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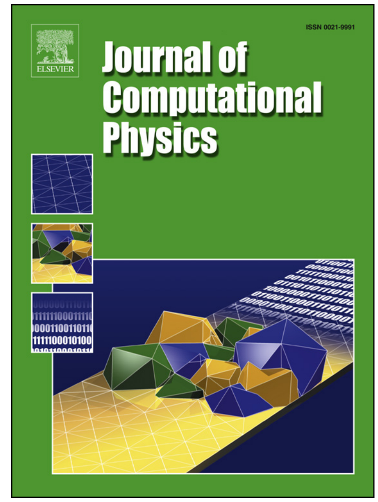

An RBF-FD closest point method for solving PDEs on surfaces

A. Petras, L. Ling, S.J. Ruuth

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Highlights

- In this paper, a new method for the numerical approximation of PDEs on surfaces is proposed. Our method has the advantage of being comprised of standard computational components, such as the closest point representation of the surface, and RBF finite difference methods.
- Our approach uses a narrow computational tube around the surface and avoids the need for a quasi-uniform distribution of surface points. This makes the method a natural candidate for coupling with grid-based methods such as the grid-based particle method for moving interface problems (Leung and Zhao, J. Comput. Phys. 228(8):2993–3024, [2009]). The method is also effi- cient: it exploits repeated patterns in computational geometry, it uses small computational tubes, and it avoids an explicit interpolation step. Furthermore, a change in the order of the method is carried out simply by changing the number of points in the finite difference stencil. See our novelty state- ment for details on how the method compares with the original closest point method (Ruuth and Merriman, J. Comput. Phys. 227(3):1943-1961, [2008]) and recent RBF methods (e.g., Piret, J. Comput. Phys. 231(14):4662-4675, [2012]))
- We conduct convergence studies in two and three dimensions and apply the method to a variety of problems, including reaction-diffusion systems and image denoising. Second order accurate results are observed in our experi- ments.