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ORIGINAL PAPER

The solution techniques for linear and quadratic equations with coefficients as Cauchy neutrosphic numbers

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Abstract
Finding the roots of equations is an ancient art of mathematics. To deal with the physical phenomena with vague information, the relations and equalities have to be expressed in terms of uncertain coefficients. In this context, the theory of fuzzy equations attained huge attentions to model the phenomena under uncertainty. However, a Neutrosophic set (or numbers) has the capabilities to carry more structured sense about the imprecise data in the domain of uncertainty analysis. In this present paper, the solutions of the polynomial equations of one and two degree are bothered in a Neutrosophic arena. The whole study is organized on the basis of two distinct pockets of theoretical enrichment. The establishment of the mathematical frame of generalized bell-shaped Neutrosophic number (more specifically, Cauchy Neutrosophic number) and exploration of the arithmetic properties of the defined number are the initial objectives. Subsequently, the main goal of the paper is executed through the illustration of the proposed number as a domain of interpretation for the detailed manifestation of different solution approaches of linear and quadratic equations. In this paper, several possible solution techniques of linear and quadratic equations are theoretically addressed assuming the association of Neutrosphic data as the coefficients of the equations. The theoretical advancements are crystallized through the numerical simulation and graphical visualizations in the every pocket of discussions. A problem of investment firm is viewed in the light of Neutrosophic philosophy and is solved as an aptly fitted physical scenario of the proposed theory.

Keywords Bell-shaped neutrosphic number · Cauchy neutrosphic number · Neutrosophic equation · Extension principle method · Transmission of average method

1 Introduction

Searching the roots of the polynomial and transcendental equation is a very celebrated custom among the family of pure mathematician. It may be an orthodox pleasure for a scholar engaged for finding zeros of mathematical expressions. At the same times, the mathematical expressions and equations are built up on the basis of some ground realities. In this context, the coefficients and expected roots of such equations vary within different domains of number systems. The domains of integer, rational number, real number, complex number were gradually coming to fulfil mathematical obligations for the expected roots of equations. In reality, the available information regarding the physical phenomena are not always certain and precise. So, the mathematical expressions must be structured in such a way that it can capture and carry the sense of uncertainty and vagueness in the process of mathematical manipulation. Fuzzy set theory is such emerging philosophy introduced by Zadeh (1965). Later, Chang and Zadeh (1972) contributed a clear insights on the fuzzy theory. The binary trend of exclusion and inclusion of members of a set was generalized in the fuzzy set theory with the addition of the notion of membership grade of elements of fuzzy sets. Several worthy findings and explorations (see Dubois and Prade 1978; Turksen 1986) were contributed on the goal of enrichment of the

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