Topics in Operator Theory

Edited by Carl Pearcy

Mathematical Surveys, Number 13

The five articles in this volume are expository in nature, and they all deal with various aspects of the theory of bounded linear operators on Hilbert space. The volume is very timely, because in the last year or two great progress has been made on hard problems in this field, and thus operator theory today is a very exciting area of mathematical research. One particular problem on which considerable progress has been made recently is the invariant subspace problem. This is the question whether every bounded linear operator on a separable, infinite-dimensional, complex Hilbert space H has a nontrivial invariant subspace. Even though this problem remains unresolved, there are some operators T on H for which the structure of the lattice of all invariant subspaces of T is known, and the first article in this volume, "Invariant subspaces", by Donald Sarason, is devoted to a discussion of such operators. One of the interesting features of this lucid presentation is the interplay between operator theory and classical analysis.

The second article is entitled "Weighted shift operators and analytic function theory" and was written by Allen Shields. He has taken essentially all of the information presently known about weighted shift operators (with scalar weights) and incorporated it into this comprehensive article. A central theme of the exposition is the interaction between weighted shift operators and analytic function theory, and as an added bonus for the reader, the article contains a list of thirty-two interesting research problems.

The third article in the volume is a treatise entitled "A version of multiplicity theory" by Arlen Brown. The problem treated is how to decide when two normal operators are unitarily equivalent. (Unitary equivalence is the analog for operators of the concept of isomorphism for groups, rings, etc.) The unitary equivalence problem for arbitrary operators is exceedingly difficult, but the theory of spectral multiplicity, which can be approached in several different ways, furnishes a reasonable complete set of unitary invariants for normal operators. The author focuses attention on the concept of a spectral measure, and his clear presentation of this circle of ideas should lead to a better understanding of multiplicity theory by beginners and experts alike.

The fourth article in this volume, "Canonical models" by R. G. Douglas, is concerned with the theory of canonical models for operators on Hilbert space. The central underlying idea is that if T is any contraction operator on H (i.e., if the norm of T is at most 1), then there is a canonical construction that associates with T an operator M_T that is unitarily equivalent to T, called its "canonical model". One can therefore study T by studying M_T instead, and this theory has made significant progress in the past ten years. The author, who has contributed substantially to the geometrization of this theory, exposes in his article various important components of the theory, and thereby gives the reader much insight into its successes and failures.

The final article in this volume, "A survey of the Lomonosov technique in the theory of invariant subspaces" by Carl Pearcy and Allen Shields, is a survey of some new invariant-subspace theorems that resulted from the brilliant and elegant method of proof introduced by Victor Lomonosov early in 1973. Further study and refinement of this technique should lead to additional progress on the invariant subspace problem.

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The INDEX TO MATHEMATICS OF COMPUTATION is a compilation, by author and by subject, of all material which has appeared in MATHEMATICS OF COMPUTATION and its predecessor, MATHEMATICAL TABLES AND OTHER AIDS TO COMPUTATION, during the years 1943—1969—twenty-three published volumes. The INDEX contains over 7,000 entries. This is an unusual compilation because of the unique character of the journal which not only publishes research papers, but also publishes reviews of material on mathematics of computation and a table errata section covering a number of other publications. In addition, an unpublished mathematical tables (UMT) file is maintained.

A new classification system, which was developed in 1969 by a committee chaired by Yudell Luke at the Midwest Research Institute, is used in the *subject classification index*. In this section, all articles, tables, reviews, etc. are classified. The classification scheme is designed as an indexing system for retrieval of information in MATHEMATICS OF COMPUTATION, and the present index contains classification numbers for all entries beginning with 1943.

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P = research paper	E = table errata
R = review of article or book	Q = queries and replies
T = table in UMT (unpublished mathematical table) file	M = microfiche

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The identifying code appearing in both indexes provides a cross-reference system that enables the reader to retrieve information rapidly. For example, if the following entry appears in the *subject classification index*

3.10 Linear Equations
Smith, A. B. 1 PR, 3E

the reader knows immediately that under Smith's name in the *author index*, there will be listed both a research article on the subject of linear equations, written by Smith, and a review of the article. In addition, an errata to a table which Smith published in another journal will be listed.

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The editorial committee would welcome readers' comments about this microfiche feature. Please send comments to Professor James H. Bramble, MATHEMATICS OF COMPUTATION, Center for Applied Mathematics, 275 Olin Hall, Cornell University, Ithaca, New York 14853.

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