

fundamentals of pulse amplitude distributions, operation and construction of spectrometers, single-channel and multichannel spectrometers, computer methodology, multiparameter approaches, and applications. There is a significant amount of redundancy within the chapters; however, this redundancy permits selective reading of individual chapters without reference to those previous. The content ranges from the very basic concepts of an electrical pulse to rather sophisticated discussions of mathematical modeling for spectral analysis and data processing.

Chapter one on preliminaries provides a readable and complete description of what is meant by a pulse and its descriptive parameter and gives a brief survey of pulse-height distributions and spectrometers as well. There is a concise description of the most common transducers for generation of electrical pulses for the subsequent recording and analysis. Also included is an overview of the parameters of single and multichannel spectrometers, which are described in much greater detail in subsequent chapters.

Chapter two describes types of measured distributions analyzed, typical displays, and data processing. It begins with a rather basic and repetitive description of how a multichannel analyzer works and some features present in most systems, including displays, concepts of real and live-time accumulation, and some basic data manipulation techniques. Many examples are presented based on specific models of multichannel analyzers from several manufacturers. A description of the applications of minicomputers to these systems is described, and an overview of other applications, such as multiscaling, multispectral scaling, time histograms, multichannel averaging, correlation analysis, probability analysis, analysis of Gaussian distributions, and Fourier transform analysis is included.

Chapter three, "Operation and Construction of Pulse Height Spectrometers," comprises over one third of the text. It presents a very good description of pulse amplifiers and characteristics of pulse preprocessing, including shaping, base line restoration, pile up rejection, and pulse stretching. Extensive descriptions of design and operation of several amplifiers and single-channel analyzers with specifications of many models are included. There is also discussion on the features of rate meters and high-voltage power supplies. Several examples of commercially available single and multichannel analyzers are described. Methods of analog to digital conversion, types of CRTs, and memory circuits are detailed. The description of the design of multichannel analyzers and parameters of operation is quite extensive. All of these discussions are illustrated with commercially available systems.

Chapter four discusses the determination of pulse height distributions with single-channel spectrometers. Some of this material is repetitive from previous chapters but describes different recording methods and interpretations of results. Error analysis from the standpoint of finite channel widths, time constants, and channel shift rates is discussed. A good presentation on the resolution of neighboring peaks and spectrogram processing is included.

Chapter five, "Determination of Pulse Height Distributions with Multichannel Spectrometers," begins with a discussion of the accuracy of the CRT display and presents a considerable amount of mathematical analysis of methods for determination of spectrum parameters.

Chapter six, on the determination of pulse height distributions by computer methods, presents material dealing with extensions

and automation of techniques discussed in the previous chapter. The three stages in the processing scheme (data smoothing, peak location, and determination of parameters of the peak) are clearly described. Several examples are used to illustrate each of the stages.

Chapter seven not only covers multiparameter spectrometers including methods of recording and display but also presents the applications of computers once again.

The final chapter, "Applications of Pulse Height Spectrometers," surveys the areas of nuclear engineering, medicine and biology, astronomy and space research, and physicochemical techniques.

Each chapter has an acceptable number of references and clear illustrations. For those users of pulse-distribution spectrometers who require a deeper understanding of the principles of operation and techniques for the analysis of results, this text will be valuable. It is not an introductory reference on pulse-height spectrometry but could be very helpful to those who rely upon these systems for accurate quantitative results.

PAUL MURPHY

Baylor College of Medicine  
Houston, Texas

**RADIOLOGIC SCIENCE FOR TECHNOLOGISTS: PHYSICS, BIOLOGY, AND PROTECTION.** 2nd ed. S. C. Bushong. St. Louis, The C.V. Mosby Company, 1980, 503 pp, \$21.95

This second edition of Dr. Bushong's textbook is primarily for students in radiologic technology. As noted in the preface, the expansion of material for this edition in the areas of basic physics, radiobiology, and radiation protection reflect the 1978 curriculum guide of the American Society of Radiologic Technology. The bold-style printing of terminology, shading of key physical relationships, and unique clarity of illustrations, in combination with a characteristically readable and sometimes witty text, make this an enjoyable textbook for radiologic technology students and instructors.

Separate chapters on mammography, computed tomography, diagnostic ultrasound, and design of radiology facilities are included in addition to the topics usually found in basic radiologic physics. Radiographic system components are generally well described; however, closed-circuit television and cinefluorographic systems receive rather brief treatment. Radiation protection is specifically presented in two chapters as well as being integrated throughout the text. The fundamentals of radiobiology, molecular and cellular effects of irradiation, and early and late radiation effects comprise four chapters.

Mathematical problems are presented in a simple, stepwise fashion with examples usually linking the theoretical to a clinical application. Review questions at the end of each chapter and an answer key for numerical problems contribute to the usefulness of this text in a radiologic technology instructional program.

RICHARD J. VAN TUINEN  
FDA, Bureau of Radiological  
Health  
Cincinnati, Ohio