part of the boundary (eventually, with suitable other restrictions, the whole boundary) is left free on some manifold of less than m dimensions. Only special types of this problem are considered. The second question is that of unstable minimal surfaces with prescribed boundary, which has been considered by Morse and Tompkins, and, with another approach, by Shiffman. The short exposition follows the latter author's lines.

Schiffer's appendix deals with such problems as: The relations between Green's function of a multiply-connected domain, Neumann's function, the harmonic measures of the boundary curves, certain special mapping functions, kernel functions, etc.; certain extremal problems; the variation of Green's function considered as a function of the domain, with applications.

Two bibliographies, one for the main part and one for the appendix, are inserted.

It may well be hoped that this lucid presentation of results obtained up to now will prove a sound basis and a stimulus for further research.

H. GRUNSKY

Mathematische Grundlagen der höheren Geodäsie und Kartographie. Vol. I. *Das Erdsphäroid und seine konformen Abbildungen.* By R. König and K. H. Weise. Berlin, Springer, 1951. 18+522 pp. 49.60 DM.

The mathematical theory of cartography and related problems in higher geodesy has provided frequent inspiration for basic studies in geometry, function theory, and conformal transformation. Most mathematicians have been inclined however to dismiss the subject as a fairly elementary exercise in analysis and have left its problems to the geographers and map makers. A small group has nevertheless maintained a continuing interest in this field which was set on a sound mathematical basis by the early work of Lambert, Lagrange, and Gauss.

The present work represents a significant contribution to the few outstanding works in this field. It stands along with the three major references: M. A. Tissot, *Mêmoire sur la représentation des surfaces géographiques et des projections des cartes*, Paris, 1881; L. Driencourt and J. Laborde, *Traitê des projections des cartes géographiques*, Paris, 1932; and W. Jordan and O. Eggert, *Handbuch der Vermessungskunde*, 8th ed., Stuttgart, 1939–1941. These three together with the present treatment provide a comprehensive background and guide for research and application.

The authors make their contribution primarily in establishing a more generalized mathematical basis for their subject. Rather than starting with the most familiar projections, they have started with certain general analytical formulations from which the several projections arise as specializations. The tone of the work is indicated by the fact that not a single world map appears while a great many diagrams illustrating the pattern of various conformal transformations are included.

This volume is the first of two with the second forthcoming. The first part as indicated by the subtitle is restricted to a closely coordinated, comprehensive study of the conformal mapping of the spheroid on the sphere and plane. Considerable emphasis is made of the use of complex variables to their fullest extent and on the characteristics of the projection in the large. The second volume is to be devoted largely to problems of higher geodesy such as the geodetic line and its conformal representation, and to the geodetic triangle.

The first and third chapters are introductory. The earth as an ideal ellipsoid of revolution is described and its geometrical characteristics are catalogued. A number of analytical and series relations are listed for future reference. The third chapter reviews compactly the basic principles of conformal transformation between two planes by use of various complex variable transformations.

In the second chapter there are described the so-called three fundamental surface variables $A=M$, B, Γ, representing the complex extension of the isometric latitude, the geographic latitude, the meridian arc length respectively. As complex variables they can be interpreted to give respectively the Mercator projection, the ellipsoidal transverse Mercator projection, and the Gauss-Kruger projection. The analytical and geometrical relations between these three variables are considered in chapters four and five. Various analytical correlations are developed explicitly by methods from the complex function theory. The several pairs of coordinate transformations are examined in relation to behavior of coordinate net distortion, rotation, and curvature in the manner of conventional conformal transformation and differential geometry theory.

Chapter six provides a description of the basic conformal projections on a plane, sphere, and spheroid derived from the three fundamental variables. Questions of scale variation and rotation, and series evaluation of projection coordinates are considered. The conformal projection on a sphere provides a convenient intermediate step for subsequent projection transformations. The projection from one spheroid to another is of concern in evaluating the effect of modification of the reference ellipsoid.

The application of exponential transformations to the three fundamental variables is the subject of chapter seven. The complex variable $H=-e^{-M}$ and its linear transformations determines the stereographic projections. Similarly $\Lambda=-e^{-\alpha M}$ provides the conic projections.

In chapter eight is outlined the method of conformal displacement on the spheroid from one reference point to arbitrarily selected alternative reference points. Chapter nine surveys briefly some of the more geographical aspects of the several types of projections and mentions briefly other than conformal types. The work is concluded with a chapter providing an extensive set of auxiliary formulae and analytical relations.

This contribution represents an unusually exhaustive treatment of a fairly practical application of differential geometry and conformal transformation. The organization is good though overburdened with multiplicity of formulas. This is somewhat mitigated by a formula summary at the end of each chapter. The important characteristics of conformal maps are treated so as to provide an adequate basis for any further work. This volume and apparently the one to follow refers to the conformal projection almost exclusively. While this is of primary concern in higher geodesy it would seem appropriate in a basic treatise on cartography to give more than a cursory treatment to equal-area and the several geometrically defined projections such as the polyconic.

NEWMAN A. HALL

BRIEF MENTION

Problèmes de propagations guidées des ondes électromagnétiques. 2d ed. By L. de Broglie. Paris, Gauthier-Villars, 1951. 8+118 pp. 1100 fr.

This text is concerned with the classical phases of the theory of guided electromagnetic waves and as such does not discuss the developments made in the United States and Great Britain during the past ten years. Chapter I summarizes the basic facts regarding Maxwell's equations. They are written in Cartesian as well as orthogonal curvilinear coordinates. Complex representation of the field quantities and some of the useful potentials are discussed. Attention is turned to wave guides in Chapter II. For purposes of illustration four different cross sections are discussed: rectangular, circular, coaxial, and elliptic. The chapter closes with a brief but informative section on methods of excitation as well as transient effects. Chapter III is concerned with characteristic frequencies of electromagnetic