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**Abstract:** In the Sparse Point Representation (SPR) method the principle is to retain the function data indicated by significant interpolatory wavelet coefficients, which are defined as interpolation errors by means of an interpolating subdivision scheme. Typically, a SPR grid is coarse in smooth regions, and refined close to irregularities. Furthermore, the computation of partial derivatives of a function from the information of its SPR content is performed in two steps. The first one is a refinement procedure to extend the SPR by the inclusion of new interpolated point values in a security zone. Then, for points in the refined grid, such derivatives are approximated by uniform finite differences, using a step size proportional to each point local scale. If required neighboring stencils are not present in the grid, the corresponding missing point values are approximated from coarser scales using the interpolating subdivision scheme. Using the cubic interpolation subdivision scheme, we demonstrate that such adaptive finite differences can be formulated in terms of a collocation scheme based on the wavelet expansion associated to the SPR. For this purpose, we prove some results concerning the local behavior of such wavelet reconstruction operators, which stand for SPR grids having appropriate structures. This statement implies that the adaptive finite difference scheme and the one using the step size of the finest level produce the same result at SPR grid points. Consequently, in addition to the refinement strategy, our analysis indicates that some care must be taken concerning the grid structure, in order to keep the truncation error under a certain accuracy limit. Illustrating results are presented for 2D Maxwell's equation numerical solutions. (C) 2010 Elsevier B.V. All rights reserved.

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