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OPTIMIZATION UNDER UNCERTAINTIES USING THE CONTINUOUS ADJOINT METHOD AND POLYNOMIAL CHAOS EXPANSION

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The existence of uncertainties, associated with either the operating conditions (environmental uncertainties) and/or manufacturing imperfections (unpredictable shape imperfections during the manufacturing process) is quite usual in various engineering fields.

This paper deals with optimization under flow uncertainties using the non-intrusive Polynomial Chaos Expansion (PCE) for the uncertainty quantification (UQ), which allows for a controllable computational cost compared to standard sampling techniques. In previous work by the same group of authors, PCE was combined with Evolutionary Algorithms (EA) [1], whereas in this work the optimization is assisted by the continuous adjoint technique [2].

To this end, PCE is used to compute not only the statistical moments of the objective function under consideration but also, the gradient of those statistical moments w.r.t. the design variables. Applications on the optimization under uncertainties of a) the DrivAer car model for minimum drag and b) the flow control system (using jets) in a cavity for the maximization of the heat transfer from its sliding wall, will be presented.

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