



## Book Review

### Data analysis in the Earth sciences using Matlab

Gerard Middleton; Prentice-Hall, Upper Saddle River, NJ, 2000, 260pp., ISBN 0133935051 (paperback + disk)

*Data analysis in the Earth Sciences using Matlab* is a straightforward, how-to guide to the analysis of data using Mathwork's *Matlab* software platform. This work is appropriate for classroom applications at any collegiate level. Moreover, anyone desiring a guide to using Matlab for data analysis will find this book of considerable help.

Topics covered by this text include *Fundamentals of Statistics, Algorithms and Computing, Data as Matrices, Regression and Curve Fitting, Classification* (principal components methods), *Time Series, Spatial Data, Directional and Computational Data, and Fractals*. Additionally, two appendices are included. The first, *Introduction to Matlab*, covers starting Matlab, entering data, matrix and array operations, scripts and functions, vectorizing code, and creating figures. The second appendix presents a list of Matlab scripts and functions, and also presents a list of data files included on the disk.

I was one of the reviewers with Prentice-Hall when this book was in draft form. Since its publication, I have acquired Matlab to aid the writing of a book on data visualization. Middleton's book was an invaluable resource for this effort because I applied many of his Matlab examples to create visual outcomes of data analysis. What is said in the remainder of this review is consequently based on my extensive knowledge and use of this book.

All Matlab routines developed by Middleton are listed in full within the text and are included on the one accompanying diskette. Students need only to load a routine from the disk into Matlab; retyping routines is not necessary. This is most advantageous, particularly for routines that generate graphics. Middleton's routines provide correct labeling and scaling, alleviating students' need to design graphical images, a difficult and time-consuming process, even when using Matlab.

In his preface, Middleton notes that the book was written using Matlab, version 4, but routines were tested using Matlab, version 5, prior to final publication. Retesting routines developed under earlier versions is an absolute necessity with Matlab. This program offers a pseudo-language environment. In comparison, as FORTRAN evolved through iterations, IV, 77, and

90, programs written under earlier versions still compile and execute properly. This is not always the case with Matlab. Nevertheless, every one of Middleton's routines that I executed using Matlab 5.3 executed properly.

One coding error was encountered in the kriging routine, *pkrige* (pp. 155–156). The portion of the code that computes spherical variogram model values, as published, reads

```
if mod == 1 % calculate semivariance matrix
    for i = 1:n+1
        for j = 1:n+1
            if i == j
                Gam(i,j) = 0;
            elseif H(i,j) > a
                Gam(i,j) = co + c;
            else
                h = H(i,j)/a;
                Gam(i,j) = c*1.5*h - 0.5*h^3;
            end
        end
    end
end
```

This portion of the code should read

```
if mod == 1
    for i = 1:n;
        for j = i:n;
            if i == j
                Gam(i,j) = 0;
            elseif H(i,j) > a
                Gam(i,j) = co + c;
                Gam(j,i) = Gam(i,j);
            else
                h = H(i,j)/a;
                Gam(i,j) = co + c*(1.5*h - 0.5*h^3);
                Gam(j,i) = Gam(i,j);
            end
        end
    end
end
```

The key change is:  $\text{Gam}(i,j) = \text{co} + c \cdot (1.5 \cdot h - 0.5 \cdot h^3)$ , with the constant,  $c$ , multiplied to both components inside the parentheses. For readers who are unfamiliar with Matlab, this brief example shows that Matlab, although a pseudo-language environment, involves about the same number of code instructions to execute a sophisticated algorithm, such as kriging, as what is required when using another high-level programming environment, such as C++ or

FORTTRAN. The one error in the kriging routine is the only one that I encountered with any of Middleton's routines.

This text offers a distinct advantage for data analysis over spreadsheets. As has already been stated, Matlab code for the various analytical methods developed by Middleton is available on disk. The only way to equal this power with Microsoft Excel, for example, is to write macros in Visual Basic, a substantial coding challenge. Practitioners may well appreciate the advantages offered by this book.

If using this book as a classroom text, it must be understood that students will require access to Matlab.

They can purchase the student version (approximately \$90US), or an instructor can buy a license for running multiple copies. These additional costs must be considered. If an instructor of data analysis insists on using Matlab, then this book by Middleton is indispensable. I could not have mastered the use of Matlab for data analysis and graphics without it.

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