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The use of a meshless technique based on collocation and radial basis functions for solving the time fractional nonlinear Schrödinger equation arising in quantum mechanics. (English)

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Summary: In this paper, we propose a numerical method for the solution of the time-fractional nonlinear Schrödinger equation in one and two dimensions which appear in quantum mechanics. In this method we first approximate the time fractional derivative of the mentioned equation by a scheme of order $O(\tau^{2-\alpha})$, $0 < \alpha < 1$ then we will use the Kansa approach to approximate the spatial derivatives. The meshless method has already proved successful in standard quantum mechanics as well as for several other engineering and physical problems. The aim of this paper is to show that the meshless method based on the radial basis functions and collocation approach is also suitable for the treatment of the fractional quantum mechanics. The results of numerical experiments are compared with analytical solution to confirm the accuracy and efficiency of the presented scheme.

MSC:

65M70	Spectral, collocation and related methods for initial value and initial-boundary value problems involving PDEs	Cited in **63** Documents
35Q55	NLS equations (nonlinear Schrödinger equations)	
35R11	Fractional partial differential equations	
45K05	Integro-partial differential equations	
81Q05	Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics	

Keywords:

time fractional; nonlinear Schrödinger equation; Kansa method; radial basis functions (RBFs); interpolation method; fractional quantum mechanics; meshless methods

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