space system identification methods presented later. Chapter 5 presents the Eigensystem Realization Algorithm and its Data Correlation version, which were developed by the author and co-workers. The algorithms are widely used in the structural identification community, and in recent years, at least in the aerospace community, they have become the standard to which any new method is compared. Chapter 6 presents one of the most exciting developments in state-space system identification to date, the Observer/Kalman filter Identification algorithm. This is the first textbook to treat the subject. The method simultaneously identifies a state-space model and an observer/Kalman filter needed by the control system designer. The ability to generate a Kalman filter directly from data eliminates much of the uncertainty in Kalman filter design for control applications. Chapter 8 presents still more unique results, those that allow one to identify a system, not from input-output data of the system itself, but from closed loop data while it is being controled. The method enables one to perform identification in certain difficult situations, for example, to identify flutter modes while under active control, when without such control the test fixture would be destroyed by the flutter instability.

In summary, *Applied System Identification* is an excellent and timely addition to the current set of system identification textbooks. What sets this book apart is its unique approach to state-space system identification and its incorporation of some of the most recent developments in the field. Many of these recent methods have proved highly successful in difficult real world spacecraft problems at NASA and JPL. Hence, this book is not just presenting theoretical advances, but advances that have proved important in practical applications. For mechanical and aerospace engineers engaged in structural identification and control, this book is a must. This reviewer uses this textbook in a graduate course in System Identification at Princeton University. The book brings forth a powerful and fresh perspective on system identification in relation to the more traditional approaches. It is ideal for use with Matlab, a mathematical programming language particularly suited for system identification and control.

7R7. Control of Systems with Aftereffect. Translations of Mathematical Monographs, Vol 157. - VB Kolmanovskii *(Moscow Univ of Electron and Math, Russia)* and LE Shaikhet *(Donetsk State Acad of Man, Russia)*. Am Math Soc, Providence RI. 1996. 336 pp. ISBN 0-8218-0374-3. $99.00.

Reviewed by ML Nagurka (Dept of Mech and Indust Eng, Marquette Univ, PO Box 1881, Milwaukee WI 53201-1881).

The focus of this book is the control of systems described by differential equations with aftereffect. The first issue one would expect is a solid explanation of what the authors mean by *aftereffect*. According to the authors, differential equations in which the unknown function $x(t)$ and its derivatives depend on different values of the argument t are differential equations with aftereffect. For example, the simplest equations with discrete (concentrated) aftereffect are of the form $\dot{x}(t) = f(t, x(t), x(t-h))$ and $\dot{x}(t) = f(t, x(t), x(t-h), \dot{x}(t-h))$. More generally, the authors are concerned with equations with several discrete lags and equations involving both discrete and distributed delay. This reviewer believes the term *delay* would be more appropriate than *aftereffect*, since the latter is not an accepted term in the controls and system dynamics literature.

This book is heavily grounded in mathematics. It consists of eight chapters detailing methods for solving problems of optimal control and estimation for deterministic and stochastic systems with aftereffect (to use the authors' term). This reviewer admits it would be naive to assume that such a book could be written without recourse to mathematics. To its credit, this book contains significant detail and mathematical formalism. However, this reviewer would feel more comfortable recommending this book if it put the topic in perspective relative to the current, richly established controls literature. It does not provide deep insight into the control of these special dynamic systems, it does not address implementation nor computational issues, and it does not present the information in a form so that readers who do not wish to assimilate all of the detail have a good starting point from which to understand the topic and conduct a control design.

In Chapter 1, the introduction, a classification of equations with aftereffect is given, existence and uniqueness theorems for solutions of various types of equations are formulated, and methods for stability testing are described. Chapter 2 is concerned with the dynamic programming method. The linear-quadratic optimal control problem is solved for various classes of systems with aftereffect, bilinear controled systems are investigated, and the stabilization problem is studied.

In Chapter 3, necessary conditions for optimality in the form of the maximum principle are developed for systems with constant lags and variable lag. Chapter 4 is devoted to the investigation of model-reference adaptive control systems. In Chapter 5, a general approach for the stochastic optimal control of systems with aftereffect is expounded, and a method is developed for constructing successive approximations to optimal control in quasilinear systems.

In Chapter 6, noise-contaminated control of systems with aftereffect is analyzed. The authors claim to generalize classic solutions of the linear-quadratic problem for stochastic systems. In Chapter 7, the filtering problem is formulated. The Wiener-Hopf equation for an unobservable general Gaussian process is derived, forecasting and interpolation problems are considered, and a filtering theorem for integral equations is proved.

In Chapter 8, various problems of control with incomplete information about the controled object are described. The linear-quadratic optimal control problem of the partially observable Volterra equation is investigated, leading to estimation algorithms for the control of systems with unknown parameters under random perturbations. Finally, adaptive control of observable and partially observable systems is addressed.

The authors claim that the book is intended for control theorists and applied mathematicians. The book is primarily based on the authors' results obtained between 1970 and 1990, as evidenced by the references to their many papers and reports in Russian. The book contains an extensive bibliography, with 357 references, a significant number of which are to documents in Russian.

Regarding production quality, the book is of sound construction. It is well organized (with sections, subsections, and subsubsections), but does not contain an index nor end-of-chapter problems. The figures, mainly for example problems, are fine but lack a professional touch.

In closing, *Control of Systems with Aftereffect* cannot claim to be a textbook for engineering students nor a reference source for practicing engineers. This translated monograph is a book for mathematicians who enjoy detailed formalism. In this reviewer's assessment, this book will not have significant impact on the engineering community, although it may have some appeal to control theorists.

7R8. Fundamentals of Robotic Mechanical Systems: Theory, Methods, and Algorithms. Mechanical Engineering Series. - J Angeles *(Dept of Mech Eng, McGill Univ, Montreal, PQ, Canada)*. Springer-Verlag, New York. 1997. 511 pp. ISBN 0-387-94540-7. $69.00.

Reviewed by RL Huston (Dept of Mech, Indust, and Nucl Eng, Univ of Cincinnati, PO Box 210072, Cincinnati OH 45221-0072).

This book focuses on the fundamental principles of the mechanical aspects of robotic systems. It is billed as a textbook, suitable for undergraduate engineering students. The book is also intended to serve as a reference for researchers and practicing engineers. Although some familiarity with undergraduate engineering mathematics and elementary mechanics is assumed, the book