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CFD-based derivative-free optimization using polyharmonic splines, Part 1 POORIYA BEYHAGHI, DANIELE CAVAGLIERI, THOMAS BEWLEY, Flow Control Lab, UC San Diego — Nonsmooth CFD-based optimization problems are difficult, due both to the nonconvexity of the cost function and to the extreme cost of each function evaluation. In this work, we develop a derivative-free GPS optimization scheme which makes maximum use of each function evaluation. We seek to improve on the efficiency of the existing methods that have been applied to this class of problems (genetic algorithms, SMF, orthoMADS, etc). At each optimization step, the algorithm proposed creates a Delaunay triangulation based on the existing evaluation points. In each simplex so created, the algorithm optimizes a cost function based on a polyharmonic spline interpolant. This interpolation strategy behaves appropriately even when the evaluation points are clustered in particular regions of interest in parameter space (in contrast with the Kriging interpolation strategy used in existing GPS/SMF algorithms). At each optimization step, an appropriately-modeled error function is combined with the interpolant, weighted with a tuning parameter governing the trade-off between local refinement and global exploration.

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