Preface

The systematic study of matrices began late in the history of mathematics, but matrix theory is an active area of research now and it has applications in numerical analysis, control and systems theory, optimization, combinatorics, mathematical physics, differential equations, probability and statistics, economics, information theory, and engineering.

One attractive feature of matrix theory is that many matrix problems can be solved naturally by using tools or ideas from other branches of mathematics such as analysis, algebra, graph theory, geometry and topology. The reverse situation also occurs, as shown in the last chapter.

This book is intended for use as a text for graduate or advanced undergraduate level courses, or as a reference for research workers. It is based on lecture notes for graduate courses I have taught five times at East China Normal University and once at Peking University. My aim is to provide a concise treatment of matrix theory. I hope the book contains the basic knowledge and conveys the flavor of the subject.

When I chose material for this book, I had the following criteria in mind: 1) important; 2) elegant; 3) ingenious; 4) interesting. Of course, a very small percentage of mathematics meets all of these criteria, but I hope the results and proofs here meet at least one of them. As a reader I feel that for clarity, the logical steps of a mathematical proof cannot be omitted, though routine calculations may be or should be. Whenever possible, I try to have a conceptual understanding of a result. I always emphasize methods and ideas.

Most of the exercises are taken from research papers, and they have some depth. Thus if the reader has difficulty in solving the problems in these exercises, she or he should not feel frustrated.

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