# An RBF-FD Method for Solving Partial Differential Equations on Evolving Curves and Surfaces

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Many applications in the natural and applied sciences involve the solution of partial differential equations (PDEs) on surfaces. Application areas for PDEs on static surfaces include image processing, biology, and computer graphics. Applications for PDEs on moving surfaces also occur frequently. Notable examples arise in biology, material science, fluid dynamics, and computer graphics.

Radial Basis Function-generated Finite Difference (RBF-FD) methods have the properties of being meshfree (giving it flexibility to represent complex geometries in any spatial dimension), of providing a high order of accuracy, as well as having a low computational complexity. Although RBFs have been used for solving PDEs on static manifolds for a few years (e.g. [1, 2]), its application to solving PDEs on moving curves and surfaces is in its infancy. In this presentation, we introduce a procedure to solve PDEs on evolving surfaces. Our method is based on the RBF-FD method to discretize curve (or surface)-constrained differential operators, to accurately and efficiently evolve solutions, manifolds, and the computational grid. We will show that the proposed method is stable, has a high order of accuracy, and is computationally cheap compared to its various counterparts (e.g. [3]). We will present a number of examples to illustrate the numerical convergence properties of our proposed method.

**Joint work with:** C. Piret, J. Blazejewski.

## References

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[3] A.Petras, L.Ling, C. Piret, S. Ruuth. A least-squares implicit RBF-FD closest point method and applications to PDEs on moving surfaces. *J. Comput. Phys.*, 381, 2019, pp. 146–161.