Book Reviews

Interpolating Cubic Splines

by Gary D. Knott
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The intention of the author was to provide a reasonably broad survey of explicit formulas and algorithms for interpolating spline functions, and to cover some less-commonly treated topics such as optimal smoothing splines and cardinal splines, or untreated topics such as monotonic spline interpolation and physical splines which have heretofore been confined to technical reports and journals.

There is a vast literature on spline functions spread across the various disciplines. Much of this work in the last twenty years, including the material covered in most common references texts on spline and, to a lesser degree, rational splines, has considered splines that approximate given points rather than exactly interpolate them. In contrast, the focus in this book is on the under-discussed area of spline interpolation, although approximation is also covered in a few especially important contexts.

This book counts **18 Chapters**. The **first Chapter** contains a reminder of some basic vector algebra used in the book. The focus is on a geometric view of vector spaces, and on the inner product and vector cross product operations.

The **second Chapter** is dedicated to curves: Curve Parameterization, Normal Curve, Envelope Curves, Arc Length Parameterization, Curvature, the Frenet Equations, Involutes and Evolutes, Helices, Signed Curvature, Inflection Points, and proposes 56 exercises.

The **third Chapter** is dedicated to surfaces, as definitions, with 10 exercises provided.

The **fourth Chapter** addresses the first problem: how to construct an interpolatory space curve.

The **following Chapters** are dedicated to: 2D-Function Interpolation, Λ-Spline Curves with Range Dimension *d*, Double Tangent Cubic Splines, Global Cubic Space Curve Splines, Smoothing Splines, Geometrically Continuous Cubic Splines, Quadratic Space Curve Based Cubic Splines, Cubic Spline Vector Space Basis Functions, Rational Cubic Splines.

The **fifteenth Chapter** contains two programs of C functions. The first provides a routine that can be used to compute a variety of different interpolating cubic spline curves which differ in the choice used of the tangent estimation method. The second program provides a routine that can be used to compute an optimal cubic smoothing spline curve through a user specified program estimated smoothing factor.

The **next Chapter** presents the construction of various parametric functions piece-wise composed of bicubic functions that map R^2 and R^3. These functions are bicubic surface splines analogous to the cubic space curve.

The **next two Chapters** are dedicated to Boundary Curve Based Surface Splines and Physical Splines.

There are more than 350 exercises scattered throughout the text, in most cases at the places where they seem most relevant to the story.

Many exercises have solutions, often because these are repositories of useful information and sometime because the result is subsequently required in the text.

We hope that this book will be a useful reference for numerical analysts, engineers, computer graphics programmers and CAD specialists, as well as other mathematical scientists and students.

Dr. Angela Ioniţă