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Piecewise rational quintic shape-preserving interpolation with high smoothness

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Abstract

We present C^3 or C^4 shape-preserving interpolation schemes based on a two-parameter family of rational quintics, which fits in the frame proposed in [22]. First, given a set of data values and first derivatives, we construct a C^3 shape-preserving piecewise rational quintic interpolant. Second, when only data values are available, a C^4 shape-preserving piecewise rational quintic interpolant is provided. These interpolants are obtained by solving a suitable linear sparse system. We show that it is always possible to select the shape parameters associated with each rational quintic segment so that the shape of the data is locally preserved.

Keywords: Shape-preserving interpolation, rational quintics, totally positive bases.

MSC: Primary 41A29, 65D05, 41A20; Secondary 65D15.

§1. Introduction

Smooth functions interpolating a given set of data and preserving some of their shape properties (like positivity, monotonicity, convexity) are required in several applications. Interpolation or approximation schemes that preserve the shape of the data are referred to as *shape-preserving* schemes.

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