

gular perturbations, Lyapunov stability theory, closed loop systems, and Volterra and Fredholm operators. The reader may find that some of these concepts are introduced for the control engineer without sufficient initiation for the generalist.

While most formulations treat the differentiable case, there is a discussion on optimization issues for discrete systems with sub-problems derived from temporal decomposition. Some of the difficulties that can arise in discrete systems are also discussed in A. Charnes and K. Kortanek, "A note on the discrete maximum principle and distribution problems", *J. Math. Physics* 45 (1966) 113-121.

The topic of Chapter 5 is the real time management of telephone networks. The authors apply a two stage approach to this stochastic dynamic control problem for the case of a simple star network over a finite set of time periods. Stage I is to solve a mathematical program whose intended objective is to minimize total blocked traffic for each period. Stage II is to solve a control problem within each period to account for random traffic fluctuations. As formulated on p. 241 in apparent error, the Stage I problem seeks to minimize total carried traffic over the network. Also, total blocked traffic is not in general a convex function of the decision variables. Each stage is illustrated numerically.

Stage I is complicated by the combinatorial aspects of network flows for more general networks. Thus Chapter 6 is devoted to multicommodity flow problems, for which several formulations follow a brief review of network theory. A number of relevant and efficient algorithms are presented, including aggregation of flows and the decentralized approaches of Gallager and Bertsekas.

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Algorithms and Theory in Filtering and Control: Proceedings of the Workshop on Numerical Techniques for Systems Engineering Problems, Part 1

Volume 18 in: Mathematical Programming Stud-

ies, North-Holland, Amsterdam, 1982, ix + 159 pages, Dfl.60.00

This volume contains one part of the proceedings of the Workshop on Numerical Techniques for Systems Engineering Problems held in June 1980 in Lexington, Kentucky. The ten contributions are all more or less devoted to specific research areas in the broad field of filtering and control, e.g. multivariable systems identification, stochastic control, square-root filtering and smoothing, stochastic realization theory, etc.

During the last few years there has been an increasing interest in applying numerical linear algebra to algorithms for solving numerical problems arising in linear systems theory. These efforts have already resulted in some quality software for both the analysis and design of linear control systems. Relatively little of this type of work can be found in this volume. There is a paper of G. Picci about some numerical aspects of multivariable systems identification which can serve as a nice introduction to topics as system identification and model structure selection by state space methods. It also clearly demonstrates that for reliable and efficient solutions one absolutely needs to rely on the techniques of modern numerical linear algebra. Another paper, written by C. Van Loan describes the role the Hessenberg decomposition of a matrix can play in some specific problems of control, like computing the matrix exponential.

Two other papers are concerned with design methods for control systems. In general these methods can be classified into two categories, i.e. the time-domain approach and the frequency-domain approach. The more theoretical paper by A. Bensoussan on stochastic control in discrete time belongs to the first category and the interesting contribution of D.Q. Mayne and E. Polak to the second. They describe algorithms for finding feasible solutions to a set of singular value inequalities as well as for solving a minimization problem subject to this type of inequalities.

The last paper I explicitly want to mention is that by D.C. Sorensen. It gives an excellent tutorial introduction to quasi-Newton methods and collinear scaling. Interesting for systems people is that a connection can be made between sequential estimation on one side and the updating process for the Hessian matrix on the other side.

In conclusion, the papers in this volume cover a

wide range of research. All papers are written by well-known experts. Some can be read as a first introduction to the subject. Most of the papers stress the theoretical foundations of the algorithms more than the potential applications.

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Lieferzeit-orientierte Lagerungs- und Auslieferungsplanung

Physica-Verlag, Würzburg, 1983, ii + 193 pages, DM42.00, paperback

This book is an unaltered version of the author's Ph.D. Thesis written under the guidance of B. Kromschöder at the University of Treves from 1979 to 1982, in which he develops a two-stage hierarchical model for planning physical distribution systems consisting of an inventory system and a transport system.

As suggested by recent marketing management literature, the author chooses the delivery lead time as a natural efficiency criterion of the system. Seen from the customer's point of view this seems to be more appropriate than the service level, which is commonly used in inventory models.

But the problem is to analyze the connection between an inventory policy coupled with a known replenishment lead time of the subsystem and the delivery lead time for a customer. In the case of a probabilistic reorder-point-order-level inventory system—under special assumptions—this problem can be solved. With these premises it is possible to study the following two-stage decision problem: The expected total delivery lead time is given. It is the sum of the lead times of the two subsystems. The inventory lead time and the transport lead time are parameters in the restrictions of the two decision problems at the first stage and, at the second stage, they are decision variables. The aim is to minimize the total cost of the physical distribution with the decision variables at the first stage being: reorder point/order level and mode of dispatch or fleet size.

The book has been written for management economists. It devotes a lot of space to motiva-

tions and heuristic considerations. But I think that it opens up new avenues worth being pursued by operations research specialists.

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Entscheidungsregeln bei Risiko: Multivariate stochastische Dominanz

Volume 204 in: *Lecture Notes in Economics and Mathematical Systems*, Springer, Berlin, 1982, 172 pages, DM35.00

The stochastic dominance framework was developed to cope with decisions under risk if the utility function is only partially known. By partially known is meant the information that the utility function belongs to a certain class, e.g. to the class of all monotone increasing and concave univariate functions. One refers to multivariate stochastic dominance if the utility function is defined on a multidimensional space. Multidimensional spaces arise in a natural way if multicriteria or multiperiod decision problems are taken into consideration.

Mosler's book is devoted to the theory and the applications of multivariate stochastic dominance. The book is subdivided into four chapters. Chapter I consists of an introduction, a historical survey and a summary of the main results of the book.

Chapter II introduces abstract stochastic dominance in general spaces as a relation defined on probability distributions. Several principles and rules are developed from which the stochastic dominance or its infringement can be concluded. Furthermore, conditions are investigated under which the stochastic dominance relation is asymmetric or carried over from given probability distributions to transformed probability distributions.

Chapter III is concerned with the multivariate stochastic dominance in the narrow sense, e.g. with the stochastic dominance between n -dimensional random vectors with real components. Necessary and sufficient conditions for stochastic dominance are established for several classes of multivariate utility functions, including the monotone increas-