

A Novel Perturbed Dynamical Method for Solving Singular Systems of Nonlinear Equations

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Summary

ABSTRACT: In this paper, a novel method, named the perturbed dynamical method, is proposed to solve nonlinear systems whose Jacobian matrix is singular. The concept of the proposed method roots from the conventional homotopy method but it takes the advantages of converting a vector function to a scalar function by using the square norm of the vector function to conduct a scalar-based homotopy method. Then, a small parameter, which is similar to the perturbation theory, is introduced to the singular systems of nonlinear equations such that the modified singular systems of nonlinear equations become nonsingular and the asymptotic solutions may be found. As a result, the proposed novel method does not need to calculate the inverse of the Jacobian matrix and thus has great numerical stability. Results obtained show that the proposed novel method can be used to solve singular systems of nonlinear equations with high accuracy as well as the convergence and it may be a better alternative for solving a system of non-linear algebraic equations.

