Multivariate Polysplines: Applications to Numerical and Wavelet Analysis

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Multivariate polysplines are a new mathematical technique that has arisen from a synthesis of approximation theory and the theory of partial differential equations. It is an invaluable means to interpolate practical data with smooth functions.
Multivariate polysplines have applications in the design of surfaces and "smoothing" that are essential in computer aided geometric design (CAGD and CAD/CAM systems), geophysics, magnetism, geodesy, geography, wavelet analysis and signal and image processing. In many cases involving practical data in these areas, polysplines are proving more effective than well-established methods, such as kKriging, radial basis functions, thin plate splines and minimum curvature.

Part 1 assumes no special knowledge of partial differential equations and is intended as a graduate level introduction to the topic
Part 2 develops the theory of cardinal Polysplines, which is a natural generalization of Schoenberg's beautiful one-dimensional theory of cardinal splines.
Part 3 constructs a wavelet analysis using cardinal Polysplines. The results parallel those found by Chui for the one-dimensional case.
Part 4 considers the ultimate generalization of Polysplines - on manifolds, for a wide class of higher-order elliptic operators and satisfying a Holladay variational property.

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