94[P, X].—M. R. HESTENES, *Calculus of Variations and Optimal Control Theory*, John Wiley & Sons, Inc., New York, 1966, xii + 405 pp., 24 cm. Price $12.95.

This book, by an eminent author whose contributions to the calculus of variations date from 1930 and who wrote in 1950 on the Maximum Principle, will be used and cited for many years.

Emphasis is on first-order necessary conditions for a variety of problems leading to the general control problem of Bolza. Other necessary conditions and sufficient conditions are treated for some of the simpler problems. The approach is classical in the sense that admissible state variables x are of class D', admissible control variables u are piecewise continuous and integrands f together with left members φ of side-conditions are of at least class C'. The Lebesgue integral is used only in the appendix and in occasional brief remarks.

There is an appropriate treatment of fields and Hamilton-Jacobi methods, needed for various manifestations of the Maximum Principle. That this topic, as well as the foundations of Dynamic Programming, as applied to variational problems, is an extension of classical Hamilton-Jacobi theory and not a separate subject becomes clear.

The book is not a survey of the current status of variational theory. There is very little on parametric problems, since control problems are for the most part nonparametric. There is nothing on existence of global extrema, on multiple integral problems or on numerical methods but there is much valuable background for the last. Those topics that the author has chosen are treated in depth and detail. The exposition is largely self-contained and, in view of the introductory chapter and a full treatment of classical fixed endpoint problems in Chapter 2, does not assume previous acquaintance with the calculus of variations. However, it will be read with more ease and appreciation by those who have some prior knowledge.

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95[P, X].—C. T. LEONDES, Editor, *Advances in Control Systems, Vol. 3*, Academic Press, New York, 1966, x + 346 pp., 24 cm. Price $14.50.

[P, X].—C. T. LEONDES, Editor, *Advances in Control Systems, Vol. 4*, Academic Press, New York, 1966, xiv + 320 pp., 24 cm. Price $14.50.

As the first two volumes in this series were, the present two are collections of papers which aim to acquaint the reader with recent work in the theory of control systems and its applications.

Volume 3 consists of six articles. The first, by Thomas L. Gunckel, II, entitled "Guidance and Control of Reentry and Aerospace Vehicles" reviews the problems of near-earth navigation and orbit determination, rendezvous guidance and control, and reentry guidance in relation to computer technology and, in particular, the requirements of an on-board computer. The second paper, "Two-Point Boundary-Value-Problem Techniques," by P. Kenneth and R. Mc Gill discusses in detail the numerical solution of two-point boundary value problems for systems of nonlinear ordinary differential equations by the generalized Newton-Raphson algo-