1162-65-154 **Varun Shankar***, shankar@cs.utah.edu, and **Grady B Wright** and **Aaron L Fogelson**. *An Efficient High-Order Meshless Method for Advection-Diffusion Equations on Time-Varying Irregular Domains.*

We present a high-order radial basis function finite difference (RBF-FD) framework for the solution of advection-diffusion equations on time-varying domains. Our framework is based on a generalization of the recently-developed Overlapped RBF-FD method, and utilizes a novel automatic procedure for computing RBF-FD weights on stencils in variable-sized regions around stencil centers. This procedure paves the way for tuning-free assembly of RBF-FD differentiation matrices on moving domains. In addition, our framework utilizes a simple and efficient procedure for *updating* RBF-FD differentiation matrices on moving domains. Finally, advection-diffusion in time-varying domains is handled through a high-order semi-Lagrangian method that utilizes the parameter-free overlapped RBF-FD method combined with rapid and localized node set modification. The resulting framework has no tuning parameters and allows for large time-steps. We demonstrate high-orders of convergence for advection-diffusion equations on time-varying 2D and 3D domains for both small and large Peclet numbers. Finally, we utilize our method to solve a coupled 3D problem motivated by models of platelet aggregation and coagulation, once again demonstrating high-order convergence rates in a refinement study. (Received August 30, 2020)