Themes

The main theme of this book is to take a good quality reflection seismic data set from the Gulf of Mexico and guide you through the basic geophysical data processing steps from raw data to the best-quality final image. Secondary themes are to introduce you (1) to cleaned up but real working Fortran code that does the job, (2) to the concept of “adjoint operator”, and (3) to the notion of electronic document.

What it does, what it means, and how it works

A central theme of this book is to merge the abstract with the concrete by linking mathematics to runnable computer codes. The codes are in a consistent style using nomenclature that resembles the accompanying mathematics so the two illuminate each other. The code shown is exactly that used to generate the illustrations. There is little or no mathematics or code that is not carried through with examples using both synthetic and real data. The code itself is in a dialect of Fortran more suitable for exposition than standard Fortran. (This "ratfor" dialect easily translates to standard Fortran). Some codes have been heavily tested while others have only been tested by the preparation of the illustrations.

Imaging with adjoint (conjugate-transpose) operators

A secondary theme of this book is to develop in the reader an understanding of a universal linkage beween forward modeling and data processing. Thus the codes here that incarnate linear operators are written in a style that also incarnates the adjoint (conjugate-transpose) operator thus enabling both modeling and data processing with the same code. This style of coding, besides being concise and avoiding redundancy, ensures the consistency required for estimation by conjugate-gradient optimization as described in my other books.

Adjoint operators link the modeling activity to the model estimation activity. While this linkage is less sophisticated than formal estimation theory (“inversion”), it is robust, easily available, and does not put unrealistic demands on the data or imponderable demands on the interpreter.

Electronic document

A goal that we met with the 1992 CD-ROM version of this book was to give the user a full copy, not only of the book, but of all the software that built the book including not only the seismic data processing codes but also the word processing, the data, and the whole superstructure. Although we succeeded for a while having a book that ran on machines of all the major manufacturers, eventually we were beaten down by a host of incompatibilities. This struggle continues. With my colleagues, we are now working towards having books on the World Wide Web where you can grab parts of a book that generates illustrations and modify them to create your own illustrations.

Acknowledgements

I had the good fortune to be able to establish a summer 1992 collaboration with Jim Black of IBM in Dallas who, besides bringing fresh eyes to the whole undertaking, wrote the first version of chapter 8 on dip moveout, made significant contributions to the other chapters, and organized the raw data.

In this book, as in my previous (and later) books, I owe a great deal to the many students at the Stanford Exploration Project. The local computing environment from my previous book is still a benefit, and for this I thank Stew Levin, Dave Hale, and Richard Ottolini. In preparing this book I am specially indebted to Joe Dellinger for his development of the intermediate graphics language `vplot` that I used for all the figures. I am grateful to Kamal Al-Yahya for converting my thinking from the `troff` typesetting language to LaTeX. Bill Harlan offered helpful suggestions. Steve Cole adapted `vplot` to Postscript and X. Dave Nichols introduced our multivendor environment. Joel M. Schroeder and Matthias Schwab converted from cake to gmake. Bob Clapp expanded Ratfor for Fortran 90. Martin Karrenbach got us started with CD-ROMs. Sergey Fomel upgraded the Latex version to “2e” and he implemented the basic changes taking us from CD-ROM to the WWW, a process which continues to this day in year 2000.

Jon Claerbout
Stanford University
December 26, 2000