Operator Theory
Operator Algebras
and
Applications
Operator Theory
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Applications

William B. Arveson and
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Preface

During the last twenty years operator theory has come of age. The subject has developed in several directions, using new and powerful methods that have led to the solution of basic problems thought to be inaccessible in the sixties. Some of these developments have made mutually enriching contact with other areas of mathematics, including algebraic topology and index theory, complex analysis in one and several variables, and probability theory.

This period has seen the full characterization of quasitriangular operators in terms of the Fredholm index, the classification of families of essentially normal operators via C*-algebraic extensions, and the consequences of the latter subject culminating in the unification of C*-algebraic K-homology and K-cohomology in the Kasparov KK-bifunctor. The invariant subspace problem has been solved for subnormal operators and related classes. The classical Weyl-von Neumann theorem has been vastly generalized to separable C*-algebras. The Ringrose problem on the multiplicity of nests of subspaces has been solved, using algebraic methods that have provided striking insight into the behavior of operators under similarity transforms. The classical perturbation theory for Schrödinger operators has been transformed and simplified by the use of path integrals and the Feynman-Kac formula. A rich theory of completely positive and completely bounded maps of C*-algebras has emerged, and this has had significant implications for operator theory, including dilation theory, the characterization of operators having annular spectral sets, and the partial solution of Sz.-Nagy's problem. The C*-algebras of Toeplitz operators associated with a large class of domains in $C^n$ are now clearly understood. Finally, the structure of broad classes of reflexive operator algebras has been penetrated and put into the context of “noncommutative” spectral synthesis.

These algebraic methods are diverse, and they touch upon a broad area of mathematics. In addition to the interrelations alluded to above, there have been direct applications to systems theory, complex variables, and statistical mechanics. Moreover, significant problems and motivations have arisen from the subject's traditional underpinnings for partial differential equations. While it would not be possible or perhaps even desirable to attempt to unify these results and methods, it seemed an appropriate time to
summarize progress and examine the common points of view that now run through the subject. Thus, we organized the 1988 AMS Summer Institute on Operator Theory/Operator Algebras and Applications. The present two volumes contain papers representing most of the invited talks, as well as many of the seminar talks that were given there. We think that the points made above are amply borne out in these Proceedings.

William B. Arveson
Ronald G. Douglas