Matrix Methods In Stability Theory

Section 6 deals with mixed integer programming and variants of the warehouse location problem. Section 8 contains an expository paper on geometrical programming. The author demonstrates how such nonlinear programming problems arise in a chemical plant and in engineering design.

Section 9 is mainly devoted to the use of mathematical programming in military problems of strategic mobility and the allocation of resources to defence. Also in this section is a review of computational experience in solving large mixed integer problems. Section 10 contains two applications of non-linear programming in a military context.

This book will be of interest to readers who already know some mathematical programming and who are interested in the new and expanding fields to which it is being applied.

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Matrix Methods in Stability Theory. By S. BARNETT and C. STOREY. Pp. vii, 148. £4. 1970. (Nelson.)

The background of this book lies in the field of stability theory of ordinary differential equations. In particular the book revolves around the matrix equations which arise when a quadratic function is taken for the Liapounov function for a system of linear equations with constant coefficients. The properties of special matrix forms can then be adduced to prove theorems relating to the stability of the systems and for sensitivity analysis.

In the last twenty years there has been a widespread international interest in the stability of engineering systems and in optimal control. A good deal of the work described relates to this period and includes numerous contributions by the authors. The book has been designed as an introductory text for young graduate or undergraduate mathematicians and mathematically inclined engineers and scientists but will also be found a useful reference book for those engaged in research in control.

There are four chapters dealing with matrix algebra, special forms of matrix and functions of a matrix. These chapters are fairly condensed and contain numerous theorems together with suitable references to proofs. Classical canonical forms are described. These introductory chapters of the book form a useful compendium of results in matrix theory and as the authors point out their aim has not been to provide a substitute for a standard textbook on matrix algebra.

Chapter five introduces the stability of differential equations and outlines Liapounov stability theory. Then come methods of solution of the associated matrix equation with special emphasis on linear systems. Further results dealing with properties of the stability matrix are given and extensions to non-linear systems in sensitivity analysis and in optimal control.

Although there are a number of exercises and examples there is a surprising lack of examples of 'real' systems for a book in a series on 'Applications of Mathematics'. These would help to motivate the student and to provide a feel for the subject. While the authors do refer to some of the computational difficulties involved in practical calculations it is somewhat distressing to find mathematical solution methods being described in such detail without a fairly strong warning note being sounded on the difficulties and dangers of straight-forward implementation. The algebraic eigenvalue problem has produced

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