A MANUAL OF FIELD ASTRONOMY

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PREFACE

If the reason be demanded for the appearance of another book on Field Astronomy when there are already published several excellent works on the subject, it may be stated as follows: That although any one of them may serve very well as a text for a comparatively extended study, the author has been unable to find one sufficiently concise to fit the short time usually allowed for the work in a civil engineering course which would still provide enough of the fundamentals of the subject to enable the reader to make, intelligently, the observations and accompanying computations required in the practice of general engineering and surveying. Something is needed more complete than the usual chapter in books on surveying and less extensive than most texts on field astronomy. This need, which is acknowledged by other teachers to exist, it is hoped to fill; and at the same time it has been attempted to provide a book which will be of service to engineers and surveyors whose practice requires that they occasionally make astronomical observations.

To this end the discussion of fundamentals has been made brief, but it is thought sufficiently thorough for the purpose. Special attention has been given to the matter of measurement of time, because it is believed that this causes more difficulty for students in general than any other part of the subject.

In the selection of the methods described for the determination of latitude, azimuth, time, and longitude, care has been taken to choose those which are believed to be most capable of producing results when used with field instruments under ordinary field conditions. Realizing that the determination of azimuth is more frequently required than any other observation, more methods have been given for this than for the other problems.

Each observation has been presented essentially as follows: The work of which the observation consists is first stated briefly, followed by the relations and theory on which it depends, accompanied by such explanation as seems necessary. The procedure is then outlined, step by step, under the general headings:

"Computations Preceding Field Work," "Field Work," and "Computations Following Field Work." This outline is supplemented by a copy (near the back of the book) of the field-notes and computations of a similar observation.

It is hoped that this method of presentation will commend itself not only to the student but to the engineer in practice.

The "Summary of Observations" in Chapter XI should be useful in selecting an observation or in determining whether sufficient data are at hand to permit an observation which is under consideration.

In Appendix A are given the derivations of the formulas of Spherical Trigonometry which are needed in the work, and in Appendix B is a brief discussion of the theory and use of the "Solar Attachment" for the engineer's transit.

No excuse is made for the omission of refinements of either theory or practice which are not required in work done with an engineer's transit or a sextant.

While preparing the manuscript the author has studied several of the existing works on field astronomy, and this book has profited thereby, acknowledgment being made in the body of the book whenever anything has been copied. No claim is made to having produced anything new; but merely to having put well-known facts in a new, and it is hoped useful, form.

The thanks of the author are due to Messrs. W. and L. E. Gurley and the Bausch & Lomb Optical Company, who have furnished cuts for the book; to the Superintendent of the U. S. Coast and Geodetic Survey, who has permitted the use of tables from Government publications, to friends who have given advice and suggestions, and among these particularly to Mr. R. B. Kittredge, Assistant Professor of Railroad Engineering in the College of Applied Science of the State University of Iowa, who has read the entire manuscript, very much to its improvement.

A. H. HOLT.

IOWA CITY, IOWA, November, 1916.

NOTATION

ϕ = Latitude.
λ = Longitude.
Z_n = Azimuth, referred to true north.
Z_s = Azimuth, referred to true south.
t = Hour angle.
RA = Right ascension.
h = Altitude.
δ = Declination.
Z = Interior angle of the astronomical triangle at the zenith.
P = Interior angle of the astronomical triangle at the pole.
S = Interior angle of the astronomical triangle at the star.
z = Co-declination or polar distance, $90° - \delta$.
p = Co-altitude or zenith distance, $90° - h$.
s = Co-latitude, $90° - \phi$.
$k = \frac{1}{2}(s + p + z) = \frac{1}{2}[270° - (\phi + h + \delta)]$.
Sid. T = Sidereal time.
Std. T = Standard time.
LMT = Local mean time.
LAT = Local apparent time.
A = Right ascension of the mean sun.
A_m = Right ascension of the mean sun at local mean noon.
E = Equation of time.

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