Approximation of B-Spline Curves and Surfaces Using Matrix Representation*

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Abstract

We present approximation algorithms for generating a B-spline curve from separately created curve segments. All input curves are represented by B-spline functions and they may join in a common end point or may have gaps in between. The generated curve merges the input curves and also fills the gaps. Our algorithm computes the control polygon of the new curve from the data of the input curves by minimizing a target function. In the presented examples we analyze the generated solution curves according to the chosen target function and knot vectors. We give also the symbolical solution of this approximation problem when the curves are represented by uniform B-spline functions of degree four. This merging algorithm can be applied on the control net of B-spline surfaces too.

In order to simplify these computations we present an algorithm to compute the matrix representation of non-uniform B-Spline functions defined on arbitrary knot sequences. This algorithm is derived from the reformulation of the de Boor-Cox recursion. Also the conversion matrix is obtained between non-uniform B-Splines and Bézier representations.

Keywords: B-spline approximation, matrix representation

MSC: 68U05, 65D15

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