1 Book reviews

Time-Varying Discrete Linear Systems
Aristide Halanay and Vlad Ionescu
Operator Theory Advances and Applications, Vol. 68, Birkäuser, Basel-Berlin, 1994, 228 pages, ISBN 3-7643-5012-1, Hardcover, DM 148, £56.

This research monograph gives a systematic state space approach to control theory for time-varying discrete time systems. Since time-varying systems are relatively new, the authors have chosen to develop the theory for these systems first. Thus the first three chapters develop the basic facts about evolutions, controlability, observability, Hankel and Toeplitz operators. The central element is a node which is the time-varying equivalent of the [A,B,C,D] matrices of classical state space realization. These matrices are now depending on a time index and are represented as operators on a larger space. Notions like contractive nodes, all-pass nodes, inner-outer factorization of nodes etc. are carefully explained. Chapter 3 ties this up with the solution of Riccati equations and an extended Nehari problem. Chapter 4 is the core of the book giving the time-varying H^∞ control theory. It describes a solution for the disturbance alternation problem under minimal assumptions on the system. In two appendices details are given about discrete-time stochastic control and almost periodic discrete-time systems.

This book is the first systematic account on this topic to be published as a monograph. It will be of interest to researchers in system theory and control.

A. Bultheel

Matrix and Operator Valued Functions
I. Gohberg and L.A. Sakhnovich (eds.)
Operator Theory Advances and Applications, 72, Birkhäuser Verlag, Basel, Boston, Berlin, 1994, xxviii+211 pages, ISBN 3-7643-5091-1, Hardcover, DM 118, £48.

This book is dedicated to the memory of V.P. Potapov (1914-1980). Potapov initiated the analysis of J-contractive matrix valued functions, i.e. matrices having the property that $A^*JA \leq J$

where J is some signature matrix. Such matrices appear in linear fractional transforms which in turn are intrinsically connected with classical moment and Schur-Nevanlinna-Pick interpolation problems. The scalar versions of these problems date back to the beginning of this century but since the publication of the papers by Adamjan-Arov-Kreĭn around 1970 this has attracted the interest of many mathematicians as well as engineers which created a new research field that is now widely known as Schur analysis. Many matrix and operator valued generalizations were studied in the last 25 years and the analysis of J-contractive and J-inner matrix functions has been an important tool in the development.

The contribution to this volume vary from personal reminiscences over surveys by Potapov's students, sketching the early evolution of the theory, up to the latest achievements.

There are 10 mathematical contributions of varying length, most of them by Ukrainean authors, a tribute to Potapov who was very active in the Odessa-Kharhov School.

The reader will find a historical evolution and a state of the art of an interesting piece of mathematics that interrelates many fields such as indefinite inner product spaces, approximation theory, operator theory, differential equations, etc.

A. Bultheel

Nonselfadjoint Operator and Related Topics
A. Feintuch and I. Gohberg (eds.)
Operator Theory Advances and Applications, 73, Birkhäuser Verlag, Basel, Boston, Berlin, 1994, x+416 pages, ISBN 3-7643-5097-0, Hardcover, DM 178, £78.

This book contains the proceedings of a U.S.-Israel workshop held in Beersheva in 1992 in honor of Moshe Livšic at the occasion of his retirement. The 16 contributions are related with topics in which M. Livšic has made some contributions. They deal with linear and nonlinear problems in modern operator theory and its applications. Many of them deal explicitly with or use tools from system theory. The majority of them are longer papers of expository nature and thus they are of wide interest to researchers in

pure and applied operator theory. Here is a list of the contributions:

M.S. Livšic, A.S. Markus Joint spectrum and discriminant varieties of commuting nonselfadjoint operators (20p) (On the edge of algebraic geometry. Investigates the spectrum of commuting operators with finite dimensional imaginary parts)

D. Alpay, L. Baratchart, A. Gombani On the differential structure of matrix-valued rational inner functions (37p) (Parametrizations are described for the submanifold of such functions. Related to linear control systems)

J.A. Ball Conservative dynamical systems and nonlinear Livšic-Brodskii nodes (29p) (Classical results from linear system theory are extended for nonlinear systems)

A. Ben-Artzi, I. Gohberg Orthogonal polynomials over Hilbert modules (31p) (The polynomials are obtained by orthogonalization of the powers of the shift matrix in the modules of C^*-algebra of block diagonal matrices in ℓ_r^2)

R. Bhatia, C. Davis Relations of linking and duality between symmetric gauge functions (11p) (Mainly the introduction of linked s.g.f. and the quotient or 2 s.g.f.)

G. Christner, K.Y. Li, J. Rovnyak Julia operators and coefficient problems (44p) (Relates to contractive triangular operators and the Schur algorithm)

H. Dym Shifts, realizations and interpolation, redux (60p) (A study of vector valued meromorphic functions invariant with respect to a generalized backward shift)

A. Feintuch Arveson's distance formulae and robust stabilization for linear time-varying systems (12p)

P. Fillmore, M. Khalkhali Entire cyclic cohomology of Banach algebras (8p) (Report on recent results. Details appear elsewhere)

P.A. Fuhrmann The bounded real characteristic function and Nehari extension (52p) (Study of analytic functions in the right half plane with close links to H^∞ control)

L. Hanin On isometric isomorphism between the second dual to the small Lipschitz space and the big Lipschitz space (9p)

J.W. Helton, J.J. Wavrik Rules for computer simplification of the formulas in operator model theory and linear systems (30p) (computer algebra and operator theory)

V. Khatskevich Some global properties of fractional-linear transformations (7p)

E. Nordgren, P. Rosenthal Boundary values of Berezin symbols (7p) (All Berezin symbols of an operator have continuous extensions to the boundary iff the operator is a translate of a compact operator)

M. Rosenblum Generalized Hermite polynomials and the Bose-like oscillator calculus (28p) (Study of these polynomials, relation to generalized Fourier transform and application in said calculus)

N. Zobin, V. Zobina A general theory of sufficient collections of norms with a prescribed semigroup of contractions (20p) (Review on the interpolation theory of such norms)

A. Bultheel

Basic Algebraic Geometry
Igor R. Shafarevich

Second, Revised and Expanded Edition, Translated by Miles Reid, Springer-Verlag, 1994
Volume 1: Varieties in Projective Space
ISBN 3-540-54812-2, Softcover, DM 68.
Volume 2: Schemes and Complex Manifolds
ISBN 3-540-57554-5, Softcover, DM 68.

Algebraic geometry deals with the study of solution sets of polynomial systems. During the 19th century, it played a central role in mathematics. Towards the middle of our century, algebraic geometry has undergone a complete reconstruction, while the application of its ideas has grown tremendously.

The aim of the book is to provide an overall view of the many varied aspects of algebraic geometry. The prerequisites for reading the first volume are kept to a minimum. In addition to an undergraduate algebra course, the author assumes familiarity with finite and transcendental field extensions, and with ideals and quotient rings. For the second volume, the reader must be familiar with the definition of differential manifolds, with the basic theory of analytic functions of a complex variable and know about homology, cohomology and differential forms. For the last chapter, familiarity with the notion of fundamental group and the universal cover is needed.

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1 JOINT SPECTRUM AND DISCRIMINANT VARIETIES OF COMMUTING NONSELFADJOINT OPERATORS

M.S.Livsic and A.S. Markus

1 Introduction

The theory of commuting operators with finite-dimensional imaginary parts which has been developed during the last decade yielded fruitful connections with algebraic geometry. Let $A = (A_1, \ldots, A_n)$ be an n-tuple of commuting bounded operators with finite non-Hermitian rank in a Hilbert space $\mathcal{H}$ and let $A^* = (A_1^*, \ldots, A_n^*)$ be the adjoint n-tuple. In many cases of interest this subspace is not important for the theory of nonselfadjoint operators and, in such cases, it can be omitted.