[16] A. Tychonoff, *Théorèmes d'unicité pour l'équation de la chaleur*, Mat. Sb. **42** (1935), 199–216.

[17] S. Täcklind, *Sur les classes quasianalytiques des solutions des équations aux derivees partiélles du type parabolique*, Nova Acta Soc. Sci. Upsal. **10** (1936), 1–57.

[18] I. N. Vekua, *Generalized analytic functions*, Addison-Wesley, Reading, Mass., 1962.

[19] A. L. Vol′berg, *The logarithm of an almost analytic function is summable*, Dokl. Akad. Nauk SSSR **265** (1982), 1297–1301.

[20] A. A. Borichev and A. L. Vol′berg, *Uniqueness theorems for almost analytic functions*, Algebra and Analysis **1** (1989), 144–176.

[21] M. Benedicks, *The support of functions and distributions with a spectral gap*, Math. Scand. **55** (1984), 285–309.

JAMES E. BRENNAN
UNIVERSITY OF KENTUCKY

BULLETIN (New Series) OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 24, Number 1, January 1991

0273-0979/91 $1.00 + $.25 per page

Systems of equations of composite type, by A. Dzhuraev. Translated by H. Begehr and Lin Wei. Pitman Monographs and Surveys in Pure Applied Math., vol. 44, Longman Scientific and Technical, Essex; John Wiley & Sons, New York, 1989, xv+333 pp. ISBN 0-582-00321-0

The classic study of linear partial differential equations centered around the three basic types of equations: elliptic, parabolic, and hyperbolic. From physical considerations for the potential, heat, and wave equations, one was able to determine suitable boundary value problems for each category of equation or system of equations.

However, when an equation or system did not fit into one of the three types, little was known or done concerning the determination of proper boundary value problems. In the 1930s, J. Hadamard, O. Sjostrand, and others began the study of equations of *composite type* in two dimensions. These are equations that have characteristics of both elliptic and hyperbolic (or parabolic) type. For example, if one considers a first-order system of three or more equations, then the system will be of composite type if at least one of the roots of the characteristic equation is real and at least two are complex conjugate. Even the simplest of such systems presents great difficulties in determining well-posed boundary value problems.

It appears that not much was done after the work of Hadamard and Sjostrand until the early 1960s when Dzhuraev began to study such systems again. He considered first-order systems in the plane and utilized the methods of I. N. Vekua, L. Bers, and others, which were developed to solve elliptic systems in the plane with nonanalytic coefficients. It is surprising that the theorems he obtained are of the type one usually obtains in connection with elliptic equations.

The present book describes Dzhuraev's work during those years. He starts with first-order systems of three equations and progresses to systems of any number of equations. He first reduces them to canonical form and exhibits domains and boundary conditions, which will produce Fredholm operators. Moreover, he derives a formula for the index. The domains are fairly general, but different boundary conditions are applied to different parts of the boundary.

The presentation is not elementary. There are many long tedius calculations, and singular integral equations are used. The methods are restricted to two dimensions. There is no attempt to consider higher dimensions. The book is a translation of *Systems of equations of composite type* (Nauka, Moscow, 1972).

The emphasis of the book is on boundary value problems. The results and methods have little connection with studies of the structure of general linear partial differential equations and systems. On the other hand, Dezin's *Partial differential equations* (Springer-Verlag, New York, 1987) considers general boundary conditions for arbitrary partial differential equations from a different point of view.

MARTIN SCHECHTER
UNIVERSITY OF CALIFORNIA, IRVINE