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Editorial

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Analysis of a New Nonlinear Interpolatory Scheme on Quasi-Uniform Grids

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Abstract

In this paper, we tend to introduce and analyze the behavior of a nonlinear subdivision operator referred to as PPH, that comes from its associated PPH nonlinear reconstruction operator on inhomogeneous grids. The descriptor PPH stands for Piecewise Polynomial Harmonic, since the reconstruction is constructed by victimisation piecewise polynomials outlined by means that of associate degree adaption supported the employment of the weighted mean value. The novelty of this work lies within the generalization of the already existing PPH subdivision theme to the inhomogeneous case. we tend to outline the corresponding subdivision theme and study some vital problems associated with subdivision schemes like convergence, smoothness of the limit perform, and preservation of convexity. so as to get general results, we tend to think about think about quasi-uniform grids. we tend to conjointly perform some numerical experiments to strengthen the theoretical results.

Keywords: Interpolation; Subdivision schemes; Nonlinearity; Nonuniform; σ quasi-uniform

Introduction

Subdivision schemes ar closely associated with reconstruction operators. they need been utilized in the previous couple of decades in several applications starting from the numerical answer of partial differential equations to image process and computer-aided geometric style. Subdivision schemes provide straightforward and quick algorithms to approximate the limit perform from a group of initial knowledge at a rough resolution level. there's associate degree methodology of in real time generating subdivision schemes from reconstruction operators and additional specifically from prediction operators. thanks to this affiliation, subdivision schemes inherit several of the properties of their associated reconstruction operators. particularly, the subdivision theme is nonlinear if the reconstruction operator is nonlinear associate degreed it's aforesaid interpolatory if it comes from a reconstruction operator that's an interpolation.

Nonlinear subdivision schemes have emerged pretty much as good candidates to adapt to the concrete knowledge in use. The analysis during this field has expanded, with new contributions annually, and has received the eye of the many researchers; see for instance. Nonlinearity means that data-dependent subdivision schemes, which can conjointly involve nonlinear operations in their definition. Then, by definition, they're designed to beat sure drawbacks that seem once addressing their linear counterparts, like unhealthy behavior within the presence of isolated discontinuities for example. associate degree example of those kinds of operators was outlined in and was named PPH (Piecewise Polynomial Harmonic). This theme essentially consists on an ingenious modification of the classical four-point Lagrange subdivision theme. many studies are dispensed regarding their properties and performance in several applications, see for instance. 2 main functions of this subdivision theme are associated with addressing knowledge containing isolated discontinuities, reducing the undesirable effects, and conserving the convexity of the initial knowledge whereas maintaining a focused support supported four points.

In the authors extended the definition of the PPH reconstruction operator to inhomogeneous grids. In turn, this reality permits United States to increase the PPH subdivision theme to inhomogeneous grids and to hold out a parallel study during this new situation. So as to beat some technical difficulties within the theoretical proofs, we tend to restricted some results to σ quasi-uniform grids. The resultant theme is kind of fascinating in terms of applications thanks to the virtually C one smoothness of the limit perform, permitting United States to approximate accurately continuous functions with corners, and thanks to applicable properties concerning convexity preservation of the initial data; see during this paper, we tend to specialize in proving the convergence of the theme towards associate degree nearly C one limit perform and that we address numerically the difficulty of stability, that could be a central issue so as to be helpful for applications.

The paper is organized as follows: Section 2 is devoted to a review of the PPH reconstruction operator over nonuniform grids. Section 3 presents a short review about Harten's interpolatory multiresolution setting, which is closely connected to interpolatory subdivision schemes. In Section 4, we define the associated subdivision scheme, which we show amounts to the PPH subdivision scheme when use a restriction to uniform grids. The definition is given for general nonuniform meshes, although in order to establish some theoretical results, we consider σ quasi-uniform meshes. In Section 5, we analyze the main issues about subdivision schemes. In particular, we prove some results about convergence, smoothness of the limit function, and convexity preservation. In Section 6, we carry out some numerical tests to check the theoretical smoothness of the limit function and the performance of the nonlinear subdivision scheme. Finally, we give some conclusions in section 7.

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