

## BOOK REVIEWS

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SIDNEY J. YAKOWITZ. *Mathematics of Adaptive Control Processes*. Elsevier, Modern Analytic and Computational Methods in Science and Mathematics, No. 14, 1969. xv+158 pp. \$11.00.

Review by S. ZACKS

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**1. General introduction.** The term adaptive control processes had been initiated in the field of automatic self-adjusting control systems early in the 1950's. Later it was adopted by statisticians as a title for the general class of sequential decision problems in which the statistician is faced with an identical decision problem, which repeats at a specified sequence of epochs. At each decision epoch the statistician has to choose a "control"  $k$  from a specified set,  $K$ , of alternative controls. The choice of a control  $k_t$  at epoch  $t$  effects the stochastic law according to which the state of the system will be realized at the consecutive epoch,  $t+1$ ; which in turn determines the yield (loss) of the system. The objective can be generally stated as that of choosing a sequence of controls  $\{k_1, k_2, \dots, k_N\}$  so that the total expected yield of the system will be maximized. The time span of the control process, which is reflected by the number  $N$  of control epochs, is called also the control or planning horizon. This planning horizon could be finite or infinite. In the infinite horizon case we generally consider the objective of maximizing the total expected discounted yield. The treatment of adaptive control problems of the kind described here involves generally the statistical problem of deciding at each control epoch what is the stochastic (distribution) law associated with each one of the specified controls. As we all know there are Bayes procedures of optimal adaptive control; empirical Bayes procedures, and other procedures of statistical control. Many of the statistical problems of current interest, like problems of optimal sequential design of experiments, quality control, etc. are problems belonging to the general class specified above. The existing literature on these problems is very extensive.

**2. Review of the book content.** The book under consideration is a very concise monograph on the subject of adaptive control processes. It contains five chapters and nine short appendices. Chapter 1 (only 4 pages) is a very short introduction to the main problem treated in the book. Chapter 2 (20 pages) provides the basic definitions of the concepts involved with control processes (like: state space, decision times, control set functions, policy, trajectory, loss function, control process, a solution, etc.). In Section 2.1 the author treats general loss functions, not necessarily separable (additive) ones. A solution to the control process is defined as a feasible control policy which minimizes the loss (over the whole