List Overview

- The work in [1] involves solving PDEs over evolving domains in contrast to our work which focuses on PDEs on evolving surfaces.
  - They use Semi-Lagrangian based automatic Overlapped RBF-FD methods to solve advection-diffusion equations.
  - Evolving domains are actually on our list of possible extensions of our method. Our extension would look quite different from what was done in [1] in that we would be using tensor formulations to handle the evolving domains.
  - Merging domains can be easier to resolve because we can take advantage of interior data.
- Semi-Lagrange (SL) based automatic Overlapped RBF-FD method for solving advection-type equations
  - To use an SL method, Shankar, et al. used a fixed background node set that had its nodes activated and deactivated to keep track of the boundary of the domain. This dynamic node set looks really similar to modern level-set methods and closest point methods for solving evolving surfaces.
  - Shanar, et al. use appended Legendre polynomials when solving for their FD weights. In contrast, we have only used monomials up to this point but have started to explore using Barycentric formulations for the appended polynomials.
  - In contrast to using an overlap parameter δ, Shankar, et al. have replaced δ with two proxies to measure the quality of the FD stencils. This is my first time hearing about Overlapped RBF-FD methods. As such, I could definitely see using Overlapped RBF-FD methods to improve our accuracy and stability in solving surface PDEs.

Remarks

Although our research is currently focused on PDEs on evolving surfaces, the scope of PDEs we are attempting to solve is broader than advection-diffusion equations. As a result, we are not able to rely on SL methods directly for solving our PDEs. However, we could possibly improve modern level-set techniques by employing an SL based automatic Overlapped RBF-FD method for solving the advection-type level-set equation.

The improvement of Overlapped RBF-FD methods could be used instead of RBF-FD to solve our PDEs. Using Overlapped RBF-FD methods could improve the cost of our current method and may even improve stability by creating better stencils.

References

[1] Varun Shankar, Grady B. Wright, and Aaron L. Fogelson. An efficient high-order meshless method for advection-diffusion equations on time-varying irregular domains. *Journal of Computational Physics*, 445, Nov 2021.