



Dynamics of Newton-like root finding methods

B. Campos¹ · J. Canela¹ · P. Vindel¹

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Abstract

When exploring the literature, it can be observed that the operator obtained when applying *Newton-like* root finding algorithms to the quadratic polynomials $z^2 - c$ has the same form regardless of which algorithm has been used. In this paper, we justify why this expression is obtained. This is done by studying the symmetries of the operators obtained after applying Newton-like algorithms to a family of degree d polynomials $p(z) = z^d - c$. Moreover, we provide an iterative procedure to obtain the expression of new Newton-like algorithms. We also carry out a dynamical study of the given generic operator and provide general conclusions of this type of methods.

Keywords Iterative methods · Newton-like algorithms · Complex dynamics of rational functions

Mathematics Subject Classification (2010) 65F10 · 37F10 · 30C10

1 Introduction

Numerical methods allow finding solutions of non-linear equations that cannot be solved by algebraic procedures. The development and improvement of these methods and their behaviour constitute a field of intense research and a vast literature related to this topic can be found (see, for example [21, 24, 25, 28] [26] and references therein).

Iterative methods solve non-linear equations by generating successive approximations that may eventually converge to the solution. The so-called one-point-methods

✉ P. Vindel
vindel@uji.es

B. Campos
campos@uji.es

J. Canela
canela@uji.es

¹ Instituto de Matemáticas y Aplicaciones de Castellón, Universitat Jaume I, Castelló, Spain