1890–1937 as his data. The author gives a large number of tables of weights and coefficients of various kinds, critical ratios of two sums of squares of differences, formulae for selections of items in various pairs of consecutive differences which would be independent, etc., to facilitate the application of the method.

A considerable amount of historical material on the variate difference method is given. One chapter is devoted to the application of Sheppard's smoothing formulae and serial correlation, and the connetion between the variate difference method and these methods is pointed out.

Several appendices are given: Appendix I is a summary of computation formulae used in the various chapters; Appendix II is devoted to the mathematics underlying the various formulae which are used; the remaining four appendices deal with special topics such as seasonal variation, normality of the random element, etc. Author and subject matter indices are provided.

The question as to whether the variate difference method is superior to other methods of time series analysis is largely a matter of opinion. Tintner has given a very good account of the method, although it appears to the reviewer that he did not concern himself enough with the problem of estimating the m_i after it had been decided for which value of K the value of $\Delta^{(K)}(m_i)=0$. He approached the problem of determining the m_i by using the Sheppard smoothing formulae, but this, of course, is essentially another method of time series analysis.

Tintner's book is an interesting contribution to the literature of time series analysis. It is well documented by references and footnotes and reflects a great deal of work on the part of the author.

S. S. WILKS

Tensor Analysis of Networks. By Gabriel Kron. New York, Wiley, 1939. 24+635 pp. $7.50.

In the introduction to this book, the author states: "It is emphasized that this book is not written by a mathematician and is not written for mathematicians. This book is written by an engineer for engineers who are interested in learning an *organized* method of attack to analyze and synthesize electrical networks."

The first two chapters provide an extremely detailed account of the tensor and matrix notation, of the multiplication of matrices and describes the impressed voltages, currents and self- and mutual impedances of a network as components of tensors e_α, i^α and $Z_{\alpha\beta}$, respectively. In Chapter III the type of electromagnetic networks considered are described as mesh, junction and orthogonal networks. It is emphasized that mesh and junction networks are special cases of orthogonal networks and are due to the "special assumptions as to the nature of the impressed quantities that are known or of the response quantities that are to be found." The primitive mesh network consisting of n individual coils, each short-circuited on itself is defined and observed to satisfy the generalized Ohm's law $e_m = Z_{mn} i^n$.

The central concept of the book is that of the transformation matrix, denoted by C. Its function is to allow one to describe any particular (mesh) network in a methodical way in terms of the primitive (mesh) network. This may be thought of as being accomplished by a linear transformation of the covariant vector e. The invariance of the power, $e_m i^m$, determines in the usual fashion the transformation law of the current vector and the invariance of Ohm's law then requires the impedances to be transformed as the components of a tensor having two covariant indices.

The theory is considerably complicated by the necessity for introducing equations of constraint which require the consideration of singular transformation matrices. A discussion of this, of the complications involved in combining two more-or-less interconnected networks into a single network, and a large number of detailed applications of the theory to specific problems occupy pages 117–323. In Chapter XIII the theory is extended to allow for alternating currents by permitting the current and potential vectors to have complex numbers as elements. The power input is now taken to be $e_m^* i^m$, where the star denotes the complex conjugate. Its assumed invariance leads to transformations involving C^*, in which case spinor indices (here denoted by the addition of a bar rather than a dot) are employed. Junction networks are next discussed, their mathematical theory being obtained from that of mesh networks by interchanging contravariant and covariant indices and adding or removing a bar. After a chapter on multielectrode-tube circuits, orthogonal networks are considered. A chapter on interlinked electric and magnetic networks precedes the introduction of a metric tensor (the inductance tensor) which is claimed to represent "the additional characteristics acquired by the electrical network owing to its linkage with an underlying magnetic network."

Chapters on Compound Networks, Symmetrical Components, and Multiple Tensors are followed by chapters on the application of the theory to the analysis and synthesis of networks. An extensive bibliography and an index conclude the book.

It is evident that a book of this kind provides difficult reading for both the mathematician and the electrical engineer. The mathematician will find the mathematical details exceedingly tedious, the derivations sometimes very obscure, and the technical terminology of the engineer unfamiliar. The engineer, on the other hand, may resent being called upon to learn a large amount of mathematical notation without the prospect of any corresponding gain in the computations he must perform. In spite of this, the book demands and is receiving attention from workers in both fields. Thus the investigation of singular transformations in tensor algebra and of tensor concepts in combinatorial topology were stimulated by this book. The introduction of concepts tending to unify special methods of approach to engineering problems will, in the long run, have an important influence on the development of engineering theory.

WALLACE GIVENS

Fourier Series and Boundary Value Problems. By R. V. Churchill. New York, McGraw-Hill, 1941. 206 pp. $2.50.

This book is a useful addition to the meager number of existing books of this general nature in English. Its major use will be as a textbook for students in engineering and the sciences interested in these topics.

The book contains no more subject matter than is implied by the title; that is, it leads up to and considers the solution of the usual several linear partial differential equations by series of trigonometric, Bessel, and Legendre functions. A considerable part of the book is devoted to an exposition of the concept of orthogonal sets of functions in general and Fourier series in particular.

The book contains some material of mathematical interest, but not very suitable to certain types of engineering students. However, it is so arranged that such material can be omitted.

From the point of view of mathematical preciseness the treatment is excellent. The book is also well planned for teaching purposes.

N. LEVINSON

The Weight Field of Force of the Earth. By William H. Roever. (Washington University Studies, New Series, Science and Technology, no. 1.) St. Louis, 1940. 84 pp. $1.50.

This monograph is an extension of the author's retiring address as Chairman of Section A of the American Association for the Advancement of Science. It deals with some statical and dynamical