times it stops short; there are sections which could offer some more theory and others which could do with some more examples. It certainly starts investigating "substantive questions" and it is one of few books which can claim to include an introduction to generalised linear models. There are many students in applied statistics and operational research as well as researchers in these fields who will find the book very useful and I am sure I will refer to it again.

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Observers for Linear Systems

Volume 170 in: Mathematics in Science and Engineering, Academic Press, London, 1983, xi + 246 pages, $39.50

This book presents in a mere 246 pages a surprisingly complete overview of observer theory for linear systems. Observers are very well known to systems and control theorists and have found wide acceptance. Operational researchers are less likely to be familiar with the notion, but might be able to exploit it to advantage in situations where it is necessary to reconstruct the internal behavior of a dynamical system from partial external observations. An observer is another dynamical system that has the observed variables of the original system as its inputs, and produces as its output a reconstruction of the internal behavior of the original system.

For linear systems described by a set of ordinary linear differential or difference equations observer theory is well-developed. Much of it can be found in the book. Chapter 1 deals with the elementary theory, while in Chapters 2 and 3 minimal-order state observers and linear state function observers, respectively, are treated. Chapter 4 deals with the design of linear control systems based on observers. The subject of Chapter 5 is the minimum-time state reconstruction of discrete-time systems, while in Chapter 6 the celebrated Kalman filter is obtained as an optimal observer in a stochastic setting. The next four chapters are devoted to topics that are current active research areas: adaptive observers (Chapter 7), observer-based compensation in the frequency domain (Chapter 8), the application of polynomial matrix models (Chapter 9), and the geometric theory of observers (Chapter 10). Finally, in Chapter 11 some topics for further study are briefly touched upon.

The intended readership of the book consists of post-graduate students and researchers in control theory. The claimed mathematical prerequisites are modest: some understanding of linear algebra, the elementary theory of linear dynamical systems and introductory probability theory. For a full grasp of some of the material that is treated, however, more than a superficial acquaintance with these areas is needed.

The relatively modest mathematical scope and self-containedness make the book easily accessible. The wide coverage of topics within the subject area adds to its attraction. The compactness of the book, however, occasionally results in a somewhat sketchy treatment. This is compensated by numerous and accurate references to the literature. A nice feature of the book is that each chapter closes with a section titled "Notes and References", with extensive attributions. Completely missing are examples. This makes the book less suitable as a classroom text, unless the teacher is prepared to make up his own examples.

The book is not the best place to look up the Kalman filter. The reason is that what is actually treated is a generalized version of the Kalman filtering problem, allowing noise-free observed outputs, the resulting extra complications obscuring some familiar results. There are other texts, of course, that treat the Kalman filter at length.

In conclusion it is fair to state that this is a useful, compact book, handy for reference to a wide range of results in linear observer theory and a key to the literature up to and including 1982.

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Some Useful BASIC Subroutines

Newnes Microcomputer Books, Butterworth, Sevenoaks, 1983, 82 pages, £4.95

Observability implies Observer Design for Switched Linear Systems. â̂—. Aneel Tanwani.Â This paper presents a unied framework for observability and observer design for a class of hybrid systems. A neces-sary and sucient condition is presented for observability, globally in time, when the system evolves under predeter-mined mode transitions. A relatively weaker characteriza-tion is given for determinability, the property that concerns with unique recovery of the state at some time rather than at all times. These conditions are then utilized in the construc-tion of a hybrid observer that is feasible for implementation in practice. The observer, without using the derivatives of the System-Observer Conguration We will show that the system-observer structure preserves the closed-loop system poles that would have been obtained if the linear perfect state feedback control had been used. The system under the perfect state feedback control, that is. has the closed-loop form as. In control theory, a state observer or state estimator is a system that provides an estimate of the internal state of a given real system, from measurements of the input and output of the real system. It is typically computer-implemented, and provides the basis of many practical applications. Knowing the system state is necessary to solve many control theory problems; for example, stabilizing a system using state feedback. In most practical cases, the physical state of the system cannot be determined