

Orbital Mechanics

Theory of Orbits: The Restricted Problem of Three Bodies. By V. Szebehely. Academic Press, New York, 1967. xvi and 663 pp. \$25.

REVIEWED BY F. T. GEYLING¹

DR. SZEBEHELY'S book will probably rank among the most useful texts on orbital mechanics that have appeared in recent years; especially so, since it covers a subject that has not been overworked by modern textbook authors: the restricted three-body problem.

This treatise goes well beyond the obligatory treatments of Jacobi integrals, zero-velocity curves, and earth-moon transfer trajectories which prevail in current texts on space flight. While the author encourages applications of his material to aerospace trajectory work and cosmogony, he devotes the major part of the text to a thorough exposition of classical astronomical theories and the related mathematical techniques, including some modern efforts in topological dynamics.

His expository style, in approaching new topics, follows the time-tested stratagem: Be specific first and generalize later. Thus, the discussion usually opens with very simple analytic models and specific numerical examples to fix ideas. The more advanced material reflects in many places the philosophy that qualitative and formalistic dynamics, on one hand, must be complemented by quantitative dynamics on the other. The former includes regularization, classical series expansions, and canonical transformations and must describe the general character of permissible motions, including their bounds, dependence on initial conditions, and the existence of periodic solutions. Complementing this, the quantitative results obtainable with high-speed computing techniques lend practical significance to various classes of orbits, exhibiting their evolution with changing initial conditions and mass ratio among the primaries. Each chapter concludes with a detailed commentary on numerous references. Thus, in style and content, the book effects a successful compromise between the needs of students, engineers, and research workers in orbital mechanics.

Shells

Thin Elastic Shells. By H. Kraus. John Wiley & Sons, Inc., New York, N. Y., 1967. xvi and 476 pp. \$18.95.

REVIEWED BY A. KALNINS²

THIS BOOK presents a modern up-to-date treatment of the theory of thin elastic shells and its applications. It is divided in four parts: (I) geometry and basic equations, (II) static analysis (III) dynamic analysis, and (IV) numerical methods of static and dynamic analysis.

Part I gives the necessary concepts of geometry and develops

¹ Head, Analytical Mechanics Department, Bell Telephone Laboratories, Whippany, N. J.

² Professor, Department of Mechanics, Lehigh University, Bethlehem, Pa. Mem. ASME.

the basic equations of the linear classical theory. The method of derivation is essentially the one used by E. Reissner (*American Journal of Mathematics*, 1941). Furthermore, a brief discussion of some improvements proposed for the classical theory is given, and Part I is terminated by an account of E. Reissner's version of a large deflection and rotation theory for an axisymmetrically loaded shell of revolution.

Parts II and III contain a discussion of the methods of analysis for various special cases, such as membrane shells and some shells of revolution. Some approximate methods of solution are also given. Part IV presents the latest numerical methods for the static and dynamic analysis of arbitrary shells of revolution. Solutions obtained by various methods are discussed and compared.

The strength of this book lies not so much in the presentation of the theory, but rather in the excellent treatment of the available methods of analysis. The comparisons given in Parts II and IV of actual solutions obtained by various methods will give the reader a good idea of the applicability of the methods. The book can be strongly recommended to a teacher of a graduate course on shells as well as to an analyst who is concerned with obtaining solutions of shell problems.

Fluid Mechanics

An Introduction to Fluid Mechanics. By G. K. Batchelor. Cambridge University Press, Cambridge, England, 1967. xviii and 613 pp. \$13.50.

REVIEWED BY A. D. YOUNG³

THE AUTHOR, as editor of the *Journal of Fluid Mechanics*, must be well aware of the recent spate of books on fluid mechanics and the growing difficulty of justifying yet one more book. Nevertheless, he need have no qualms; this is a magnificent book which will readily find a place with the other great classics of the subject.

Its scope is indeed classical although there is much that is new and illuminating; its outstanding qualities are an acute physical insight and a thorough and logical development. It is designed for applied mathematics students, but it is the physics that is consistently stressed and the mathematics is well within the scope of scientists and engineers. Even established fluid dynamicists will find this book a great stimulus.

The first three chapters provide a general foundation applicable to all developments and the relationships between molecular behavior and macroscopic properties are rightly stressed. The remaining four chapters concentrate on the laminar flow of an incompressible fluid. Viscous effects take pride of place, the development moving logically from flows at small to large Reynolds numbers; then come irrotational flows and finally rotational flows and vortex systems. The text is strikingly illustrated by a magnificent collection of plates. Professor Batchelor pleads that lack of room has caused him to omit such topics as turbulence, heat and mass transfer, and magneto-fluid dynamics, but he promises a further volume if the reception of this one is encouraging. It is to be hoped that he will be so encouraged.

³ Professor, Queen Mary College (University of London), London, England.