

# Preface

B-splines are fundamental to approximation and data fitting, geometric modeling, automated manufacturing, computer graphics, and numerical simulations. Because of their computational efficiency, flexibility, and elegance, B-spline techniques are much superior to other, more elementary, piecewise polynomial representations. As a consequence, they have become the method of choice in numerous branches of applied mathematics, computer science, and engineering.

In this book we give an introduction to the basic B-spline theory, describing approximation methods and algorithms as well as modeling and design techniques. We think that only a solid knowledge in all these areas provides an optimal basis for interdisciplinary research and handling of complex novel applications. The new finite element schemes with B-splines provide a perfect example of a successful synthesis of methods from these different fields.

Topics discussed in our book include the Bézier form, computing with B-splines, approximation and interpolation, spline representations of curves, surfaces, and solids, hierarchical bases, and finite element simulation. We do not aim for completeness as more comprehensive and specialized texts do. Instead, we focus on key results and methods which are most widely used in practice. In this way, every important aspect of B-spline theory is described in a relatively short monograph, leading from elementary basic material to advanced topics which are subject of current research.

The material of the book can be almost covered in a one-semester mathematics or computer science graduate course. The combination of mathematics, programming, modeling, and graphics makes the subject fascinating to teach. There is a never-ending supply of interesting thesis topics, typically provided by new industrial applications. Further stimulating the enthusiasm for B-splines among students and assisting in teaching are some of our goals. Together with this book we plan to provide

- a collection of problems, partially with solutions;
- slides for lectures;
- programs and demos.

This supplementary material will be made available on the website for our book (<http://www.siam.org/books/ot132>).

The book is essentially self-contained. Some basic facts from linear algebra, analysis, as well as elementary differential geometry and functional analysis, which are required, are listed in an appendix. Hence, the material is easily accessible not only for mathematics and computer science students but also for beginning graduates in engineering.

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