Impact of complex and real dynamical analysis on the performance of a new iterative family

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Abstract

Dynamical analysis on numerical methods involves studying the behavior of numerical methods applied to dynamical systems, with a focus on understanding their accuracy, stability, and convergence properties. The impact of complex and real dynamical study on the performance of numerical methods has been a topic of research in various fields such as computational mathematics, physics, and engineering. One of the main goals is to identify the limitations and potential errors of numerical methods when applied to nonlinear equations and nonlinear systems of equations.

The dynamical behavior of the rational operator associated with iterative schemes applied to low-degree nonlinear polynomial equations or systems, has proven to be an efficient tool to analyze the stability and reliability of the methods. For example, refer to [1, 3] and the references it contains.

In this conference, we will introduce a new three-step sixth-order uniparametric iterative family for solving nonlinear equations [4] and its extension for systems [5]. A complex dynamical analysis is carried out on scalar cases and a real dynamical study on vector cases. The purpose of this manuscript is to show the impact of these studies on the performance of the family, considering parameter spaces and dynamical planes as tools to determine the best and worst iterative schemes in terms of stability. Several numerical tests are performed with selected members to illustrate the errors and the number of iterations to converge to the solution.

References

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