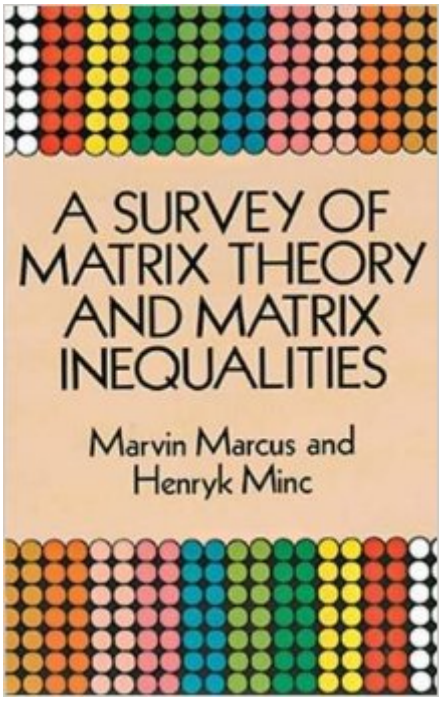
A Survey Of Matrix Theory And Matrix Inequalities (Dover Books On Mathematics)



Synopsis

Written for advanced undergraduate students, this highly regarded book presents an enormous amount of information in a concise and accessible format. Beginning with the assumption that the reader has never seen a matrix before, the authors go on to provide a survey of a substantial part of the field, including many areas of modern research interest.Part One of the book covers not only the standard ideas of matrix theory, but ones, as the authors state, "that reflect our own prejudices," among them Kronecker products, compound and induced matrices, quadratic relations, permanents, incidence matrices and generalizations of commutativity.Part Two begins with a survey of elementary properties of convex sets and polyhedra and presents a proof of the Birkhoff theorem on doubly stochastic matrices. This is followed by a discussion of the properties of convex functions and a list of classical inequalities. This material is then combined to yield many of the interesting matrix inequalities of Weyl, Fan, Kantorovich and others. The treatment is along the lines developed by these authors and their successors and many of their proofs are included. This chapter contains an account of the classical Perron Frobenius-Wielandt theory of indecomposable nonnegative matrices and ends with some important results on stochastic matrices.Part Three is concerned with a variety of results on the localization of the characteristic roots of a matrix in terms of simple functions of its entries or of entries of a related matrix. The presentation is essentially in historical order, and out of the vast number of results in this field the authors have culled those that seemed most interesting or useful. Readers will find many of the proofs of classical theorems and a substantial number of proofs of results in contemporary research literature.

Book Information

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Customer Reviews

This book is not really a review of matrix theory; the focus is on inequalities, mainly for PD matrices, convex functions and eigenvalue problems. The book tries to present a general framework, a-la Hardy, but is not quite as successful. Nevertheless, if you need to find that elusive inequality that you saw in undergraduate, this book will likely contain it. This book should be on every mathematical researcher’s shelf.

I have just read part I of the book (table of contents below), and I like it very much. So many information, on so few pages. Everything is threated in FULL generality, and proves are included for the main theorems. This book has also an excellent encyclopedia function, as it contains the main properties of anything that one can think of.Beware: I have some mathematical background, and if you fully want to appreciate this book you will need this. (don’t buy this book if this would be your first confrontation with matrices).Table of contents:I Survey of matrix theory 1 Introductory concepts 2 Numbers associated with matrices 3 Linear equations and canonical forms 4 Special classes of matrices, commutativity 5 CongruenceII Convexity and matrices 1 Convex sets 2 Convex functions 3 Classical Inequalities4 Convex functions and matrix inequalities. 5 Nonnegative matricesIII Localization of characteristic roots 1 Bounds for characteristic roots 2 Regions containing characteristic roots of a general matrix 3 Characterstic roots of a general matrix 4 The spread of a matrix 5 The field of values of a matrix

Although the text is not up-to-date (e.g., it states on pp. 129-130 that the van der Waerden conjecture on the permanent of stochastic matrices is still unresolved!), most classical results in matrix theory and analysis is presented in an unpretentious style and with due credit to the original contributions. Proofs are given with only a modicum of rigor for the more important and general theorems and some exemples (but not many) are worked out to illustrate the possibilities and limitations of the techniques.On the downside, the book is typeset in a small type that makes it difficult to discern sub-subscripts and superscripts in some expressions. I am not nitpicking here: sometimes you cannot affirm if that index is an "i" or a "t", and if it is an "i_t" or a "t_i" it only gets worse. Given its enduring value, a new printing in a slightly larger font, say, 1pt up, would be a good service to its readership.I prefer this title to the much more expensive (and not that much up-to-date) book by Horn & Johnson. If you cannot afford both, go with Marcus & Minc. I am not rating it 5 stars because of (i) its age, (ii) its annoying typeset (a minor issue, actually), and (iii) the typos, of the confusing kind. Otherwise, for the practicing scientist and engineer and for students looking for a

cheap reference, I can only recommend this book.

Each section starts with a set of necessary definitions. Then, theorems are stated without proof---therefore, the it can also be used as an exercise book. One can go to a section of interest and try to prove some of the theorems listed there.