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of powerful and effective tools for obtaining qualitative and quantitative information about the composition and structure of matter. Students of chemistry, biochemistry, physics, geology, the life sciences, environmental science, and environmental science need to develop an understanding of these measurement tools and their applications to relevant problems. This book is designed to serve as a guide to these methods and other users of analytical instrumentation.

When instrument users 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 limitations 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.

- » 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 spectroscopic instrumentation, atomic absorption, atomic emission, atomic mass spectrometry, and laser spectrometry.
- » Section 3 treats molecular spectrometry in nine chapters that describe ultraviolet, visible, fluorescence, infrared, Raman, nuclear magnetic resonance, mass spectrometry, and surface analytical 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