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DEVELOPMENT AND ANALYSIS OF AN INNOVATIVE TECHNIQUE FOR ADDRESSING INITIAL VALUE PROBLEMS: THE JEEVA DHARMALINGAM METHOD

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Abstract. This study presents a novel numerical technique, the Jeeva-Dharmalingam method (JDM), which combines a third-order polynomial equation with transcendental function of specialized exponential formulation to effectively address initial-value problems (IVPs) in first-order linear, nonlinear, and system of differential equations. We conduct a detailed investigation into the proposed method's properties, including its local truncation error, accuracy, consistency, stability, and convergence. The analysis reveals that the JDM achieves fourth-order convergence, confirming its reliability and stability. To assess its effectiveness, the study employs four numerical examples derived from physical models and real-world applications. A comparative evaluation with the fourth-order Runge-Kutta method (RK4) is also presented, highlighting the JDM's superior accuracy and efficiency in approximating exact solutions. MATLAB® software has been used for the simulations. The findings affirm that the JDM is a robust and precise tool for addressing real-world problems in IVPs, positioning it as a valuable addition to existing numerical methods for researchers and practitioners in the field of numerical analysis.

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