSTEMS (GPS)

13. GEOGRAPHIC INFORMATION SYSTEMS (GIS)