Non-linear Partition of Unity method

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Abstract: Kernel-based schemes are used in many applications, such as machine learning or regression. One of their principal advantages is their easy implementation in several dimensions. However, these methods present some problems due to their computational cost when a large number of data is used. In order to solve this disadvantage, Partition of Unity method is presented, see e.g. [1], as an efficient solution. It consists in dividing the domain in some patches and solving a small interpolation problem for each of those subdomains. Finally, a convex combination of these solutions is applied. In this work, we modify the last part of this algorithm introducing a non-linear procedure based on the well-known WENO method, see e.g. [2]. The result is a non-linear interpolation technique with accurate results when the data presents isolated discontinuities or strong gradients. Some numerical experiments are performed to check the theoretical properties.

References:

[1] R. Cavoretto, A. De Rossi, S. Lancellotti, E. Perracchione (2022): "Software Implementation of the Partition of Unity Method", *Dolomities Research Notes on Approximation*.

[2] C.-W. Shu, (1999): "High Order Weighted Essentially Nonoscillatory Schemes for Convection Dominated Problems", *SIAM Review*.