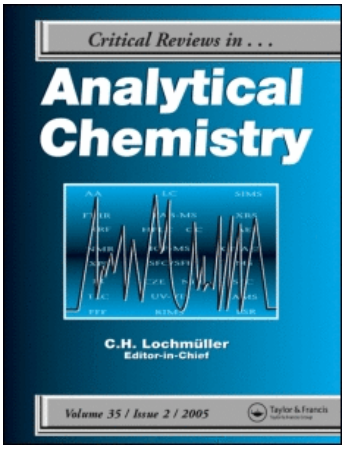

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A Review of: "Review of Practical Handbook of Curve Fitting, Sandra L. Arlinghaus, Editor, CRC Press, Boca Raton, 1994"

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BOOK REVIEW

Review of Practical Handbook of Curve Fitting
Sandra L. Arlinghaus, Editor
CRC Press, Boca Raton, 1994

Reviewer: Johna Leddy, University of Iowa 319-335-1720

The fitting of data to an appropriate curve in the absence of a detailed model is achieved through a balance of intuition and experience. This book is intended for one with experience in their field, but no practice in curve fitting. The examples used to illustrate the methods are taken from numerous fields, ranging from epidemiology to agriculture. There is not a strong focus on chemical data, but large data sets, such as those which might be encountered in environmental sampling, atmospheric observation, and kinetic studies of commercial processes are not dissimilar to the data sets used as examples in the book.

The introduction begins with a very clear and simple explanation of the least squares regression line. The development is different from that used in teaching statistics to undergraduate analytical students, and, is perhaps more readily grasped. The introduction provides a survey of three curve types often used in fitting data sets composed of $y(x)$ and x, where $y(x)$ is an observable dependent on parameter x. These curves are a straight line, an exponential curve, and a logistic curve. The exponential curve is appropriate for unbounded growth, and describes a rate change in $y(x)$ proportional to the current value of $y(x)$. The logistic curve allows for exponential growth of $y(x)$ at low values of x and then leveling off of $y(x)$ at high values of x. The last section in the Introduction describes the cubic spline for fitting evenly spaced data between two bounds to a cubic equation. The spline equation is useful for interpolation but not extrapolation.

Armed with the rudiments of curve types and cubic splines, the reader is provided with ten chapters, each proffering typical analyses in a different field. Chapter topics cover data on population, epidemiology, agriculture, biodiversity, soils and forestry, education, transportation and communication, environmental toxicity, urbanization, and world trade. Each chapter serves to illustrate fitting and data analysis by discussing an example analysis protocol The example is usually taken from the literature. Each chapter stands alone, with only minimal reference to methods described in prior chapters. The examples chosen for analysis involve large data sets, with substantially less correlation between $y(x)$ and x than is typically encountered in chemical measurements made under controlled conditions. The degree of variability in the example data is typical of variation in environmental observations. Because a significant part of the focus in each chapter is on how to deal with significant variability in data, the applicability of this book for most data generated through chemical analysis is probably limited. The discussion includes use of a spreadsheet (Lotus 1-2-3) for presenting and analyzing data. Discussion is provided on how to download data from Internet sources. In general, the level of the book is probably not sufficiently sophisticated to aid the chemist well-versed in data handling.

The book does present two fitting protocols not typically used in chemical data analysis. The first method is a Gompertz curve fitting. The Gompertz curve is a variant of the logistic curve; both curves are S-shaped with the Gompertz curve flattening more severely with increasing x. The logistic curve fits the rate equation $dy(x)/dx = y(x)\,[a - by(x)]$, where $y(x) = q/[1 + a\exp(bx)]$. The Gompertz curve fits $dy(x)/dx = y(x)[a - b\ln y(x)]$, where $(x) = q\exp[-c\exp(-bx)]$. The second method is Feigenbaum's method. This geometric method was developed as part of chaos theory and allows the identification of the critical point above which a system becomes unstable. In such systems, x is not the critical input for subsequent behavior, but $y(x)$. The method is appropriate for identifying the efficacy of control measures in a potentially oscillatory system.