MATHEMATICAL ASPECTS OF PRODUCTION AND DISTRIBUTION OF ENERGY

edited by Peter D. Lax

Volume 21 of the Proceedings of Symposia in Applied Mathematics contains the papers presented at the Energy Short Course held on January 20-21, 1976 in San Antonio, Texas at the Eighty-second Annual Meeting of the American Mathematical Society. The papers are grouped in two categories: those having to do with the mathematical problems involved in the technology of energy production, and those which have to do with the mathematical problems of estimating the resources of energy and the efficient distribution of available energy. In both areas we are dealing with idealized models. The models for energy production are in the form of fairly complicated systems of partial differential equations whose solutions require techniques of finite difference schemes, finite element methods, and Fourier techniques. The models of energy distribution are large networks; their analysis is based on techniques from statistics, linear programming, dynamic programming, and techniques of optimization.

The organizing committee had asked as speakers mathematicians deeply committed to energy related applications as well as experts in these fields who have a flair for mathematical ideas and techniques. Several of the speakers are not only technical experts in their field, but have also been involved in decision making. For this reason, several of the articles contained interesting remarks on public policy.

The section of the book which deals with the mathematics of energy production includes *Magnetic confinement fusion energy research* by Harold Grad, *Nuclear energy—problems and promise* by Milton S. Plesset, and *Laser fusion* by F. D. Tappert. Articles in the section dealing with mathematical problems in modeling energy production and distribution are: *Estimation of undiscovered oil and gas* by E. Barouch and G. M. Kaufman, *On a pilot linear programming model for assessing physical impact on the economy of a changing energy picture* by George B. Dantzig and S. C. Parikh, *The problem of aggregation in modeling physical and social systems and processes* by Richard L. Garwin, and *Project independence evaluation system: Structure and algorithms* by William W. Hogan.

This is expository work; for the papers on energy production, some previous knowledge of differential equations is necessary. For the problem of energy distribution, some background in operations research is needed.

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VECTOR MEASURES

by J. Diestel and J. J. Uhl, Jr.

In this survey the authors endeavor to give a comprehensive examination of the theory of measures having values in Banach spaces. The interplay between topological and geometric properties of Banach spaces and the properties of measures having values in Banach spaces is the unifying theme.

The first chapter deals with countably additive vector measures, finitely additive vector measures, the Orlicz-Pettis theorem and its relatives. Chapter II concentrates on measurable vector valued functions and the Bochner integral.

Chapter III begins the study of the interplay among the Radon-Nikodým theorem for vector measures, operators on L_1 and topological properties of Banach spaces. A variety of applications is given in the next chapter.

Chapter V deals with martingales of Bochner integrable functions and their relation to dentable subsets of Banach spaces. Chapter VI is devoted to a measure-theoretic study of weakly compact, absolutely summing and nuclear operators on spaces of continuous functions.

In Chapter VII a detailed study of the geometry of Banach spaces with the Radon-Nikodým property is given. The next chapter deals with the use of Radon-Nikodým theorems in the study of tensor products of Banach spaces. The last chapter concludes the survey with a discussion of the Liapounoff convexity theorem and other geometric properties of the range of a vector measure.

Accompanying each chapter is an extensive survey of the literature and open problems.

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THE THEORY OF ULTRASPHERICAL MULTIPLIERS

by W. C. Connett and H. L. Schwartz

Many multiplier theorems of Fourier analysis have analogs for ultraspherical expansions. But what was a single theorem in the Fourier setting becomes an entire family of theorems in this more general setting. The problem solved in this paper is that of organizing the children of the Fourier theorems, and many new theorems besides, into a coherent theory. The most critical step in this organization is identifying a family of Banach spaces which include the sequences described in the classical multiplier theorems as special cases. Once this family is found, the next step is to develop the methods of interpolation necessary to show that this family forms a *scale* of spaces—in the sense that if two spaces in the family act as multipliers on L^p, then all spaces "between" these two spaces act as multipliers on L^p.

Neither the family of Banach spaces nor the methods of interpolation mentioned above utilize facts about ultraspherical expansions or are restricted in application to ultraspherical expansions.

This material on interpolation and Banach spaces is gathered together in the first part of the paper to make these results accessible to those who would like to apply them to other settings. Next, the applications to ultraspherical expansions are given, and finally applications to other expansions are given.

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LECTURES ON SYMPLECTIC MANIFOLDS

by Alan Weinstein

The first six sections of these notes contain a description of some of the basic constructions and results on symplectic manifolds and lagrangian submanifolds. §7, on intersections of lagrangian submanifolds, is still mostly internal to symplectic geometry, but it contains some applications to mechanics and dynamical systems. §§8, 9, and 10 are devoted to various aspects of the quantization problem. In §10 there is a feedback of ideas from quantization theory into symplectic geometry itself.

In addition to an introduction and references, the following lectures are included in these notes: Sympletic manifolds and lagrangian submanifolds, examples; Lagrangian splittings, real and complex polarization, Kähler manifolds; Reduction, the calculus of canonical relations, intermediate polarizations; Hamiltonian systems and group actions on symplectic manifolds; Normal forms; Lagrangian submanifolds and families of functions; Intersection Theory of lagrangian submanifolds; Quantization on cotangent bundles; Quantization and polarizations; Quantizing lagrangian submanifolds and subspaces, construction of the Maslov bundle.

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TABLE OF CONTENTS

JANUARY 1978