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The chapter on radio astronomy falls a little apart from the rest of the book.

In a small compass the author illuminates his chosen subjects with his own ideas, and he does not fear to be speculative or controversial. Where the general reader will catch something of modern astronomical thought, the astronomer will read between the lines.

Even though the book is a short one, the absence of an index is to be regretted.

Dynamics. By Robert L. Halfman. Vol. 1, Particles, Rigid Bodies, and Systems, 379 pp., \$7.50; Vol. 2, Systems, Variational Methods, and Relativity, 584 pp., \$6.00. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1962. Reviewed by C. H. Holbrow, Haverford College.

AS physics has grown in scope and content, curricula have been adjusted to meet the demands of contemporary physics. In classical mechanics, this has resulted in a reduction in depth and comprehensiveness of treatment as for example, rotating and linearly accelerating coordinate systems, which are emphasized by the treatment of small oscillations and the forced damped harmonic oscillator with little concern for the broader significance of linear systems. Furthermore, there is little indication of the implications of non-linearity of a system. Many lovely techniques and methods of approaching problems are never considered, thus leaving the student ignorant of them with embarrassing gaps in his general knowledge of the tools available to him.

The increasingly better mathematical preparation of many students makes it possible to upgrade intermediate level mechanics courses and to fill in some of these gaps. Robert L. Halfman's book *Dynamics: Particles, Rigid Bodies, and Systems* is a text which could well be useful to such a course. The author designed his book as a text for a full-year advanced engineering course. However, its mathematical sophistication and generality of treatment would make it an excellent supplementary text for a one-semester (perhaps slightly longer) physics course.

Vector algebra is used from the start, making possible concise but meaningful treatment of the problems of complicated motion. The author's treatment of rotating and linearly accelerating coordinate systems is unusually thorough and lucid. For this feature alone, the book can be recommended.

Matrices are also introduced, first very simply for transforming from Cartesian to cylindrical coordinates, and then with increasing intricacy as for principal-axes transformations of the moment-of-inertia tensor. For the benefit of those students unacquainted with matrices, matrix algebra is adequately described in an appendix.

One surprising feature, in view of the general level of mathematical maturity, is the absence of vector calculus. Treatment of dynamics of continuous media is awkward in the absence of the del operator. Further-

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more, in view of the present interest of both physicists and engineers in the dynamics of continuous media, the discussion of continuous media is not adequate.

The author's treatment of rigid-body dynamics is good, covering about the same material as Goldstein does in his book. The heavy symmetric top, however, is only briefly considered in this book, and one should look elsewhere for more complete treatment. Nor are the more general formulations of Newton's laws developed in the first volume, where only the rudiments of the Lagrangian formulation are introduced.

The engineering aspects of this book are often evident in the choice of examples and problems. Fortunately, the examples and problems are so plentiful that although many are "lift-drag" types there are still numerous examples and problems which are more to the taste of the physicist.

A chapter on system dynamics provides considerable insight into the general problems of linear and nonlinear systems. These general aspects should be of interest as well as useful to the physics student.

Linear and nonlinear systems are considered further in the second volume *Dynamics: Systems, Variational Methods, and Relativity*. However, the highly detailed treatment will probably be of little interest to physicists.

The level of mathematical sophistication demanded by the second volume is higher than that of the first. Signal-transmission problems in linear systems are treated in terms of Laplace transforms. Fourier series and integrals are used. Matrix algebra is extended to achieving orthogonality in nonself-adjoint systems. In addition, there is an extensive treatment of the variational calculus which is nicely formulated and developed along physical lines. This treatment could well serve as useful reference for the student when variational calculus is taught in physics courses. In the course of the development of variational calculus, the Lagrangian and Hamiltonian formulations of Newton's laws are derived with little fanfare.

The development of relativistic mechanics in the second volume seems curiously out of place. No practical engineering applications of the material developed are given, and the material is not really harmonious with the text. Perhaps it was included for the sake of completeness and to avoid giving the impression that Newton's laws are omnipotent. However, better treatments can be found elsewhere, because a penchant for elaboration of details tends to obscure the broad outline of the theory.

Of the two volumes, the first seems the more useful for teaching physics. The style of presentation is interesting and lively. The first volume shows good balance between the development of the general theory and illustration of that theory with detailed examples. The second volume lacks the unity of development and sense of direction of the first. Concern is primarily for specialized techniques for specialized problems of interest more to engineers than to physicists.