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Instrumental analysis requires qualitative and quantitative information about the composition and structure of matter. Students of chemistry, food science, physics, geology, the life sciences, medical science, and engineering must have a need to develop an understanding of the basic principles of analytical methods to relate them to problems in their fields. This book is designed to serve the advanced undergraduate and other users of analytical chemistry in the physical sciences.

When users of this text are familiar with the fundamental principles underlying modern analytical instrumentation, they can make appropriate choices and efficient use of these measurement tools. For any given analytical problem, a seemingly bewildering number of alternative methods exist for obtaining the desired information. By understanding the advantages and disadvantages of the various tools, suitable choices can be made, and the user can be attuned to limitations in sensitivity, precision, and accuracy. In addition, users of instrumental methods should be aware of the various techniques for calibrating and standardizing instruments, and validating the measurements made. It is therefore our objective to give readers a thorough introduction to the principles of instrumental analysis, including spectroscopic, electrochemical, chromatographic, radiochemical, thermal, and surface analytical methods. By carefully studying this text, readers will discover the types of instruments that are available and their strengths and limitations.

ORGANIZATION OF THIS EDITION

This text is organized in sections similar to the sixth edition. After the brief introductory chapter, the book is divided into six sections:

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- » Section 1 contains four chapters on basic electrical circuits, operational amplifiers, digital electronics and computers, signals, noise, and signal-to-noise enhancement.
- » Section 2 comprises seven chapters devoted to various atomic spectrometric methods, including an introduction to spectroscopy and spectrometry, instrumentation, atomic absorption, atomic emission, atomic mass spectrometry, and X-ray spectrometry.
- » Section 3 treats molecular spectrometry in three chapters that discuss atomic absorption, atomic fluorescence, infrared, Raman, nuclear magnetic resonance, mass spectrometry, and nuclear magnetic methods.
- » Section 4 consists of four chapters that treat electroanalytical chemistry, including potentiometry, coulometry, and voltammetry.
- » Section 5 contains five chapters that discuss analytical separation methods including gas and liquid chromatography, supercritical fluid chromatography, electrophoresis, and field-flow fractionation.
- » Section 6 consists of four chapters devoted to miscellaneous instrumental methods with emphasis on thermal, radiochemical, and automated methods. A chapter on particle size analysis is also included in this final section.

Since the first edition of this text appeared in 1971, the field of instrumental analysis has grown so large and diverse that it is impossible to treat all of the modern instrumental techniques in a one- or even two-semester course. Also, instructors have differing opinions on which techniques to discuss and which to omit in their courses. Because of this, we have included more material in this text than can be covered