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High-Order Discontinuous Galerkin Level Set Method for Interface Tracking and Re-Distancing on Unstructured Meshes[1] PATRICK GREENE, ROBERT NOURGALIEV, SAM SCHOFIELD, Lawrence Livermore National Laboratory — A new sharp high-order interface tracking method for multi-material flow problems on unstructured meshes is presented. The method combines the marker-tracking algorithm with a discontinuous Galerkin (DG) level set method to implicitly track interfaces. DG projection is used to provide a mapping from the Lagrangian marker field to the Eulerian level set field. For the level set re-distancing, we developed a novel marching method that takes advantage of the unique features of the DG representation of the level set. The method efficiently marches outward from the zero level set with values in the new cells being computed solely from cell neighbors. Results are presented for a number of different interface geometries including ones with sharp corners and multiple hierarchical level sets. The method can robustly handle the level set discontinuities without explicit utilization of solution limiters. Results show that the expected high order (3rd and higher) of convergence for the DG representation of the level set is obtained for smooth solutions on unstructured meshes. High-order re-distancing on irregular meshes is a must for applications were the interfacial curvature is important for underlying physics, such as surface tension, wetting and detonation shock dynamics.

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