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A Posteriori Error Analysis of a Non-Standard Quantity of Interest

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Abstract

Classical *a posteriori* error analysis quantifies error in a Quantity of Interest (QoI) which is represented as a bounded linear functional of the solution. In this work we consider *a posteriori* error estimates of a specified non-linear quantity of interest using adjoint-based analysis for linear and nonlinear systems of Ordinary Differential Equations. We apply the estimates to the problem of uncertainty quantification of certain example ODEs which depend on a stochastic parameter. In particular, we compute a bound for the error in a corresponding cumulative distribution function. We derive two methods for computing the error estimates for the QoI. The first directly computes the error estimate using linearizations via Taylor's Theorem. The second method acquires our estimate indirectly by implementing root-finding techniques on a corrected solution. We provide several examples to test the accuracy of the methods.

Research done in collaboration with:

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