SHODOR REPORT

A brief report on Landau's text: *A Survey of Computational Physics*

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I am speaking from the standpoint of an experimental physicists who has come to computation first as a laboratory tool, then as a learning tool, and only more recently as a modeling tool. These correspond to computer-supported activities whose goals are, respectively, instrumentation, instruction, and understanding. What makes computational physics so exciting to me is the prospect of having a third approach to doing physics that sits between and is vital for progress toward understanding nature using the older two approaches of theory and experiment. I say "prospect" advisedly, since I do not believe that, as professional physicists, have neither a majority consensus nor fully explored practice of wedding these three approaches.

Having confessed to my bias, I also must admit that I have looked over this text unevenly. I have not taught from it, nor am I likely to, since I have retired and in any case spent the last half of my career doing research work. But I do have strong feelings about the need to integrate computation into physics education and so I have a preferred framework for situating my observations, however anecdotal they may be.

This is an admirable book. It represents, in some way, a lifetime of experience that the principal author has had with computational science, and that shows through. I really appreciate the long list of different aspects of computation that a professional computational scientist should know:

- Computer science
- Mathematics
- Theory
- Algorithms
- Methods
- Models

As a latter-day professor, I appreciate the inclusion of the major instructional elements right in the text narrative as they are in this book, not tacked on as "appendices" to the material, where they appear to students as separate and sometimes unconnected to the conceptual narrative. Among these elements are:

- Problems / solutions
- Exercises
- Explorations
- Assessments

In its treatment of discrete Fourier transforms early on and in close company with experimental data, this book makes an important association. One of my favorite gripes is the way that computational texts frequently treat discretization in modeling as some burden imposed by digital computers rather than an unavoidable fact of measurements in the physical world. I believe the former association is a disservice to students, which eventually must be remedied in later life, but that the latter is best inculcated as a habit of thought at the beginning as in this book.

Despite this and other admirable attempts to move the experimental approach closer to the computational approach, I still find the general treatment to serve this movement less than that it affords between the theoretical and computational approaches. Professionally, I know Landau often toi have made the case for computation being a third methodology for doing science equally significant as both experimentation and theory. But I sense his treatment of material in this book to be characteristically symptomatic of his training as a theorist rather than that of an experimentalist. I am wondering if his coauthors come from an experimental rather than a theoretical background, and if not then whether the treatment might have been more equitable if they had been.

Admittedly, many experimentalists today are not thoroughly schooled in how powerful a tool numerical modeling can be for unraveling the underlying mechanisms for physical effects manifest in their experiments. As the editor of a scientific publication on computational science I find examples of experimental/computational synergy disappointingly rare and seize upon evident cases to solicit manuscripts from researchers when I discover them. In introducing myself to this book, I had hopes that it would make this case more strongly than it does, and should as an introductory survey if it is to lead the way to computation's rightful place.