American Mineralogist, Volume 102, page 231, 2017

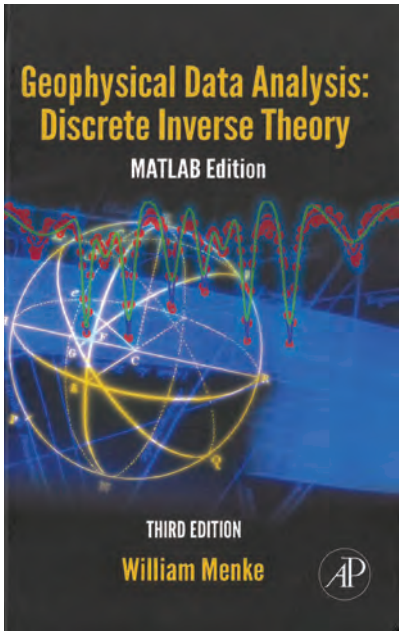
Book Review

Book Review: Geophysical Data Analysis: Discrete Inverse Theory (MATLAB Edition), Third edition. By William Menke. (2012) Academic Press/Elsevier, 330 p. $88.95 ebook, ISBN: 978-0-12-397160-9.

I eagerly awaited the arrival of the third edition of *Geophysical Data Analysis* on my desk, as an earlier edition of the book is a well-used mainstay of my reference shelf. This invaluable book contains a complete yet concise introduction to inverse theory from a geophysical perspective, and is widely used both as graduate-level textbook and as a reference for practicing geoscientists. The author is Professor of Earth and Environmental Sciences at Lamont-Doherty Earth Observatory, Columbia University, and has published extensively on observational and theoretical seismology, inverse problems, and data analysis.

The book represents a wide-ranging overview of discrete inverse theory at a level of mathematical rigor that is sufficient to communicate the concepts, but avoids getting bogged down in detail. Early chapters cover an overview of inverse problems and their description, a brief treatment of probability theory, and a detailed discussion of the solution of linear, Gaussian inverse problems. Later chapters introduce maximum likelihood methods, vector spaces, and non-Gaussian statistics in linear inverse problems. Towards the end of the book, there is a discussion of nonlinear inverse problems and model space search approaches, factor analysis, tomography (introduced by a brief discussion of continuous inverse problems), sample inverse problems, and finally applications of inverse theory to solid Earth geophysics, the author's specialty. In its scope the new edition covers much the same ground as earlier editions, with some additions—new material on Fréchet derivatives, adjoint methods, and seismic waveform tomography particularly caught my eye—but the figures have been completely updated, with the Matlab scripts used to draft the figures typically included.

The most exciting innovation in the new edition is, as the title suggests, the addition of an accompanying set of Matlab scripts that are used to illustrate concepts and implement many of the examples discussed in the text. The website accompanying the book includes dozens of Matlab scripts for download (as well as PowerPoint slides that are useful for teaching). These range from simple scripts that illustrate basic syntax and usage in Matlab to more complicated codes that, for example, compute sensitivity kernels for acoustic wave propagation or implement a simulated annealing algorithm for a nonlinear curve-fitting problem. Another excellent addition to the new edition is the inclusion of problems at the end of each chapter, most of which involve writing code or modifying the provided scripts. The inclusion of the Matlab-based problems and example scripts enhances the book's utility as a teaching and learning tool for practicing researchers and students alike. While the book does not contain an exhaustive guide to Matlab, it does provide a brief and very useful tutorial in the introduction; for new users, this tutorial (perhaps in combination with an introductory Matlab textbook) should be enough to get off the ground.



Geophysical Data Analysis is both an excellent reference for practicing scientists and a clear, thorough, and practical textbook for an inverse theory course at the graduate or advanced undergraduate level. As Menke points out in the book's preface, every scientist who has used data to make inferences about how the Earth works has practiced inverse theory; while the book is written from the perspective of a solid Earth geophysicist, it will be useful to scientists across a range of geoscience disciplines. The breadth of material covered in the text is impressive, and the book strikes a good balance between completeness and conciseness. The third edition of *Geophysical Data Analysis* represents a valuable update to one of the definitive textbooks on inverse theory for geoscience applications, and I highly recommend both the book itself and the accompanying Matlab code resources.

Maureen D. Long
Department of Geology and Geophysics
Yale University
New Haven, Connecticut 06520

0003-004X/17/0001–xxx$05.00/DOI: http://dx.doi.org/10.2138/am-2017-671

How to Submit to American Mineralogist

Our full manuscript preparation guidelines are available at http://www.minsocam.org/msa/AmMin/Instructions.html and should be consulted. Also find a list of our abbreviations and other style information. Author information can be found on the inside back cover, if you have the print version of the journal.

1. Ready to submit the paper: the file is finished, you have contact info for all co-authors, etc.? Then go to https://aminsubmissions.msubmit.net -- be sure cookies are on and Java enabled and no firewall blocks you. Use the most recent version of Firefox, Explorer, Safari, etc. Register on our site if a first-time user and then log in and see your "home page" in our system. Note that you can update your profile (address, phone, email, password) at the bottom at any time.

2. Read all the info…or at least print out the basic submission information *before* pressing that "continue" button!

3. Submitting a paper online basically boils down to uploading files and, while the merge file creates in the background, typing in (or cut-and-pasting) some basic information. Then approve and submit.

A Quick Guide to the Tab-based Process

● *Upload your files first.* Just drag and drop them into the box. Or zip them up and drag that file into the box (watch the system un-zip them and sort them out). Or stick with using the Choose File button and select each file you need one by one. When all the files are in a list (or do it in batches, we're flexible), *press the Upload Files button*. Watch the green progress bars and see the checkmarks appear. When all the files are uploaded, the computer takes you to the next screen, to sort out the files (article, figure, etc.), then press next to work through each step. File Description ("Figure 1", be brief), then File Order (in which you move files via up and down arrows if necessary). It is important in File Order to press the very small button that says "Please check here…." This triggers the system to create the merge file (for the editors and reviewers) while you go on to Manuscript Information via the "next" button.

● *Then cut-and-paste in the author and paper information.* Have all the contact info for your co-authors ready—names, emails, address, phone, fax. If you are working with them, you should have this info! Each author will be sent a letter to confirm their agreement to the authorship, so do not honor someone with authorship—they must agree to it.

Please note that you can put a co-author's email into the field and press "Find Person" and if they are in our system, it will autofill. (In fact, at the top of that screen, you see a box where you can put in everyone's email as the directions explain and it will find all that are in our system at once.) Do the best you can with our basic format for addresses and other contact data and put in "none" if some required field does not apply to your situation. Do NOT duplicate the corresponding author as a contributing author. Note that the order of authors in the database has nothing to do with the published order—the published order will follow the manuscript file and the eventual proof. Formatting can be plain in the abstract box or you can use the tools for symbols and formatting.

● *The 3rd section is Validate:* Any remaining error messages will show up here. Approve files as indicated.

● *4th and final section: click Submit!*

So 4 sections, each with tabs, and you are guided by a "next" button once the files are uploaded? Is it really that easy?

Yes! At least we hope so, and we're here to help at peer_review@minsocam.org if you do have questions or a special situation. Instructions with more detail are available on the web site!