

A CLASS OF ADAPTIVE MULTIVARIATE NONLINEAR ITERATIVE METHODS

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ABSTRACT. Multivariate iterative procedures, based on the use of multivariate rational Hermite interpolants, are introduced for the solution of systems of nonlinear equations. To this end, the most recent iteration points are used as interpolation points. Coalescent interpolation points are obtained by repeating the same iteration point a number of times.

This new type of iterative procedure can be completely adapted to the cost of evaluating and/or differentiating the nonlinear equations in the system. Section 1 deals with the univariate case and repeats both one-point and multipoint iterative procedures resulting from the use of approximating rational functions. Section 2 generalizes the multipoint iterations to the multivariate case while Section 3 generalizes the one-point iterations.

1. Nonlinear methods for the solution of systems of nonlinear equations. Suppose we want to find a root x^* of the nonlinear equation

$$f(x) = 0,$$

where the univariate function f may be real- or complex-valued. If f is replaced by a local approximation, then a zero of that local approximation can be considered as an approximation for x^* . Methods based on this reasoning are called direct methods. One could also consider the inverse function g of f in a neighborhood of 0, if it exists, and replace g by a local approximation. Then an evaluation of this local approximation at 0 can be considered as an approximation for x^* since

$$g(0) = x^*.$$

Methods using this technique are called inverse methods. We now look at some univariate nonlinear direct and inverse methods that will

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