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A NEW SCHEME FOR SOLVING GOURSAT PROBLEM USING NEWTON-COTES INTEGRATION FORMULA

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulation the conduct of my study and research.

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ABSTRACT

The Goursat partial differential equation is a hyperbolic partial differential equation which arises in science and engineering fields. Many approaches have been suggested to approximate the solutions of the Goursat partial differential equations such as the finite difference method, Runge-Kutta method, differential transform method, variational iteration method and homotopy analysis method. These methods focus on series expansion and numerical differentiation approaches including the forward and central differences in deriving the schemes. In this thesis, we developed new schemes to solve a class of Goursat partial differential equations that applies the Newton-Cotes formula for approximating the double integrals terms. The Newton-Cotes numerical integration involves Newton-Cotes order one, Newton-Cotes order two, Newton-Cotes order three and Newton-Cotes order four. The linear and nonlinear homogeneous and inhomogeneous Goursat problems are examined. The new schemes gave quantitatively reliable results for the problems considered. The numerical analysis test has been performed to ensure that the new schemes are accurate, consistent, stable and converge in solving these problems. The accuracy level of the results obtained indicates the superiority of these new schemes over established scheme. It is also proven that the linear and nonlinear schemes are successfully converge to the exact solution. Thus, it implies that the schemes are also consistent and stable for linear and nonlinear Goursat problems.

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