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Using the Level-set Method to Generate Optimizable Geometries for Aerodynamic Applications JACK S. ROSSETTI, JOHN F. DANNENHOFFER III, Syracuse University — Within the last three decades, topology optimization has grown in popularity in both the structural and fluid dynamics fields. The method is a more general shape optimization, meaning, the final topology of the design does not need to be known beforehand. Currently, the applications of topology optimization in the fluid dynamics field is limited to low Reynolds number flows. At higher Reynolds numbers, inertial effects strongly influence the fluid flow, which makes maintaining smooth boundaries essential. No method exists that represents geometries used for topology optimization with adequately smooth boundaries. Herein, a level-set method for representing geometries using radial basis functions is presented. The level-set method was chosen because of its potential ability to produce smooth boundaries and its uniform parameterization of any shape, thus, no additional grids are required on the design during the optimization process. The level-set method is used to generate various geometries and the design sensitivities, with respect to radial basis function amplitude, will be calculated. Topology optimization will then be then applied to a circular level-set geometry in high-speed 2D cross-flow to maximize the lift-to-drag ratio and the optimization results will be presented.

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