methodological postgraduate education. Examples of such courses can be mentioned: planning of research, laboratory animal science, physiological measurements. These courses are annually available in the University of Kuopio and have repeatedly been arranged elsewhere, for example, in the Universities of Helsinki and Turku.

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BOOK REVIEWS

Introduction to Bioinstrumentation. C. D. Ferris. Clifton, NJ: Humana, 1978. 330 pp., illus., index, hard-cover $29.50, soft-cover $14.50.

Derived from a course on bioinstrumentation for upper-level engineers, this book has as its goal the presentation of a practical tutorial for students and life and medical scientists. Systems analysis and instrument design are stressed, rather than commercially available instruments. It is assumed that the reader has some knowledge of basic physics, electronics, and elementary differential equations.

The book is divided into six sections (second-order systems, transducers, signal processors, recording/display equipment, biotelemetery, and electrical hazards/safety). The topics in these sections are contained in 12 chapters. Mathematical analyses of hypothetical instruments are presented in an appendix. Problems and references are included.

The section on linear systems deals mainly with the three solutions to the second-order differential equation with constant coefficients. This equation describes a very large number of systems in both physics and biology. Transient and steady-state conditions are discussed. The characteristics of nonlinear systems (saturation, hysteresis, and dead zone) are also covered.

The principles of transduction, including changes in resistance, capacitance, and inductance, and of induction are presented. Thermoelectric, photoelectric, Hall effect, and magnetostrictive devices are described. A few transducers for specific events (e.g., pressure, red-cell count, hemoglobin concentration, oxygen saturation, and respiration) are described.

Techniques for environmental monitoring and the equipment used (e.g., the explosimeter, stack-plume monitor, particulate density monitors, noise meters, and illumination meters) are discussed. Information on electrodes covers devices for measuring bioelectric signals, pH, P_{O_2}, and P_{CO_2}, the nature and properties of the electrode-electrolyte interface, and metal and glass microelectrodes.

One chapter deals with amplifiers and signal processing, including topics such as input impedance, bandwidth, and distortion of short-duration pulses. Various amplifiers (AC, DC, chopper, negative capacity, and differential) and stimulus isolation techniques and noise reduction are also discussed. Methods for processing transducer signals are outlined. The types of display devices (strip chart, mirror galvanometer, plotter, and alphanumeric indicator) and the techniques for tape recording are described.

Another chapter on instrumentation systems contains an unusual collection of information, extending from descriptions of spectrophotometers to snow avalanche detection and from sensory prosthesis to X-ray and thermographic devices. Telemetery, both for location purposes and data transmission, is given broad coverage with many interesting examples. The theory underlying telemetery and considerations for antennae selection are presented.

Practical matters such as grounding, isolation, ground-current monitors, ground loop, shielding, and electrosurgery are discussed. In the appendix, there are mathematical treatments of systems response. A section devoted to problems completes the book.

Introduction to Bioinstrumentation covers an extremely wide range of topics: some covered in depth, other very large topics covered only superficially (e.g., thermography 1 1/2 pp. and X-ray 3 pp.), and a slight repetition of subjects (e.g., in transducer principles and application sections). The author has obviously strived for breadth rather than depth. Nonetheless, the inclusion of many seldom-encountered topics, such as those in the environmental area, makes this book slightly different from the many others on the subject. The book is liberally illustrated with many drawings and graphs that aid in understanding the construction and function of the instruments. Taken as a whole, the book contains a wealth of information on currently used devices and should be a good starting text for students and researchers wanting to know how their instruments work.

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