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Numerical Integration of Nonlinear FitzHugh-Nagumo Partial Differential Equations Using Second Derivative Two-step Hybrid Block Method Coupled with the Compact Difference Schemes

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In this paper, the derivation of a second derivative two-step hybrid block Method is carried out via Collocation techniques and the scheme is coupled with sixth-order compact difference schemes for the numerical solution of the nonlinear FitzHugh-Nagumo Partial Differential Equations (PDE) which is of physical relevance. The sixth-order standard compact difference schemes are used to semi-discretize the nonlinear FitzHugh PDE to a system of first-order ordinary differential equations (ODEs). Then the derived two-step hybrid block scheme proposes an approximate solution to the resulting system of ODEs. The proposed block scheme has been proven to be zero-stable, consistent, and convergent while maintaining good accuracy. The numerical results reveal that the derived block scheme is computationally efficient, when compared to the exact solution and some existing schemes solutions derived from solving FitzHugh-Nagumo PDE.

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