

I believe that Aiken's failed relationship with IBM cost Harvard important IBM largesse in the corporation's donations in the mid-1950s to MIT (and to UCLA) of a large IBM 704 computer and an endowment to support the multimillion dollar facility. With Aiken's disinclination, an obviously natural relationship between the Harvard and MIT computing groups never developed. These events all but guaranteed an isolated Harvard computing program that could not compete at the leading edge. Cohen also documents the Harvard administration's lack of sympathy for Aiken's "empire building," rather than facilitating and encouraging the computer science department, the university administration undermined it.

The appearance of the Mark I was a milestone in the evolution of the information revolution, but its successors (Mark II, III, and IV) and Aiken's thinking never really joined in the mainstream of ideas that were fomenting in the emerging computer-science community in the years immediately following World War II. Although Aiken foresaw a number of key general directions for computers, such as the shrinking size and increased power of future machines, he completely missed the importance and ubiquity they would achieve.

Probably his biggest failing was his inability to amalgamate into his thinking the ideas being developed elsewhere. Since he traveled widely and had contact with many of his contemporaries, he had every opportunity to do so, but his arrogance prevented it.

Finally, the book details Aiken's development of the Harvard program in computer science, his relationship with his students, life in the computer laboratory, his early retirement from Harvard in 1961, and his post-Harvard career as a successful entrepreneur and consultant. The recollections of those who worked with Aiken leaves us with a clear picture of a controversial, uncompromising, hard-driving man of action. He was a superb organizer, teacher, and leader. He was as demanding of others as he was of himself, but for the students and colleagues he respected, he was patient, considerate, and compassionate.

Cohen repeatedly praises Aiken's pedagogical talents, and deservedly so. Many of the first generation of computer scientists received Harvard doctoral degrees mentored by Aiken—16 during the period 1948 to 1958. And he established and continued to evolve a very strong syllabus for the discipline. In the long run, these are probably

Aiken's most notable contributions.

One of Cohen's many interesting appendices, "Who Invented the Computer? Was Mark I a Computer?," introduces the handful of contributors who developed the modern computer during the approximately dozen years starting in 1940. He gives a rather succinct description of the contributions of John Atanasoff, J. Presper Eckert, John W. Mauchly, Maurice Wilkes, Konrad Zuse, and John von Neumann. He also suggests that the honor of the "invention of the computer" might go to Alan Turing or even Charles Babbage. The fact remains that all of these participants, and a good number of others less known, contributed to the intellectual ferment that gave rise to the computer and the information revolution.

The companion volume, *Makin' Numbers: Howard Aiken and the Computer*, edited by Cohen and Gregory W. Welch with the cooperation of Robert V. D. Campell, is interesting in its own right. It contains a collection of technical essays on Aiken's machines, including the specifications of all four Mark machines, some of Aiken's own writings, a chapter by Welch on the Harvard culture in which Aiken had to develop his program, and the personal reminiscences of a number of Aiken's students and colleagues. Some of these short reminiscences do a better job than Cohen's *Portrait* in conveying the sense of the man. In particular, I found the essays by Richard Bloch, Frederick Brooks Jr., Peter Calingaert, and Maurice Wilkes most interesting.

Cohen's attempt to enhance Aiken's place in the history of computing fails in that the community has already placed him precisely where his contributions have been made. But these two books nicely reinforce the significance of his contributions and enrich the historical record.

ALFRED E. BRENNER
Institute for Defense Analyses
Alexandria, Virginia

Computational Physics

▶ J. M. Thijssen
Cambridge U. P., New York, 1999.
546 pp. \$105.00 hc (\$47.95 pb)
ISBN 0-521-57304-1
hc (0-521-57588-5 pb)

The need to solve complicated physics and engineering problems was a critical factor that helped spur the development of increasingly powerful computers, beginning in the 1940s. It con-

tinues to drive the development of modern, massively parallel computers, whose speeds can exceed 10^{12} operations per second. The availability of fast computers, conversely, has changed the way physics research is conducted, expanding the scope of theoretical physics to encompass what is often termed "computational physics."

The growing importance of computational physics to physics research as a whole will depend not only on increasingly powerful computers, but also on the continuing development of algorithms and numerical techniques for putting these machines to use. Furthermore, physics departments will need to augment their curricula to provide students with the skills needed to perform research using computers; they will need not only courses in computer programming and numerical analysis, but courses as well that describe the specific algorithms and methods employed in contemporary physics research.

In *Computational Physics*, Joseph M. Thijssen has produced a book that is well suited to meeting these needs. The 14 chapters cover a broad range of topics in condensed matter physics, including such electronic-structure techniques as tight binding, Hartree-Fock, and density functional theory; classical and quantum molecular dynamics simulations; classical and quantum Monte Carlo techniques; transfer matrix methods; and methods for lattice field theories, where he appears to concentrate his attention. In addition, he briefly describes issues related to parallel computing, and, in two appendices, he discusses useful numerical techniques.

The author's approach is to introduce each topic with a brief exposition of the fundamentals, describe the algorithms and their implementation, and then illustrate the methods with one or two simple examples. He is careful to distinguish numerical approximations from the theoretical approximations needed to make a solution tractable, and he points out possible sources of uncertainty. Because of the wide range of topics, Thijssen has chosen to focus on the development and description of techniques, purposely avoiding lengthy discussions of results obtained using these techniques. He does, however, provide a list of 351 references in which the interested reader can find real-world results as well as in-depth discussions of the theoretical foundations underlying the techniques. Thijssen also points out similarities in the formalisms and underlying numerical

Multichannel Analyzer

World's Smallest

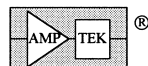
'Pocket MCA'



Size: 6.5" x 2.8" x 0.8"
(165mm x 71mm x 20mm)
Weight: <300 grams (including batteries)

The **MCA8000A** is a full featured, low power Multichannel Analyzer intended to be used with a wide variety of detector systems.

- 16k data channels
 - Stores up to 128 spectra
 - 24 hours of continuous data acquisition from two 1.5V AA batteries
 - Conversion time $\leq 5 \mu s$
($\geq 200,000$ cps)
 - Two stage input analog pipeline
 - Differential nonlinearity $< \pm 0.6\%$
Integral nonlinearity $< \pm 0.02\%$
Sliding-scale linearization
 - Two peak detection modes:
First peak after threshold
(nuclear spectroscopy)
Absolute peak after the threshold
(aerosol particle detection)
 - Two TTL compatible gates for coincidence & anticoincidence
 - Stand-alone data acquisition
 - Date-time stamp - Y2K Compliant
 - Stored spectra protection via software security & serial ID number
 - 115.2 kbps serial interface
- Free Windows & DOS software**



AMPTEK INC.

6 De Angelo Drive, Bedford, MA 01730-2204 U.S.A.
Tel: +1 (781) 275-2242 Fax: +1 (781) 275-3470
e-mail: sales@amptek.com www.amptek.com

techniques used in the various topical areas. This both makes it easier to approach a new topic and encourages the reader to consider a modular approach when writing programs.

Thijssen has targeted *Computational Physics* at graduate students and researchers interested in learning about newer computational techniques. If the instructor uses some care in selecting topics, the book may also be useful in a course for advanced undergraduates, although the reader is generally assumed to have a background in quantum mechanics, statistical mechanics, computer programming, and numerical analysis. Chapters that may be skipped in the first reading have been clearly marked, and the problems provided at the end of each chapter cover a mixture of derivation, programming, and computation.

Thijssen encourages the reader to write programs, and he gives helpful hints on ways to ensure that these programs are giving correct answers. He also maintains a Web site at <http://ectm.et.tudelft.nl> through which the reader can download a file containing computer programs discussed in the book. These programs are currently implemented only in FORTRAN 77, but Thijssen notes that he is working on versions in C and FORTRAN 90.

Thijssen's book is well suited for a graduate-level course in computational condensed matter physics, filling the gap between elementary texts such as Giordano's *Computational Physics* (Prentice Hall, 1997) and review articles on specialized topics while it provides students with an up-to-date look at computational methods used in physics research.

ALAN F. WRIGHT

Sandia National Laboratories
Albuquerque, New Mexico

Statistical Methods in Quantum Optics 1: Master Equations and Fokker-Planck Equations

Howard J. Carmichael
Springer-Verlag, New York, 1999.
361 pp. \$64.95 hc
ISBN 3-540-54882-3

Quantum optics, the union of quantum field theory and physical optics, is in one way new and another way old. In one sense, all of quantum mechanics (and indeed most of modern physics) springs from the study of black-body radiation. Planck was

arguably the first quantum optical scientist. On the other hand, quantum optics promises to be a mainstay in the 21st century, emphasizing, for example, squeezed light ("darker than dark"), cavity QED (quantum electrodynamics), quantum noise quenching through atomic coherence, and quantum decoherence. Quantum "noise" is at the cutting edge of the field, and the new book by Howard J. Carmichael, *Statistical Methods in Quantum Optics 1: Master Equations and Fokker-Planck Equations*, is a valuable addition to the literature.

If asked to describe the key events that ushered in the modern era of quantum optics, one would, of course, point to the laser. But the advent of high-efficiency photodetectors was also a key development. In the early 1960s, experiments by H. Hanbury-Brown and R. Twiss, and measurements of the laser photon statistics, stimulated Roy Glauber to develop the theory of multiphoton correlation spectroscopy and quantum coherence in pretty much the form we use today. But to get where we are today still required the clarification of many subtle issues, such as the clear distinction between quantum and classical noise. Glauber stated this well in his classic 1964 Les Houches lectures, "Quantum Optics and Electronics:"

"It has recently been claimed that the class of states of the field for which the simple statistical description we have mentioned is available includes all states of the field, and that consequently the quantum theory and the 'classical' theory will always yield equivalent results. . . . [T]his claim seems to be based more upon wishful thinking than upon accurate mathematics. The quantum theory still offers the only complete and logically consistent basis for discussing field phenomena."

Today, with the benefit of a quarter-century of experience, we recognize how deep and insightful Glauber's statement is. In fact, a hallmark of nonclassical squeezed light is the appearance of the negative diffusion coefficient in the Fokker-Planck equation. Thus, quantum noise is seen to be profoundly different from classical noise, and this is one reason Carmichael's book is so useful.

The book is divided into two volumes. For such modern topics as squeezing, the positive P representation, cavity QED, and quantum trajectories, we must wait for the second volume. The first volume concentrates on the fundamentals, the ideas developed in the first two decades of