

Wavelet analysis method for solving linear and nonlinear singular boundary value problems

ABSTRACT

In this paper, a robust and accurate algorithm for solving both linear and nonlinear singular boundary value problems is proposed. We introduce the Chebyshev wavelets operational matrix of derivative and product operation matrix. Chebyshev wavelets expansions together with operational matrix of derivative are employed to solve ordinary differential equations in which, at least, one of the coefficient functions or solution function is not analytic. Several examples are included to illustrate the efficiency and accuracy of the proposed method.

Keyword: Chebyshev wavelet; Ordinary differential equations; Singular boundary value problems; Operational matrix; Product operation matrix; Shifted Chebyshev polynomials.