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Jovana Džunić, Ivan Damnjanović

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General approach to constructing optimal multipoint families of iterative methods using Hermite's rational interpolation¹

Jovana Džunić², Ivan Damnjanović

Faculty of Electronic Engineering, University of Niš, 18 000 Niš, Serbia

Abstract

We discuss accelerating convergence of multipoint iterative methods for solving scalar equations, using particular type rational interpolant. Both derivative-free and Newton-type methods are investigated simultaneously. As a conclusion a Theorem of König's type for multipoint iterations is stated. A new optimal multipoint family of methods based on rational interpolation is constructed. The iteration uses n function evaluations per cycle and $\mathcal{O}(j)$ operations in j -th step of a single iteration to obtain 2^{n-1} order of convergence. Several equivalent forms of the obtained iterates and development techniques are presented.

MSC: 65H05

Keywords: Iterative methods, Nonlinear equations, Hermite Rational Interpolation, Divided difference.

1. Introduction

Multipoint methods are among the most efficient tools in approximating a single root of a nonlinear equation by iterative means. The search for reliable methods to construct these powerful root-finders is very intensive and has increased over the years. For details and relevant references, the reader is re-

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²Corresponding author, e-mail address: jovana.dzunic@gmail.com

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