

Gas Film Lubrication. By W. A. Gross. Wiley, New York, 1962. 413 pp. \$14.00.

With the current trend to high speed, high temperature, cryogenic temperature, radiation environment, long life, reliability, no contamination, etc., considerable interest has been focused on process fluid lubrication. Thus, a number of researchers have been working on the theory and practice of gas lubricated bearings.

In the last five years the open literature has had numerous contributions in the field of gas film lubrication. The First International Symposium on Gas Lubricated Bearings, sponsored by the Office of Naval Research in 1959, published many of the significant works of the time in a report ACR-49. More recently WADC Technical Report 58-495 on "Gas Lubricated Bearings, A Critical Survey" was issued. This book serves as a good reference up to 1961 and as such provides a very valuable contribution.

The author's purpose is to present, in unified form, the available work with slider, journal, and sector thrust bearings and this he accomplishes. The source of much of the material has been the published papers of engineering societies although some unpublished work of the author and his associates is included.

Wherever possible the book uses dimensionless parameters which makes the results more generally applicable. A familiarity with ordinary differential equations is necessary and knowledge of partial differential equations is desirable so as to enable maximum utilization of the book. An understanding of numerical methods is also profitable here.

While the book deals with both journal and thrust bearings it concentrates on the latter and does provide a number of useful results. The text is primarily devoted to compressible lubrication but it also includes incompressible results in a number of places. Unfortunately, only small portions of the book are devoted to unsteady films. The troublesome problems of instability (Half-Frequency Whirl—in the case of self-acting bearings, and Gas Hammer—in the case of externally pressurized bearings) are glanced over very lightly. Yet a better understanding of these problems is necessary in order to apply gas bearings widely.

While the book presents many equations, tables, and graphs, which the design engineer may use, it loses much of its value by not presenting the development of the fundamental fluid film equations. Since the technology is advancing very rapidly many of the references of as late as 1961 are already obsolete and only fundamental relations ensure the long term value of a book.

A handbook abstracts material from numerous sources and presents to the reader pertinent formulas, tables, graphs, etc. Unless all the limitations are clearly stated, there exists the danger that the information will be misleading and, therefore, misapplied. While the author undoubtedly knows the limitations imposed in the references, there seem to be a number of places where qualifying statements should have been made. When reading this text one is left with the impression that the author did not scrutinize the published literature but presented it as reference material for the reader to critically review. While this approach is satisfactory for a reference book it cannot help but detract from some of the book's value.

The appearance of this book is very timely and it will

provide valuable information to the researcher and designer.

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(About the Reviewer: Dr. Beno Sternlicht is Technical Director and Chairman of the Board of Mechanical Technology, Inc. which he co-founded in October, 1961. Prior to this, he was with General Electric Company's General Engineering Laboratories where he was concerned with the technical direction of the Bearing and Lubricant Center until 1958 when he was appointed a Consulting Engineer. He has taught graduate courses in applied mechanics, is a co-author of a theoretical book on hydrodynamics, and is a well-known authority on lubrication, hydrodynamics, and dynamics of machinery.)

The Challenges of Space. HUGH ODISHAW, ed. Univ. of Chicago Press, 379 pp. \$6.95, 1962.

"This book is not concerned with prophecy. It is largely an exposition of what exists today and what is scientifically and technically within reach. Its purpose is twofold: to outline the variety of activities—technical and scientific, domestic and international—that make up man's space endeavors, and to stimulate analysis of these activities." Thus the editor introduces the book.

The book deals with five aspects of space programs in more or less equal treatments by page count. The first of these sections concerns Applications of Space Research. All of the content here seems to be centered about the two key problems of communications and meteorology. The chapters on these subjects are excellent; but there is a definite lack of the space applications which are fallouts from the new technology. Some effort should have been devoted to presenting those advances in our standard of living and our health resulting from space research.

Secondly the book covers Space Research in an excellent collection of writings by top technical men. The first chapter on Biology and the Space Environment might better have been placed in the final part of the book. The chapter covers the technological problems of men in space and does not belong among the basic science oriented works. This might also have given the final chapter a more complete engineering orientation.

The third and fourth parts of the book deal with National Space Programs and International Space Cooperation. It is noteworthy that at this early time in space exploration these two chapters should require 43% of a text on the Challenges of Space. Although much of their content is out of place in this book, a good presentation is made in all aspects of these subjects, including the evolution and operation of existing organizational structures.

The final part of the book deals with Space Technology. There is a chapter on space vehicles and two chapters on propulsion schemes. This is the weakest part of the works, not due to the contributions of the authors, but due to its many light treatments and oversights. Technological developments are key challenges to accomplishing the future space missions. Neither the missions (flight technology) nor the technical subjects such as structural developments, guidance, control, life support, shielding, and other prob-