BOOK REVIEWS

MOONS, MOTORS AND MARS

Advances in Space Science and Technology

Vol. 8. Edited by Frederick I. Ordway, III. Pp. xiv + 396. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1966.) 128*s*.

PREVIOUS volumes in this series have provided lengthy reviews of known techniques or speculative essays on future developments in space science and technology. The present volume conforms to this pattern and consists of four lengthy contributions.

The first is a persuasive discourse in support of the volcanic theory of lunar craters, by G. J. H. McCall. The author is a geologist, and his arguments depend largely on detailed examination of the pattern of the craters and the way in which the smaller bite into the walls of the larger. He also produces some interesting new comparisons with terrestrial features. His thesis, though it may have little impact on exponents of the meteoric school, really leaves them with a great deal to explain away.

In Chapter 2, which runs to 130 pages, the structure of lunar craters has yielded place to the structure of solid-fuel rockets. The case of a solid-propellant rocket not only houses the propellant but also has to withstand the hot pressurized gases and carry the flight loadings due to aerodynamic forces; furthermore, its weight has a critical effect on the rocket's performance. The authors of this chapter, C. W. Bert and W. S. Hyler, provide a very thorough survey of the subject, covering stresses, structural design, reliability, forms of fracture, fatigue behaviour, environmental effects and other factors, with 317 references to support their case.

The third and longest chapter, by G. W. Morganthaler and G. E. Fosdick, is devoted to the future exploration of the solar system. Readers may quail when faced with a speculative preview extending to 150 pages. And they may also be irritated by the assumption that up to 1 per cent of the gross national product of the U.S.A. will continue to be devoted to space exploration: anyone with the smallest concern for the happiness of mankind could find better uses for $\$10^{10}$ per year, or even $\$10^{9}$; and if that concern is absent, is our way of life worth exporting to the planets? However, any such irritation tends to evaporate as one reads on. Although the authors are prone to quote 'authorities' of doubtful worth, their survey is impressive in its scope and detail. They provide extensive tables giving a complete space programme, with costs yearly for the next three decades, including manned spacecraft for landing on Mars and fly-by of Venus. It is quite a relief to find that the total cost is only about $\$10^{11}$.

In the final contribution, which is almost an appendix to the preceding one, E. A. Steinhoff considers the logistics of exploring Mars and its satellite Phobos. In particular he discusses how far to exploit extra-terrestrial resources instead of bringing all the required materials from earth.

In its printing, production and price, as well as its contents, the book maintains the high standard of its predecessors.

D. G. KING-HELE

GYRO-MECHANICS

Mechanics of Gyroscopic Systems

By A. Yu. Ishlinskii. Translated from the Russian by A. Barouch. Edited by T. Pelz. Pp. iv + 313. (Jerusalem: Israel Program for Scientific Translations; London: Oldbourne Press, 1965.) 135*s*.

THIS is primarily a textbook on the geometry and kinematics of gyroscopic systems. As such it is excellent, particularly in the development of mathematical expressions where the author applies approximations immediately they become relevant and not, as is commonly done, at a stage long after the less mathematical reader has lost the trend of the argument.

The scope of the book, however, is largely limited to geometry and kinematics. This, to some extent, is explained by the date of the first edition (1952) and that this is the first revision. Before 1950, the use of unmonitored gyros was almost entirely restricted to marine applications with a few exceptions such as the twin gyro guidance system of the German *V*2 rocket. The philosophy of this latter guidance system is clearly explained in the book. The continuous rolling and pitching of a ship makes gimballing errors of major importance, and a proper understanding of these, as is given in this book, is essential to the marine gyro designer. Since 1950 a vast amount of research and development has been done on gyros in connexion with inertia navigation. In this field, where the premium on space limits gyro angular momentum to values two or three orders of magnitude less than those of marine gyros, investigations have of necessity been directed towards ways and means of minimizing random precession of the gyro, arising from such sources as instability of the position of the centre of gravity, frictional torques in the gimbal suspensions and anisoelasticity of the rotor bearings. These topics are touched on in one chapter of the book and the few examples given are well chosen, but the treatment is too limited in view of the vast strides which have been made in the past two decades in the development of new suspension systems and in the development of single axis rate and rate integrating gyros.

I consider this book excellent in its analysis of the geometry and kinematics of gyro mechanics but I hope that in a future edition the appendix on inertial navigation will be brought into the body of the book so that the mechanical design difficulties of small angular momentum gyros and the methods adopted to overcome them could be analysed and thereby add to what is already an excellent textbook.

A. I. STEVENSON

EMIL ARTIN, MATHEMATICIAN

The Collected Papers of Emil Artin

Edited by Serge Lang and John T. Tate. Pp. xvi + 560. (Reading, Mass., and London: Addison-Wesley Publishing Company, Inc., 1965.) 102*s*.

EMIL ARTIN was born in Vienna in 1896. His father was an art dealer and his mother an opera singer. Artin himself