cess of any educational program in science must be adequate and skillful laboratory instruction; for the sciences, with the exception of mathematics, are fundamentally experimental sciences, and derive their meaning and significance in the last analysis only from observation. In this problem those schools which handle large numbers of students are at a serious disadvantage, since it is just in the experimental approach to a science that nothing can really replace individual experience. We at the Massachusetts Institute of Technology are confronted with such a problem, since at present some 1700 students study basic physics, and I can assure you that the problem of supplying adequate and meaningful laboratory instruction for all these students is by no means trivial. One of the great dangers of teaching the experimental sciences without laboratory experience is that of unwittingly creating in a student's mind the notion that science is essentially deductive in nature. A law or principle is stated either by the teacher or by the book and everything is then to be deduced from these authoritative starting points. Nothing could be more harmful to a proper understanding of the very essential inductive methods of reasoning, the generalizations from experimental experience, the probings and assumptions, and the speculations which characterize a true scientific approach to a problem. It is perhaps even more important to enable a student in the sciences to gain an insight into the manner in which the great principles have come into being, starting from experimental observations, than to acquire mechanical facility in applying well-established principles to specific problems. Just as there is a dual aspect to science, viz., pure and applied, so are there dual objectives in the teaching of science in caring for those who intend to go on professionally in the sciences and their application, and for those who will not require further education in these areas. It is my opinion that the same broad principles which I have already presented are valid for both types of students but there may well be a somewhat greater emphasis on the applications of science to technology and industry for nonscience majors than for the science majors in any given student body. In fact, a student who intends to embark on a scientific career would benefit by learning science at the secondary school level almost exclusively as a cultural subject, designed to enhance his intellectual breadth, and the applied aspect should be minimized. Since the secondary schools operate at that stage of education where interest in science essentially starts, and students begin to feel the direction in which they wish to move in later life, these schools can be looked upon properly as the primary source of the scientific manpower of the nation.

If what I have been telling you this afternoon is significant, then the extraordinary importance of science education in the secondary schools becomes evident. All of us who are concerned with scientific education look to schools such as Hebron Academy to lead the way in attaining effective solutions to these great problems which we all face.

Books

Library Organization and Management of Technical Reports Literature. By Bernard M. Fry. 140 pp. The Catholic University of America Press, Washington 17, D. C., 1953. $2.25.

Parallel with the growth of the published literature there has developed in recent years a new medium—the technical report. This book by the deputy chief of the Technical Information Service, United States Atomic Energy Commission, brings together in one volume interesting, and in some instances valuable, information on the documentation activities of the various federal agencies.

The book consists of six chapters and numerous tables, charts, exhibits and appendices. Chapters II and IV concern themselves with library practices such as administration of reports libraries, reference service, processing and cataloging. Chapter V contains a discussion of the handling of "security classified" documents.

Perhaps the most informative parts for both the scientist and the reports librarian are Chapters III, on producers and sources of technical reports, and IV, on the technical information service of the Atomic Energy Commission. In these chapters is found a concise and informative guide to the sources of scientific data, both published and unpublished, available from the various federal agencies. Included in Chapter III and its appendices are: a list of research and development organizations in the federal government, their principal fields of work, the location of main and field stations, and instructions concerning availability and source of reports issued; a list of AEC depository libraries; and a description of the abstracting journals issued by the Navy Research Section (now Armed Services Technical Information Agency), Atomic Energy Commission, National Advisory Committee for Aeronautics, and the Office of Technical Services, Department of Commerce.

The book also contains such incidental information as: Federal expenditures for research and development for the fiscal years 1940–50; total expenditures for research and development in the United States, 1941–52; distribution of the 137 000 scientists and research engineers in the United States, 1947; sources of annual production of technical reports in the United States in 1949; and the size, character, and annual growth of the technical report collections of some 29 research and development organizations in the country.

Fry's compilation provides a convenient source of information on governmental activity in the documenta-

tion of research, which, though not new to the readers of *Physics Today* (cf. Jan., Nov., Dec., 1951, Dec., 1952), requires an adequate and up-to-date guide. Though in some minor respects this work is already out-of-date, it nevertheless is a very good guide to the sources of government documents. **Joseph Hilsenrath**
National Bureau of Standards

Synchros, Self-Synchronous Devices, and Electrical Servo-Mechanisms. By Leonard R. Crow. 222 pp. The Scientific Book Publishing Co., Vincennes, Ind., 1953. $4.20.

Here, at last, is a simple description of synchro-type devices. With many pictures and a text containing almost no mathematics, the author describes the construction, operation, and some basic applications of these units. Representative commercially made devices are shown in cutaway sketches, while the operating characteristics of some are given in tabular form.

The first chapter is devoted to general information regarding construction, types of synchros, their ratings, and their accuracy. In other chapters, single and polyphase drives, synchro control transformers, and differential synchros are considered, while an entire chapter deals with "Instructive Experiments With Synchros". If one simply takes the stated experimental results in this series on faith without bothering to confirm them oneself, one will have gained much information on the behavior of the devices considered. The experiments themselves form a useful series for instructional purposes in a laboratory course.

Later chapters include one on servo-control units, error detection, coordinate transformation, and resolvers, and another on dc devices, electrical gearing, synchro ties between separate drives, and power synchros.

The last portion of the book is on devices depending on magnetic saturation for induction or motion. Simple mathematical explanations are given for these, and there is a good description of educational devices of this type.

For the person who requires a general knowledge of "how they work" without going into the actual design considerations of synchro devices, here is an excellent book. **Joseph N. Ratti**
Engineering & Research Corporation

Introduction to the Theory of Functions of a Complex Variable. By Wolfgang J. Thron. 230 pp. John Wiley and Sons, Inc., New York, 1953. $6.50.

When one approaches a new book on the subject of complex variables it is natural to expect a fresh approach to this subject which is usually the product of the author's teaching experience. Although there are numerous treatises on complex variable theory and several of these are rated as classics it is not unusual for a student to find that his instructor will recommend several texts as references and then proceed to develop the subject according to his own interests.

The thesis which is presented here is that the student of mathematics is deserving of a rigorous treatment development from first principles. The claim that no previous mathematical knowledge is required is literally true—but it goes without saying that it is advisable to approach this book with some degree of mathematical maturity.

The book may not appeal to the engineer or physicist since the point of view taken here is not of application to their problems but rigorous development of the subject. However, it can be said that those applied scientists who have not had the opportunity of studying complex variable theory as presented by Thron will always have had a gap in their mathematical training. Here they will have the opportunity of laying a foundation for themselves in rigorous mathematical thinking and the ability to tackle their problems with a bit more than "intuition".

It is usual to claim for a new work in mathematics the property of enabling the prospective reader to be able to pursue the study of the material by personal study. There is no question but that this volume meets this requirement. The student who has already had a course in complex variable will find that the development here will give a deeper understanding of the subject. The more mature mathematician who wishes to refresh his knowledge of complex variables will find not only this but an introduction to a number of other subjects of importance. The teacher will find here an excellent outline which he may follow in his lectures. The material is self-contained and although there are no references to other works, this omission will not be felt.

A deliberate and successful attempt has been made to present the material in a logical step-by-step manner. The style followed here is that followed in the classical works of Landau, namely that of "theorem-proof" without any intermediate discussion. This method of stating precisely what one wishes to prove is particularly helpful to the student. It goes a long way in helping to understand the proof itself. Professor Thron has emphasized the continuity of his presentation by calling the subdivisions of his work sections rather than chapters. This serves to remind the reader of the dependence on previous developments. There are thirty-one such sections followed by an index. Those ideas that are of importance to the logical development are introduced so that one finds here an introduction to such topics as set theory and topology. A critical study is made of the Jordan arc theorem and its presentation as given here fills a long felt need in complex variables texts in the English language. The Cauchy-Riemann equations have been accorded their proper place in one of the later sections devoted to conformal mapping. Most of the earlier works derive these conditions at the start and tend to confuse the student in his understanding of the importance of the Cauchy integral theorems.

The first three sections discuss the fundamental notions of sets, real numbers and cardinal numbers. In section four, complex numbers are introduced with par-