“The simplified topological epsilon-algorithms and their applications”

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Abstract

Shanks scalar sequence transformation (Shanks, 1949, 1955) and the corresponding ε-algorithm (Wynn, 1956) for its recursive implementation are well-known convergence acceleration methods. They were generalized to be able to treat sequences of elements of a general vector space $E$ (Brezinski, 1975). The rules of this topological ε-algorithm are quite complicated and difficult to implement since elements of $E^*$, the algebraic dual space of $E$, recursively intervene in them. Recently, these rules were greatly simplified, thus leading to the simplified topological ε-algorithm (C.B., M.R.-Z., 2014). First, we will show how its recursive rule was derived from the old rules. Then, this new algorithm and its implementation will be discussed. We will see the simplification it brought in terms of arithmetical operations and storage. The use of the freely available corresponding software will be described (C.B., M.R.-Z., 2017). This algorithm will then be applied to the solution of systems of linear and nonlinear equations, the computation of matrix functions, and the solution of Fredholm integral equations of the second kind (C.B., M.R.-Z., 2017).