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Uncertain shape optimization for dense gas flows PIETRO MARCO CONGEDO, CHRISTOPHE CORRE, LEGI-Grenoble, JEAN-MARC MARTINEZ, CEA-Saclay — Uncertain shape optimization is a fascinating but challenging task. Our work explores some key issues in uncertain optimization and proposes a strategy to obtain a more reliable solution at a moderate computational cost. The steady transonic inviscid flow of a dense gas over an airfoil is considered and a shape optimization performed to minimize the airfoil's drag coefficient. Three sources of uncertainties are accounted for : thermodynamic model, freestream conditions and geometry. The combined effect of these uncertainties is analyzed to get the average and variance of the drag coefficient, that are both minimized during the optimization. Preliminary stochastic simulations based on polynomial chaos expansions yield the most influent uncertain parameters; several optimization strategies are then studied, with an original combination of response surfaces and metamodels, to obtain robust optimal solutions for a limited number of flow computations.

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