

Among the computer sagas is the story of Belle, a very capable chess playing computer who beats 99 out of 100 human players and is providing insight into how people think when they play chess. It seems that part of what grandmasters do is to see the entire chess board as a single entity. That strikes me as being a bit like thinking of NaCl as a chemical with many properties, i.e., a whole entity. It isn't just a group of letters that are laboriously put together following a bunch of rules to make a compound. In other words, this research may give us insight into the learning process and how it can be improved.

The stories of some of the major discoveries are especially interesting. Some researchers identified their major interests quickly; others seem to be continually searching for new areas, whether in the area of computer identification of human speech or the photovoltaic effect in silicon. The latter discovery occurred by chance when Russel Ohl placed a cooling fan in front of a bench light, chopping the light. The voltage shown on an oscilloscope followed the chopped light. Instead of just moving the light, he began to study the effect, and fifteen years later the first solar battery resulted from the research begun in this way.

Many other discoveries resulted from the same combination of inspiration and hard work. Shockley and Bardeen were able to work on the transistor because of a technological breakthrough. They combined new physical insights with an improved mathematical theory to produce greater understanding and further technical breakthroughs.

Managers at every level at Bell Labs have very strong backgrounds in science and technology but very different attitudes toward their jobs. Addison White comments on his position at Bell "...the jobs that management people should be doing are fairly dull. So the higher my responsibility became, the duller the work was." Another manager, Arno Penzias, Nobel Prize winner in Physics and Director of Research, has a different slant. "The nice thing about each of the administrative jobs that I have had is that the previous occupant retired, so that I was able to redefine the job. In each case I became convinced that I had the best conceivable job, not just in Bell Laboratories but probably in the world of science ... Each new job turned out to be marvelous."

Some of those interviewed expressed concern that the break-up of AT&T may create more pressure for short term results and less emphasis on basic fundamental research which has a longer term payback. As might be expected, some individuals are mostly concerned with continued funding of personal interests, but others have a general anxiety that the strange magic that makes Bell Labs what it is may not continue. With the freedom at Bell and a Director of Research with an attitude like that expressed by Penzias, one feels that Bell Labs will continue to do very well in the future.

This gives some of the flavor of the book, good science and technology laced with interesting personal anecdotes. In many ways, these scientists and engineers come across like the rest of us. They have a great deal of uncertainty as to the future and are seeking balance and satisfaction in their work. The difference is that much of their work is literally at the frontiers of current science. Bernstein's book not only suggests that this fantastic group of people will continue their balancing act in the future but gives the reader some very positive feelings about what science and technology are creating.

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## **BASIC COMPUTER PROGRAMS IN SCIENCE AND ENGINEERING**

by Jules H. Gilder

Hayden Book Co., Rochelle Park, NJ  
1980, 256 pages, softcover, \$8.95

Reviewed by Harry E. Pence

There are a wide variety of computer books with titles that indicate that they are designed for scientists and engineers, and the purposes of such books vary equally widely. Gilder has written this book to fulfill two major goals; it is intended to be a sourcebook of mathematical, statistical, and electronic engineering programs and to provide examples that may be used

as models by those just learning to write computer programs. It accomplishes both of these ends rather well.

This book contains 114 scientific programs designed to be run on an Apple II microcomputer using Applesoft II BASIC. A machine language sub-routine to clear the screen appears in each program, but otherwise there appears to be little that is limited to either a special version of BASIC or a specific computer. There should be no difficulty adapting any of these programs to other systems. A set of two diskettes which includes all of the programs may be purchased with the book. Most of the programs are relatively short (average length about 40 lines), but those who plan to use the book extensively may find this option to be worth considering.

The library of programs provided can be roughly divided into two groups. The first group, consisting of 49 programs, deals with general mathematical principles and data analysis. These programs involve techniques such as matrix manipulation, various least squares treatments, calculations with complex numbers, Gaussian elimination, Simpson's Rule, solution of simultaneous equations, and the Newton-Raphson Method.

The other group of programs are concerned with calculations in electricity and electronics. This group begins by solving a number of potentially useful basic electricity problems dealing with simple wiring, resistor configurations, and power transformers. These are followed by basic electronics programs that perform similar calculations. The remainder, and probably the real meat of the book, deals with electronic circuit design. Over fifty programs relate to the design of basic circuits, various types of active and passive filters, attenuator pads, and communications circuits. These programs may be especially useful to not only the hobbyist but also the professional electronics technician.

In each case, the author provides a listing of the program, a print-out from a typical run of the program, and a very brief explanation of the procedure involved. The background provided is adequate for someone already familiar with the technique but probably not for most novices. The abbreviated explanations, lack of exercises, and the absence of even a brief bibliography will significantly limit the use of the book as a text.

The programs themselves seem to be error-free and straight-forward. There is little error trapping, and mistakes usually cause an exit from the program. Since many of the programs are rather short, this doesn't constitute a serious liability. The book does offer an extensive library of potentially useful programs and so does seem to fulfill the author's stated purposes reasonably well.

The usefulness of this book will vary significantly from reader to reader. It could be valuable for someone doing electronics work, but it would probably have serious liabilities if used as a textbook, and many chemists may find that the majority of the programs are not related to their normal activities. Under the circumstances, no general recommendation is possible, but each reader must decide whether or not the book will satisfy individual needs.

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