De Boor's "A Practical Guide To Splines"

This book is based on the authors experience with calculations involving polynomial splines. It presents those parts of the theory which are especially useful in calculations and stresses the representation of splines as linear combinations of B-splines. After two chapters summarizing polynomial approximation, a rigorous discussion of elementary spline theory is given involving linear, cubic and parabolic splines. The computational handling of piecewise polynomial functions (of one variable) of arbitrary order is the subject of chapters VII and VIII, while chapters IX, X, and XI are devoted to B-splines. The distances from splines with fixed and with variable knots is discussed in chapter XII. The remaining five chapters concern specific approximation methods, interpolation, smoothing and least-squares approximation, the solution of an ordinary differential equation by collocation, curve fitting, and surface fitting. The present text version differs from the original in several respects. The book is now typeset (in plain TeX), the Fortran programs now make use of Fortran 77 features. The figures have been redrawn with the aid of Matlab, various errors have been corrected, and many more formal statements have been provided with proofs. Further, all formal statements and equations have been numbered by the same numbering system, to make it easier to find any particular item. A major change has occured in Chapters IX-XI where the B-spline theory is now developed directly from the recurrence relations without recourse to divided differences. This has brought in knot insertion as a powerful tool for providing simple proofs concerning the shape-preserving properties of the B-spline series.

This is absolutely the most excellent book on the subject ever written. It is rigorous, accessible to those who are not professional mathematicians, and full of examples. Using de Boor's public domain software is a cinch, but you need to read the book to fully understand how to do it properly. I really wonder how I got along without it all these years.

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