sprightly style and is interesting from cover to cover. The comments, critiques, and summaries that accompany the chapters are very helpful in crystalizing the ideas and answering questions that may arise, particularly to the self-learner. The transparency in the presentation of the material in the book equips the reader to proceed quickly to a wealth of problems included at the end of each chapter. These problems ranging from elementary to research-level are very valuable in that a solid working knowledge of the invariant imbedding techniques is acquired as well as good insight in attacking problems in various applied areas. Furthermore, a useful selection of references is given at the end of each chapter.

This book may not appeal to those mathematicians who are interested primarily in the sophistication of mathematical theory, because the authors have deliberately avoided all pseudo-sophistication in attaining transparency of exposition. Precisely for the same reason the majority of the intended readers who are applications-oriented and are eager to use the techniques quickly in their own fields will welcome and appreciate the efforts put into writing this book. From a purely mathematical point of view, some of the invariant imbedding results may be considered to be generalizations of the classical theory of first-order partial differential equations, and a part of the analysis of invariant imbedding is still at a somewhat heuristic stage despite successes in many computational applications. However, those who are concerned with mathematical rigor will find opportunities to explore the foundations of the invariant imbedding method.

In conclusion, let me quote the following: "What is the best method to obtain the solution to a problem? The answer is, any way that works." (Richard P. Feyman, *Engineering and Science*, March 1965, Vol. XXVIII, no. 6, p. 9.) In this well-written book, Bellman and Wing have indeed accomplished the task of introducing the simplicity of the invariant imbedding method to tackle various problems of interest to engineers, physicists, applied mathematicians, and numerical analysts.

Digital Signal Processing—A. V. Oppenheim and R. W. Schafer (Englewood Cliffs, NJ: Prentice-Hall, 1975, 608 pp.).

Theory and Application of Digital Signal Processing—L. R. Rabiner and B. Gold (Englewood Cliffs, NJ: Prentice-Hall, 1975, 720 pp.).

The Fast Fourier Transform—E. O. Brigham (Englewood Cliffs, NJ: Prentice-Hall, 1974, 252 pp.).

Reviewed by C. K. Yuen, Australian National University, Canberra, Australia.

As the reader may have already recognized, the five authors listed above have all published extensively on various aspects of digital signal processing in the past ten years or so. With these three books, they bring to the reader the benefit of their wide experience with this exciting and still fast-developing subject.

The reviewer is favorably impressed by both of the digital processing texts. In each, one finds the most up-to-date material presented with clarity and with the right amount of rigor for the intended audience. Overall, the former assumes somewhat less previous background and gives more extended treatment to basic topics like the z-transform, discrete Fourier transform, and other properties of discrete time systems. Oppenheim and Schafer also discuss in some detail the fast Fourier transform algorithms, which are given only cursory attention by Rabiner and Gold. Both texts treat the theory of digital filters at length, but again with different emphasis. Altogether, these basic topics make up about half of each of the two books.

In the remaining two halves the difference in the choice of material reflects the authors' own research interests, particularly in applications. Oppenheim and Schafer devote one chapter to homomorphic filtering of various types of signals and another to autocovariance and power spectrum estimation. Rabiner and Gold, instead, write four chapters on hardware aspects of digital signal processing, and concentrate on radar and speech processing in their last two applications chapters.

Digital signal processing teachers will probably find Oppenheim and Schafer more suitable as a course textbook in view of its more extended treatment of basic material and the inclusion of a large number of problems, which are completely absent in Rabiner and Gold. However, some of the advanced material can only be found in the latter. If one can afford it, I would strongly advise the purchase of both. At the prices, both are excellent value.

The reviewer is less enthused by Brigham's book. Not that it is poorly written, in fact, it is quite easy to read. I particularly like the author's use of figures as aids to explanation. A reader with background in calculus and computer programming should have no difficulty in learning the method of fast Fourier transform from this book. Some Fortran routines are given.

The main reason for my dissatisfaction with the book is its thinness, both physically speaking and contentwise. Though its price cannot be considered excessive in today's market, one cannot help noticing that each of the other two books reviewed here has more than twice the number of pages but costs only slightly more. In regard to content, Brigham tries to do no more than introduce Fourier series, the Fourier integral, and the discrete Fourier transform; derive several fast Fourier transform algorithms; and demonstrate the evaluation of correlation and convolution via the Fourier transform. Little attention is given to such considerations as accuracy and error propagation, fast algorithms for bit reversal sorting (for both internally and externally stored data), hardware realizations, etc., which are so important in practical applications. Further, though the author does a good job in presenting the material clearly and comprehensibly through most of the book, overall, the treatment is conventional and somewhat superficial. Reading the book, one hardly gets a feeling of the exciting and revolutionary effect the fast Fourier transform has had on digital signal processing.

Although the fast Fourier transform is of interest to numerous disciplines, it is still reasonable to expect that most of this book's readers would be engineers and physical scientists. Such people would already know about Fourier series and the Fourier integral, and perhaps the discrete Fourier transform also. They might find it more worthwhile to study the relevant chapters of Oppenheim and Schafer, or refer to original papers, in order to learn the fast Fourier transform. Even those with less background may be better off doing that if they are willing to make the effort in order to learn more. All in all, *The Fast Fourier Transform* is not a bad book; but, had the author tried a little harder, by including more material and treating what he did include more imaginatively, it would have been so much better.