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A new operational matrix of integration based on the independence polynomial of graph to solve fractional Poisson equation. (English) Zbl 07459022

J. Fract. Calc. Appl. 13, No. 1, 171-188 (2022)

Summary: In this paper, we have derived a new operational matrix of fractional integration by using the independence polynomial of a complete bipartite graph and applied it to solve the Poisson equation with Dirichlet boundary conditions. While deriving the operational matrix, the Caputo sense fractional derivatives are considered. Series solutions are found by using the collocation matrix method. The main characteristic of the approach is that it reduces a complex fractional differential equation to a system of algebraic equations. The error bound and computational complexity of the projected algorithm are also investigated. Solutions obtained for the Poisson equation have established the relevance and applicability of the method described. Comparative analysis of the obtained results with the exact solutions convinces that the present method can be considered an efficient numerical tool for solving fractional differential equations.

MSC:

35J15 Second-order elliptic equations
65M70 Spectral, collocation and related methods for initial value and initial-boundary value problems involving PDEs
35R11 Fractional partial differential equations

Keywords:

Caputo fractional derivative; complete bipartite graph; fractional Poisson equation; operational matrix

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