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 classify all perfect groups of order less than a million. They do not quite make it (but see summary, pp. 260–264), there being too many extensions of large 2-groups by the simple groups of order 60 and 168. However, they do an incredible amount of work, both theoretical and computational, vastly extending Sandlöbes' classification of perfect groups of order less than 10^4 [2].

This is a great book for group theorists to dip into, since it brings together all kinds of interesting theorems hidden in the literature. Someone interested, for example, in universal Frattini extensions can find a thorough discussion here. The authors' claim that the book is self-contained, however, might be questioned. They have included accelerated introductions to, e.g., modular representation theory, but for many of the theorems they still have to quote results. That said, it is great to see these theories in action. There are many examples worked out in detail, supplemented by interesting exercises for the reader.

The tables of perfect groups occupy most of the book, extending for hundreds of pages. They are similar to the Atlas [1]. They lack discussion of subgroups, but go on extensively about the cohomology of the groups. Character tables of certain perfect groups are included in a microfiche appendix by W. Hanrath. These are quotients of space groups, which are extensions of lattices by finite groups acting faithfully. One of the best ways to produce finite perfect groups was to find such quotients, and so the book contains theory and tables of perfect space groups.

All in all, an impressive book that makes some very complicated material easily readable.

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1. J. H. Conway, R. T. Curtis, S. P. Norton, R. A. Parker, and R. A. Wilson, *Atlas of finite groups—Maximal subgroups and ordinary characters for simple groups*, Clarendon Press, Oxford, 1985.

2. G. Sandlöbes, *Perfect groups of order less than* 10^4, Comm. Algebra **9** (1981), 477–490.

33[65-06, 65N20, 65N30].—TONY F. CHAN, ROLAND GLOWINSKI, JACQUES PERIAUX & OLOF B. WIDLUND (Editors), *Domain Decomposition Methods for Partial Differential Equations*, Proceedings in Applied Mathematics, Vol. 43, SIAM, Philadelphia, PA, 1990, xx + 491 pp., $25\frac{1}{2}$ cm. Price: Softcover \$58.50.

This book is the proceedings of the Third (annual) International Symposium on Domain Decomposition Methods for Partial Differential Equations held in Houston in March, 1989. The fourth of this series has already occurred in Moscow, and the proceedings from it will also be published by SIAM.