BOOKS

Quasilinear Hyperbolic Systems and Waves, Alan Jeffrey, Pitman Publishing, London, 230 pages, £ 6.90.

Until quite recently books suitable for the chemical engineering audience on systems of first order partial differential equations did not exist. Those who desired to inquire about this fascinating field were frustrated by the older books of Goursat and Caratheodory and were only somewhat more satisfied with Courant and Fredrichs or Courant and Hilbert which, indeed, were heavy going for most of us, although it is all there. First order systems of equations are the natural starting blocks for many problems in mathematical modelling because of their simplicity and economy and because they elucidate the basic structure of many problems without the concomitant complexity caused by the transport terms now such a fetish in intentionally complicated models. Hyperbolic systems are the natural hunting ground for wave propagation; shocks arise quite naturally. For a variety of problems in chemical engineering, such as, fixed and moving bed reactors, adsorption beds, pebble heaters, and parametric pumps, to name only a few, the beautiful interplay of constant states, simple waves, and the aforementioned shocks not only enriches and enlivens our lives but informs us about the basic pathological character of a problem without the messy and often uninteresting details caused by transport and computers.

Alan Jeffrey has written an admirable book which discusses all of the pertinent topics useful to modern chemical engineers only moderately sophisticated mathematically. It is clearly an excellent book from which to learn about the structure of hyperbolic systems, namely, the anatomy of characteristics, shock waves, Riemann invariants, simple waves, and the propagation of discontinuities. The style of the book is clear and lucid, maybe too mathematical for some, but it has numerous applications, largely to fluid mechanical systems. There are no applications to other things, perhaps more interesting to chemical engineers, but, as we all know, there is another superb book that does exactly that.

NEAL R. AMUNDSON
University of Minnesota

Biomedical Engineering Principles, David O. Cooney, Marcel Dekker, New York, 1976, xiv + 458 pages, $36.50.

Written by one of the young successful researchers and educators in the field, this textbook is a very good contribution and a much needed addition to the basic literature of the growing field of biomedical engineering. Since no single book can encompass all aspects of the field, a justifiable subtitle points out the author's concentration to fluid, heat and mass transport processes in the human body.

The reviewers, a practicing pediatrician and former chemical engineer who has been engaged in the teaching of introductory courses in biomedical engineering for the past seven years, and a chemical engineer who is presently involved in related research and has been exposed to the subjects covered by this book, have sensed the necessity for a textbook directed mainly to chemical engineers and they have experienced the unfortuante educational solution of having to use handouts from physiology books and/or engineering review articles.

The author solves this problem efficiently by covering basic anatomy and physiology in an abbreviated but adequate fashion particularly in Chapters 2, 8 and 10; and by presenting the mathematical modeling and engineering aspects in a concentrated by understandable manner in the other chapters. This bias and apparent unbalance is appropriate, moreover, since the text is designed for the engineering student rather than the physician.

We are pleased that the author has included practical examples of disease states such as narrowing of arteries and aneurysms (p. 83) and has not overlooked classical physiological phenomena such as the one-way venous valves (p. 89).

Modeling the body as compartments, sources and streams, is particularly valuable as it relates to the kinetics of drug distribution. The fields of pharmacokinetics, drug design and evaluation are a "natural" for chemical engineers and are becoming increasingly important.

The only addition we would have liked to see included in this book, would be a section covering the "tools of medicine" not included elsewhere; i.e., respiratory, diagnostic and therapeutic equipment, environmental control devices (isolettes, temperature control mechanisms, etc.), and radiation diagnostic and therapeutic implements. We must, however, acknowledge that the areas most often attacked by chemical engineers (artificial kidney and cardio-pulmonary by-pass machines) have been most adequately covered.

The engineering aspects and mathmatical modeling are drawn directly from and backed very efficiently by the original literature citations of the research of Colton, Cooney, Keller, Lightfoot, Merrill, Michael, Middleman, and other chemical engineers who in the last fifteen years have contributed to this area. Consequently, chapters 3, 7, 9 and 11 dealing with blood rheology, transport through membranes, artificial kidneys and oxygenators are very well written. The book is backed by over two hundred carefully selected illustrations, numerous tables and some sixty problems.

We would not hesitate recommending this text for an introductory senior or graduate biomedical engineering