

**New simple iteration method for solving non-linear ODEs/PDEs with fluid
mechanics applications**

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Abstract

This work presents a new simple iteration method for solving different classes of non-linear ordinary and partial differential equations. The solution method extends the ideas of the fixed point iteration method to non-linear differential equations that have been derived from material derivatives. Such equations are mostly encountered in fluid mechanics applications. The study demonstrates the derivation and implementation of the iteration method, called Simple Iteration Method (SIM), on selected classical non-linear differential equations with fluid mechanics application such as selected channel flows and boundary layer flows. Examples of problems considered include the Jeffery-Hamel flow, MHD porous channel flow, Falkner-Skan equations, Micropolar flows, unsteady flow over impulsively stretching sheets and many other type of flows. Fluid flows whose governing equations are non-linear systems of coupled ODEs and PDEs are also considered. The study demonstrates that the proposed SIM approach gives accurate solutions, converges rapidly and is numerically consistent. Analysis of convergence and consistency is also presented.