Accepted Manuscript

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Jovana Džunić, Ivan Damnjanović

PII: S0377-0427(17)30104-8
DOI: http://dx.doi.org/10.1016/j.cam.2017.02.039
Reference: CAM 11041

To appear in: *Journal of Computational and Applied Mathematics*

Received date: 11 October 2016
Revised date: 23 February 2017

Please cite this article as: J. Džunić, I. Damnjanović, General approach to constructing optimal multipoint families of iterative methods using Hermite's rational interpolation, *Journal of Computational and Applied Mathematics* (2017), http://dx.doi.org/10.1016/j.cam.2017.02.039

General approach to constructing optimal multipoint families of iterative methods using Hermite's rational interpolation[1]

Jovana Džunić[2], 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-

[1]This research was supported by the Serbian Ministry of Education and Science under grant number 174022

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