Computational chemistry poses distinct and challenging problems for computational mathematics. The book by Allen and Tildesley is the right place to start for someone interested in entering the subject. For additional material regarding molecular dynamics simulations and Monte Carlo methods, with an emphasis on some applications, one could continue studying the subject with [4] and [9].

R. SCOTT

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31[65–02, 65D07, 65D10, 62–07].—GRACE WAHBA, *Spline Models for Observational Data*, CBMS-NSF Regional Conference Series in Applied Mathematics, Vol. 59, SIAM, Philadelphia, PA, 1990, xii + 169 pp., 25 cm. Price: Softcover $24.75.

This book deals with the problem of fitting noisy data in one or several variables using various types of *smoothing splines*. Such splines arise as the solution of minimization problems where the quantity to be minimized is some combination of *goodness of fit* such as the sum of squares of the deviations and *smoothness* such as integrals involving derivatives of the fitting function.

On one level, the book can be regarded as a rather complete unified treatment of smoothing splines, starting with the classical polynomial smoothing spline, and including discussions of the periodic case on a circle, both scalar- and vector-valued splines on the sphere, and thin-plate splines in the plane (or in higher-dimensional Euclidean space). In addition, two special kinds of smoothing splines, called partial splines and additive splines, are treated. All of these splines are studied from the standpoint of *reproducing kernel Hilbert spaces*, and for each of the cases treated, the associated reproducing kernel is given explicitly. These fitting methods have numerous applications. As examples, the author mentions or discusses the fitting of economical, medical, meteorological, and radiation data. She also treats the use of smoothing spline methods for solving Fredholm integral equations of the first kind, for solving fluid flow problems in porous media, and for solving inverse problems. The book develops various methods of computing the smoothing parameter, including ordinary cross-validation, generalized cross-validation, and others. Finally, numerical methods for computing smoothing splines are also discussed in depth.

On another level, the book is something quite different: it is a detailed explanation of the role of splines in statistical modelling, and in particular the link to Bayesian estimation. At this level, the cast of characters changes from Sobolev spaces and linear functionals to a plethora of statistical objects, ranging from minimum variance linear unbiased Bayes estimates to design of experiments. Statisticians will delight in the appearance of Butterworth filters, variograms, kriging, degree of freedom of signal, unbiased risk estimates, generalized maximum likelihood estimates, confidence intervals, bootstrapping, projection pursuit, loss functions, log likelihood ratios, components of variance, null hypotheses, random effects models, locally most powerful invariant tests, hazard models, etc.

This very readable book should appeal to both audiences; i.e., to approximation theorists and numerical analysts and their clients, as well as to statisticians and model builders, and it is to be hoped that it will help build bridges between these areas. The material is drawn from a series of lectures presented at a CBMS conference held in 1987, and is designed to be read by anyone with a basic knowledge of Hilbert spaces. To insure a smooth start, the author devotes the first chapter to reproducing kernels and their properties. The remaining material is divided into an additional eleven chapters. A list of approximately 300 references is included.

L. L. S.

32[20-02, 20D05, 20E99].—DEREK F. HOLT & W. PLESKEN, *Perfect Groups*, Oxford Mathematical Monographs, Oxford University Press, New York, 1989, xii + 364 pp., 2 microfiche supplements, 24 cm. Price $70.00.

Since the completion of the classification of finite simple groups, the question arises as to what further collections of finite groups to classify. The authors of this book begin work on the perfect groups, i.e., ones which equal their own commutator subgroup.

Their main tool is the computer, which, supplemented by a lot of modular representation theory and group cohomology, enables them to produce numerous perfect extensions of p-groups by known perfect groups. Their aim was to