Advances on complex geometry simulation capability for the Fire Dynamics Simulator

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The Fire dynamics simulator (FDS) is employed in evaluation and design of fire protection systems, forensic work, and study of wildland fires, among others. In this talk we present development advances on complex geometry simulation with FDS. An efficient algorithm based on spatial intersection and polygon/polyhedral reconstruction is developed to define the boundary conforming cut-cell mesh around geometrically complex objects in three dimensions. A conservative finite volume unstructured discretization of the energy and scalar transport equations (i.e. chemical species) on this cut-cell grid is implemented. The implicit solution of scalar transport, which addresses the small cell problem close to the object, is done using the Intel MKL Pardiso direct solver. Velocity reconstruction on faces near the solid surfaces is done using a direct forcing immersed boundary method (IBM). Finally, tight conservation defined by the pressure Cartesian unstructured discretization and solution is fulfilled, and compared to the global Pressure solution method present in FDS. Details on the derivation, implementation and testing of the scheme will be provided.