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## Preface to the Second Edition

In this second edition, I have corrected all known typos and other errors; I have (it is hoped) clarified certain passages; I have added some additional material; and I have enhanced the Index.

I have added a few more comments about vectors and matrices with complex elements, although, as before, unless stated otherwise, all vectors and matrices in this book are assumed to have real elements. I have begun to use “ $\det(A)$ ” rather than “ $|A|$ ” to represent the determinant of  $A$ , except in a few cases. I have also expressed some derivatives as the transposes of the expressions I used formerly.

I have put more conscious emphasis on “user-friendliness” in this edition. In a book, user-friendliness is primarily a function of references, both internal and external, and of the index. As an old software designer, I’ve always thought that user-friendliness is very important. To the extent that internal references were present in the first edition, the positive feedback I received from users of that edition about the friendliness of those internal references (“I liked the fact that you said ‘equation (x.xx) on page yy,’ instead of just ‘equation (x.xx)’”) encouraged me to try to make the internal references even more useful. It’s only when you’re “eating your own dog food,” that you become aware of where details matter, and in using the first edition, I realized that the choice of entries in the Index was suboptimal. I have spent significant time in organizing it, and I hope that the user will find the Index to this edition to be very useful. I think that it has been vastly improved over the Index in the first edition.

The overall organization of chapters has been preserved, but some sections have been changed. The two chapters that have been changed most are Chaps. 3 and 12. Chapter 3, on the basics of matrices, got about 30 pages longer. It is by far the longest chapter in the book, but I just didn’t see any reasonable way to break it up. In Chap. 12 of the first edition, “Software for Numerical Linear Algebra,” I discussed four software systems or languages, C/C++, Fortran, Matlab, and R, and did not express any preference for one

over another. In this edition, although I occasionally mention various languages and systems, I now limit most of my discussion to Fortran and R.

There are many reasons for my preference for these two systems. R is oriented toward statistical applications. It is open source and freely distributed. As for Fortran versus C/C++, Python, or other programming languages, I agree with the statement by Hanson and Hopkins (2013, page ix), "... Fortran is currently the best computer language for numerical software." Many people, however, still think of Fortran as the language their elders (or they themselves) used in the 1970s. (On a personal note, Richard Hanson, who passed away recently, was a member of my team that designed the IMSL C Libraries in the mid 1980s. Not only was C much cooler than Fortran at the time, but the ANSI committee working on updating the Fortran language was so fractured by competing interests that approval of the revision was repeatedly delayed. Many numerical analysts who were not concerned with coolness turned to C because it provided dynamic storage allocation and it allowed flexible argument lists, and the Fortran constructs could not be agreed upon.)

Language preferences are personal, of course, and there is a strong "coolness factor" in choice of a language. Python is currently one of the coolest languages, but I personally don't like the language for most of the stuff I do.

Although this book has separate parts on applications in statistics and computational issues as before, statistical applications have informed the choices I made throughout the book, and computational considerations have given direction to most discussions.

I thank the readers of the first edition who informed me of errors. Two people in particular made several meaningful comments and suggestions. Clark Fitzgerald not only identified several typos, he made several broad suggestions about organization and coverage that resulted in an improved text (I think). Andreas Eckner found, in addition to typos, some gaps in my logic and also suggested better lines of reasoning at some places. (Although I don't follow an itemized "theorem-proof" format, I try to give reasons for any nonobvious statements I make.) I thank Clark and Andreas especially for their comments. Any remaining typos, omissions, gaps in logic, and so on are entirely my responsibility.

Again, I thank my wife, María, to whom this book is dedicated, for everything.

I used  $\text{\TeX}$  via  $\text{\LaTeX} 2_{\epsilon}$  to write the book. I did all of the typing, programming, etc., myself, so all mistakes (mistakes!) are mine. I would appreciate receiving suggestions for improvement and notification of errors. Notes on this book, including errata, are available at

<http://mason.gmu.edu/~jgentle/books/matbk/>

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