

# BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.



## BOOM BOON

*Title* The Constructive Uses of Nuclear Explosives

*Authors* Edward Teller, Wilson K. Talley, Gary H. Higgins, and Gerald W. Johnson

*Publisher* McGraw-Hill Book Co., 1968

*Pages* xiv + 320

*Price* \$12.75

*Reviewer* Samuel Glasstone

Toward the end of 1956, when the closing of the Suez Canal by Egypt had caused some uncertainty in the world situation, a group of scientists met at the Lawrence Radiation Laboratory, Livermore, California, to discuss the possible use of nuclear explosives to construct another canal in a more friendly country. The activities of this group led the USAEC to establish, in 1957, the Plowshare program for the development of peaceful uses for nuclear explosives.

Although the original plan for constructing an alternative to the Suez Canal was discarded, earth moving and excavation have remained the major, but not exclusive, interests of the Plowshare project. It is in this area that nuclear explosives seem to offer the greatest economic potential. Other possible applications for nuclear explosions are to shatter underground rock formations for stimulating gas release, to break rock for mining purposes, and to heat deposits of oil-bearing sands for the recovery of petroleum. In addition to their use in projects of economic significance, there are a number of applications of nuclear

explosions that are of purely scientific interest. These include measurements of neutron cross sections as a function of energy, utilizing time-of-flight techniques, the production of new isotopes of heavy elements, and studies in seismology.

In *The Constructive Uses of Nuclear Explosions*, the authors describe the basic ideas, both theoretical and practical, of the Plowshare program. The format is derived from the lecture outline of courses on the subject taught at the University of California, at its Berkeley and Davis campuses, mainly to seniors and graduate students in civil and nuclear engineering and in physics. It is to readers in these general categories, as well as to practicing engineers of various types, that the book is directed. Some knowledge of physics, chemistry, and mathematics is assumed, but not of the phenomena associated with nuclear explosions.

The book starts with a short but adequate outline of the effects of nuclear explosions and their possible uses. This is followed by a chapter entitled "Aspects of Energy Transfer," which covers a variety of topics, including the derivation of the simple gas law equation from kinetic theory, at one extreme, to a discussion of the Liouville theorem and the Thomas-Fermi atom model, at the other. In the reviewer's opinion, it might have been to the reader's advantage if the treatment had been restricted to those areas of energy transfer that find direct application in the remainder of the book. One of the main problems arising in connection with the peaceful uses of nuclear explosions is to make sure that there are no hazards, either to human beings or to ecological systems, from radiations associated with such explosions. This matter is discussed in some detail,

and the authors conclude that "from all the information we can gather, dangers from radioactivity are not of a limiting nature in the constructive use of nuclear explosives."

The longest chapter in the book is appropriately concerned with Plowshare tests and the phenomena associated with underground nuclear explosions. The results of numerous experimental explosions are described and correlated with theoretical models, thus permitting predictions to be made for many situations of possible interest. This is followed by a chapter on the use of nuclear explosives for various earth-moving projects, such as the construction of canals and harbors. It is of interest in this connection that, contrary to the practice in the United States, engineers in the U.S.S.R. often use conventional high explosives for large-scale excavations in a manner similar to that proposed in the Plowshare program. Since the cost of the cheapest chemical explosive is \$120/ton TNT equivalent, compared with \$35 to 30 cents for nuclear explosives, depending on the particular yield, the use of the latter would appear to be especially attractive. The next chapter describes possible industrial uses of nuclear explosions, other than earth moving, and finally, there is a short section on the scientific applications of nuclear explosions.

Although physicists and chemists may be somewhat disappointed in the relatively brief treatment of the scientific uses of nuclear explosions, engineers will find a surprising amount of valuable information in this book. In recent years there has been a growing interest among civil, mining, and petroleum engineers, in particular, in the potential applications of nuclear explosives. The book under review will provide them with the necessary background for

understanding the possibilities as well as the problems involved. However, one problem does not appear to be mentioned: Before nuclear explosives can be used for earth-moving projects on a large scale, some modification of the nuclear test-ban treaty will probably be required, and this may not be easy to achieve.

*Samuel Glasstone is a resident consultant at the University of California, Los Alamos Scientific Laboratory, and is well known for his books, which include The Effects of Atomic Weapons (1950), and two editions of The Effects of Nuclear Weapons (1957 and 1962). He graduated from the University of London, England, with MS, PhD, and DSc degrees in physical chemistry, but entered the nuclear field in 1948 when the USAEC asked him to write the Sourcebook on Atomic Energy. His books on physical chemistry and nuclear science and engineering have been translated into ten foreign languages. In 1959, he was given the Worcester Reed Warner medal of the American Society of Mechanical Engineers for "outstanding contributions to the permanent literature of engineering" and, in 1968, he received the Arthur Holly Compton award in education from the American Nuclear Society.*

**OPPORTUNITY OR CHAOS ?**

**Title** Scientific Progress and Human Values  
**Editors** Edward and Elizabeth Hutchings  
**Publisher** American Elsevier Publishing Company, Inc., 1967  
**Pages** iv + 219  
**Price** \$7.50  
**Reviewer** Kenneth S. Pitzer

This book presents the proceedings of the conference celebrating the 75th anniversary of the California Institute of Technology in Pasadena, California, October 25-27,

1966, with an added preface by Lee A. DuBridges. In all, there are fifteen papers by outstanding authorities in various areas of physical, biological, and social science, as well as education and technology, together with a panel discussion on the subject "What are the Urgent Problems?"

There is no pretense of evenness in the coverage of various frontiers of knowledge, but the choice of topics and author-speakers is excellent. Each chapter gives a fine summary of recent advances and the current status of a particular field, and in some cases there is also a very penetrating and thought-provoking discussion of future problems and possibilities. I found particular interest in the discussions of the relationship between modern biology and the problems that may confront our civilization. For example, Professors Sinsheimer and Bonner suggest that it may soon be possible to separate male-producing from female-producing sperm and thereby allow parents to choose the sex of their children. How will society wish to use this possibility?

This book contains many speculations of similar developments with far-reaching consequences.

*Kenneth S. Pitzer (PhD California, 1937) has won distinction in education, science, and government. Dr. Pitzer is President of Rice University and serves as a Director of the Federal Reserve Bank of Dallas, a Director of the American Council on Education, and as a Trustee of the Rand Corporation, the Carnegie Foundation, and Pitzer College. From 1949 to 1965, he served with the U.S. Atomic Energy Commission, first as Director of the Division of Research, then as Member and Chairman of the General Advisory Committee. A member of the President's Science Advisory Committee, he has received numerous honors recognizing his contributions to molecular spectroscopy, thermodynamics, and quantum theory and statistical mechanics applied to chemistry; his most recent award being the American Chemical Society's Priestley Medal for 1968.*

**BOOKS OF INTEREST . . .**  
**From American Elsevier**

**REACTOR DYNAMICS AND CONTROL**

**State Space Techniques**

*Lynn E. Weaver.* Presents recent advances in modern control theory and their applications in nuclear dynamics control. Reviews mathematical concepts on which the state variable approach is based and problem formulation. Various reactor models are discussed, and optimal control is considered with application to optimal reactor control for various performance indices. A new approach to reactor control, termed state-variable-feedback design is introduced and specific examples of design given.

317 pages. 1968 \$15.00

**THERMAL STRESS TECHNIQUES IN THE NUCLEAR INDUSTRY**

*Z. Zudans, Tsi Chu Yen, and W. H. Steigelmann.*

A well-organized and readable book useful either as a text or as a reference for workers in the field. Gives theory, examples, illustrations and detailed procedures required for the full understanding and solution of problems in the nuclear stress field.

605 pages. 1965 \$20.00

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