1958. The volume was originally published in Russian in 1960.

The book contains papers on a wide range of subjects, including production of thorium, chromium, niobium, zirconium by the iodide process, and the properties of the metals produced; survey discussions of the metallurgy of beryllium and the rare-earth metals; the problems associated with using liquid Li as a reactor coolant; and the distribution of alloy constituents after a number of heat treatments.

The first four chapters describe Russian use of the iodide method for refining Th, Cr, Zr, Hf, and Nb. (Nb metal refined by the iodide process is confusingly called "niobium iodide.") The mechanical properties of the products are compared with the same metals refined by other techniques. Analyses for nonmetallic impurities are not given. Chapter 5 describes in detail an investigation of the Zr–Al–Be phase diagram.

Chapters 6, 14, 15, 16, 17 describe studies on liquid Li technology. These include production and uses of Li (a survey paper), measurements of solubilities of Fe, Cr, Ni, Zr, and U in Li, and studies of interactions between Li and components of steels. These chapters are of considerable interest to U. S. workers in liquid metals technology. The conclusions are similar to those of U. S. writers in this area. Results of the radioactive tracer experiments to determine the role of C, P, S in steels on their behavior in Li are particularly interesting.

Chapters 7–13 describe work on oxidation of Zr and on diffusion and electrodiffusion in Zr-base alloys. The paper on oxidation of Zr alloys offers little that is not familiar to U. S. workers in this field. The diffusion and electrodiffusion studies are particularly interesting because of the extensive use of radioactive tracers and autoradiography. Alloying elements studied include Sn, C, Pb, Ag, and Ni.

Chapters 18–20 describe an internal friction apparatus suitable for measurement up to 1600°C, and the results obtained with it on U and on Zr and Nb and their alloys. Measurements include temperature dependence of the shear and elastic moduli, and their behavior during structural changes.

Chapters 21–25 describe work on the distribution and diffusion of C, S, P, Fe, Ni, Cr in steels using radioactive tracers. The results using radioactive P and S are especially noteworthy.

The final two chapters survey the production and uses of rare earth metals and Be and are principally survey papers. Much discussion is made of the use of Mg alloys with Th and rare earths in the U. S. for jet engines. Russian techniques for melting and casting Be are described.

The title of the book obviously does not indicate its diverse contents. As in any foreign translation the choice of technical words is not always ideal; the meaning, however, is always clear. References are nearly all to Russian work or to the Russian language editions of western writings. Names of Western authors are often distorted upon retranslation and have not been corrected by the editor. A reconversion of references to those familiar to readers of the English edition would have been desirable. The book is not indexed.

This book gives a very interesting description of Russian research in metallurgy. Experimental techniques are often carefully described with clear drawings. Its usefulness as a reference lies principally in the interesting work with autoradiography, which this book shows to have become a powerful metallurgical tool, and in the studies of phase transformations by internal friction measurements.

JOHN R. WEEKS
Metallurgy Division
Brookhaven National Laboratory
Upton, New York

(About the Reviewer: Dr. John R. Weeks is currently group leader in corrosion research in the Metallurgy Division at Brookhaven National Laboratory. Since coming to Brookhaven in 1953, he has been engaged in research in liquid metal corrosion and liquid metal fuel constitution, and is currently materials consultant for the high flux beam reactor under construction at Brookhaven. During 1962–3 he served as an adjunct associate professor at the State University of New York at Stony Brook.)

Advances in Computers, Volume 3. FRANZ L. ALT AND MORRIS RUBINOFF, eds. Academic Press, New York, 1962. 361 pp. $12.00.

This book, Volume 3 of *Advances in Computers*, is the latest and best of the three volumes which have been published in this series. It also contains more information of interest to members of the nuclear science and engineering fields than the previous two volumes.

The book consists of six articles:

The Computation of Satellite Orbit Trajectories, by Samuel D. Conte, pp. 2–76.

Multiprogramming, by E. F. Codd, pp. 78–153.

Recent Developments in Nonlinear Programming, by Philip Wolfe, pp. 156–187.

Alternating Direction Implicit Methods, by Garrett Birkhoff, Richard S. Varga, and David Young, pp. 190–273.

Combined Analog-Digital Techniques in Simulation, by Harold K. Skramstad, pp. 275–298.

Information Technology and the Law, by Reed C. Lawlor, pp. 299–346.

The first article dealing with the computation of satellite trajectories is very comprehensive and presents a thorough discussion of various methods of numerically integrating systems of ordinary differential equations. The discussion involves a consideration of the complexity of the integration formulas, their flexibility, their speed, their accuracy including round-off, and the computer storage requirements. The various methods are compared with the above considerations and numerical results are presented. This article should be read by anyone concerned with nuclear space flights or reactor kinetics calculations.

The article dealing with multiprogramming deals with the concurrency of operations within computer systems. While this is of considerable importance in speeding up reactor calculations, it is not of direct interest to members of the nuclear field.

The discussion of nonlinear programming indicates the general methods which are used in attacking systems of nonlinear algebraic equations. Linear and nonlinear programming has found considerable use in solving economic, scheduling, and distribution problems. A theoretical discussion is given of the methods of differential gradient, large-step gradient, simplicial, columnar, and the cutting-plane. References are given to computer routines and the literature.

The most interesting article for individuals concerned with two- and three-dimensional reactor calculations deals with alternating direction implicit methods (ADI). The authors of this article have all contributed substantially to the more efficient numerical solving of partial differential equations. This article concerns generalization of the Peaceman-Rachford and Douglas-Rachford methods and the application of these ADI methods to a general Helmholtz equation. The ADI methods are compared with variations of the successive overrelaxation methods. Almost 20 pages are devoted to presenting the results of numerical experiments involving ADI methods.

The use of combined analog-digital techniques in simulation has a history of about 10 years. This article outlines how analog and digital computers can be combined to solve dynamic systems problems and therefore should be of interest to those concerned with reactor control problems.

The final article is concerned with the information explosion and the law and vice versa. While these comments are concerned with the impact of computers on the legal profession, they are of considerable interest to anyone living in the American culture. The charts exhibiting the growth of literature in medicine, biology, and law are frightening. One can wonder if the growth of literature is equally as rapid in other technical fields such as nuclear engineering.

WARD SANGREN
Computer Applications Inc.
San Diego, California

(About the Reviewer: Ward Sangren is a vice president of Computer Applications Inc. and the associate editor of the SIAM Journal. He is the author of a book on digital computers and nucelar reactor calculations. From 1956 to 1961 he was at General Atomic. Prior to that he was at Curtiss-Wright and at the Mathematics Panel of Oak Ridge National Laboratory, and was for two years an assistant professor of mathematics at Miami University.)

Rare Earth Research. Collected papers presented at the second conference on rare earths in September 1961 at Glenwood Springs (Colorado). JOSEPH F. NACHMAN AND CHARLES E. LUNDIN, eds. Gordon and Breach, New York, 1962. xv + 354 pp. $14.50.

The second important conference on recent rare earth researches was, by happy choice, held in Glenwood Springs (pop. 2,412) Colorado, which is located near the junction of the Roaring Fork and Colorado Silt Rivers, and is about a hundred miles southwest of the Rabbit Ears Range and some fifty miles west of Holy Cross Mountain.

For the further information of eastern provincials, Colorado lies west of Dodge City. The state was once noted for its gorgeous mountains; for its rich mines of precious metals, coal and iron; for its colorful saloons, each with its own Sweet Piano Nell and ladies of tarnished charms; and as the residence of an acute newspaper editor and an author of a modest but classic book on determinants. The wonder inspiring mountains and rich mines are still there; the saloons have given way to reputable universities; and the editor and the mathematician are long gone, but will never be forgotten. This then was the setting for the second rare earth conference.

Some thirty papers—representing the efforts of over fifty authors—were presented at the conference. The subject matter ranges from the chemical and thermodynamic properties of the rare earth elements and their compounds to the physical, mechanical, and metallurgial properties of the metals and their alloys. In itself the book might well be classed as the second volume of a yearly journal on the rare earths, and a good one too. There are scorpions who complain bitterly about conference publications; but those fierce critters should be put in a bottle, after being reminded that it is better to have a score or more of unified papers under one cover than to have to search for them in a score of journals.

It is clearly impossible, in a short review, to touch on the salient points of each paper in Rare Earth Research. At least one paper, that of Kirkpatrick and Love, tells what the rare earth metals look like; this is a hopeful sign, for even those with long experience in chemistry and physics find that voltmeter readings are no substitute for a visual examination of an object of study. The papers originate from many university, industrial, and government laboratories, and of course from Ames. (Harvard, M.I.T., and Brookhaven seem not to be represented among the authors, and so one may surmise that their faculties were preoccupied with major national crises at the time of the conference.)

First in this well printed book is the clear and vivid introductory address which Professor F. H. Spedding (of Ames) gave at the conference. This is a welcome addition to the book in that it presents a brief account of the history of the rare earths and their theoretical and practical importance, along with a peek into the bright future for these fascinating (and sometimes irrascible) elements. It would be counted as ill-tempered to complain about the address; but the present reviewers must point out that if its author were as familiar with copper, silver and gold as he is with the rare earths, he would never have claimed that the latter were as different among themselves as the former are among themselves. Why, even some two hundred years before Cleopatra was wont to dally with certain Romans while boating on the Nile, the brilliant geometer of Syracuse had already devised an acceptable method for determining the purity of the gold in a king's crown with but little more apparatus than a bath tub. To determine easily whether or not the thulium metal in a novel western pistol had been alloyed with gadolinium would probably pose a problem requiring much more knowledge and apparatus than the geometer ever dreamed of. Even access to modern undergraduate texts on chemical analysis wouldn't be of much help either.

By and large the work reported on in the book shows all signs of being of high caliber. It is fairly obvious that the scientists responsible for the many researches described are, scientifically speaking, incredibly fast guns. (This includes Professor Spedding, of Ames.) The book will be a *sine qua non* both to the specialists and to all real chemists and their handmaidens, the physicists.

While statesmen and self-styled humanitarians were quarreling over their domains and their ideologies, the more than fifty authors of Rare Earth Research were carefully investigating their environment, both for the satisfaction it gives to the inner mind as well as for the