Classical Fortran: Programming for Engineering and Scientific Applications
By Michael Kupferschmid
CRC Press, 2nd Ed., 2009, 576 pp.
ISBN 978-1-4200-5907-6

I speak from personal experience when I say that even the scientist who has intentionally avoided programming will be saying "**Hello!**" to the **World** of FORTRAN quickly after beginning Michael Kupferschmid's easy to follow, and often entertaining, introduction to classical FORTRAN (namely FORTRAN-77). Kupferschmid offers a list of "categories of readers for whom this book definitely is intended." (p. 17) I fell under the category of graduate student who only ever received minimal instruction in programming and never studied FORTRAN, but needed to write a program (calculating the density of states in various nano-scale materials to determine their quantum capacitance and ballistic conductance) for my master's project in physics. It was only due to a desire to work for a certain professor that I found myself doing computational physics, having no personal desire to program. That all changed after my experience with programming using this well written introduction, which covers the basics of classical FORTRAN in exquisite detail, in an engaging conversational tone. Now, as a recent grad, I actively seek and find research opportunities using my newfound programming skills.

The book begins with motivation for programming in general, and programming in FORTRAN in particular, to include why FORTRAN-77 is still widely used. In fact, it contains a fascinating, yet brief, discussion about the history and evolution of FORTRAN. The author then describes the organization of the book, for which it is readily apparent that he took great care, as well as his pedagogical approach. This book stems from a course taught at Rensselaer Polytechnic Institute for over twenty years. The first six chapters then give a working introduction to the language: compiling the "Hello, World!" program, expressions and assignment statements, conditionals and branching, scalar data and floating point arithmetic, arrays and DO loops, and subprograms. Almost every topic is introduced via a simple example which is thoroughly analyzed. The major concepts are usually illustrated through a case study. Every section ends with exercises, 577 in all. The first section does discuss compiling, running, and debugging programs, but the focus of the book is the FORTRAN language, rather than about computing in general.

The next four chapters cover "the remaining topics that most engineers and scientists need for casual programming." (p. xiii) As the author discusses, this book is predominantly about a common subset of the rather small working FORTRAN vocabulary that most programmers need, which he terms "Classical FORTRAN." (p. 9) The fact that this powerful and versatile subset, combined with the extensive library of

FORTRAN routines already in existence, was all that I needed to perform the cutting edge research for my master's project was a delightful surprise, and transformed my attitude about computing. Classical FORTRAN is a conceptually simple and easy to use program that scientists and engineers can use to write programs which perform their calculations, calculations that no one else knows how to perform, certainly not a commercial software developer.

Finally, the book concludes with an in-depth treatment of memory management techniques, program design, and performance optimization. It also includes a chapter on "Archaic, Unusual, and Dangerous Usages" (p. 265), as well as a chapter on modern FORTRAN, with some functionality from FORTRAN-90 such as dynamic memory allocation, as well as a discussion of High Performance FORTRAN (HPF), which supports data parallel programming. The last chapter includes some useful utility routines. My favorite features of the book are how well it is written, how easy it is to follow, the detail with which this small vocabulary which completely suits my research needs is presented, and the impressive 36 page index which makes this an excellent reference which I return to often.

Reviewed by Joseph Pedersen,
West Point, NY

This review appeared in "Mathematics and Computer Education" 2015 49:2 p140,
and is reprinted here with permission of the author.