Statistical analysis of stationary time series. By Ulf Grenander and Murray Rosenblatt. John Wiley and Sons, New York, 1957. 300 pp. $11.00.

This book treats the following problem: A process $y_t = x_t + m_t$, $t = 0, \pm 1, \pm 2, \cdots$, where x_t is a stationary (or sometimes a wide-sense stationary) process and m_t a non-random sequence, is observed over a finite set $t = 0, 1, \cdots, n$ of time points. It is desired to establish certain estimates, tests, confidence regions, etc. on various structural properties of y_t, under various degrees of ignorance concerning them; e.g., to estimate the structure of m_t when it is specified except for the value of several parameters, to estimate and find confidence intervals for the spectrum of x_t when m_t is known, etc. Also, the problems of predicting, interpolating and filtering of y_t are considered.

The avowed purpose of the book is to direct the theoretical statistician's attention "to an approach to time series analysis that is essentially different from most techniques used by time series analysts in the past" and to "present a unified treatment of methods that are being used increasingly in the physical sciences and technology." The authors have strived, with good success, to make the presentation rigorous and mathematically appealing. However, its main attraction probably will be to users who are concerned with applications, as the authors have not hestitated to sacrifice completeness and generality for that which could be explicitly calculated.

The subject is still in its formative stages and, naturally, it would be unrealistic to hope for a theory as complete as that which obtains in the standard theory when the x_t are independent and identically distributed. Indeed the authors restrict the program considerably in considering only quadratic loss functions (so that much of the material is, following the geometrical treatment of Kolmogoroff, a direct consequence of the theory of unitary operators in Hilbert space), in using large sample theory ($n \rightarrow \infty$) exclusively, and in prescribing that various estimators, testing functions, and the like be linear or quadratic, etc. It would seem, thus, that statistically the art of time series is about at the stage where classical statistics was, say roughly, 30 years ago.

In the opinion of the reviewer, it would have been instructive to have formulated, in all its complexity, the problem in the general decision theory format, and to have made some attempt to assess the consequences of the simplifications dictated by analytical expediency. Indeed, a few cases have been worked out—e.g. Wald's sequential minimax theory for the drift in an additive process—which might have been mentioned.

The material has been carefully planned and presented, and the proofs are neat and compact. Generous use has been made of outside references to most of the more delicate points, and for many of the applications. There is a set of problems at the end of the book, of a wide range of difficulty. There are a number of more or less easily rectifiable misprints.

The following is a reproduction of the table of contents: Chapter 1, Stationary Stochastic Processes and their Representation; Chapter 2, Statistical Questions when the Spectrum is Known; Chapter 3, Statistical Analysis of Parametric Models; Chapter 5, Applications; Chapter 6, Distribution of Spectral Estimates; Chapter 7, Problems in Linear Estimation; Chapter 8, Assorted Problems.

DONALD A. DARLING

Einführung in die Theorie der Differentialgleichungen im reellen Gebiet, by Ludwig Bieberbach, Berlin, Göttingen, Heidelberg, Springer-Verlag, 1956. 8+281 pp. DM 29.80. Bound DM 32.80.

This book, volume 83 in the Grundlehren series, has its genesis in the author's *Theorie der Differentialgleichungen*, which appeared as volume 6 in the same series in 1923. This earlier work had a third edition (1930), and was reprinted by Dover in 1944. Those chapters having to do with differential equations in the complex plane (which included material on analytic equations, regular and irregular singular points) have been expanded into a separate volume, *Theorie der gewöhnlichen Differentialgleichungen*, which appeared as volume 66 of the Grundlehren series. The present volume is an amplification and updating of the remaining chapters of the 1930 work. It is intended as an introduction to the subject of differential equations.

The book is divided into six sections 0–5. The introductory section 0 considers the single equation $dy/dx=f(x, y)$, and by various examples the questions of existence, uniqueness, and the behavior of solutions are posed. The section ends with a proof of the existence and uniqueness theorems assuming f satisfies a Lipschitz condition. Section 1 is an extensive treatment of existence and uniqueness results. It is much more detailed than the corresponding material in the 1930 book (56 pages to 27 pages), and for systems the author introduces vector and matrix notation. The equation $dy/dx=f(x, y)$, where f is continuous, and $|f(x, y)| \leqq M|y|+N$ on $a \leqq x \leqq b$, $|y| < \infty$, is considered. The existence theorem, using the polygonal approximations and the Ascoli lemma, is proved. Uniqueness results of the Osgood