

FPML

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Abstract

We present a novel modification of Laguerre’s method that results in a method for the concurrent approximation of all roots of a univariate polynomial. Our method has strong virtues including fourth-order convergence that is observed in practice and belonging to the class of embarrassingly parallel algorithms. A Fortran 90 implementation of our algorithm is available online and comparisons with several other software are provided to show the effectiveness of our approach.

Introduction

Let $p(\lambda)$ be a polynomial of degree m and denote by (z_1, \dots, z_m) the current approximations to the roots r_1, \dots, r_m of $p(\lambda)$. The j th approximation is updated via

$$\hat{z}_j = z_j - \frac{m}{G_j \pm \sqrt{(m-1)(mH_j - G_j^2)}}, \tag{1}$$

where

$$G_j = \frac{p'(z_j)}{p(z_j)} - \sum_{\substack{i=1 \\ i \neq j}}^m \frac{1}{(z_j - z_i)} \quad \text{and} \quad H_j = \tag{2}$$

Something else

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