***Abstract No: 99*** ***ICT, Mathematics, and Statistics***

# MATHEMATICAL MODELLINGS FOR FINGERING PHENOMENON OF INCLINE OIL LAYERS WITH AND WITHOUT CONSIDERING MASS FLOW RATES AND THEIR SOLUTIONS USING THE METHOD OF DIRECTLY DEFINING INVERSE MAPPING

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In this study, we develop mathematical models for the fingering phenomenon, with and without considering the mass flow rates of oil and water when incline occurs through a homogeneous porous media. The fingering phenomenon transpires through the secondary oil recovery process using a water injection well. Further, we develop and apply a semi-analytical method called the Method of Directly Defining inverse Mapping (MDDiM) to obtain series solutions for derived mathematical models. MDDiM was first discovered by S. Liao in 2016; later, in 2018, Vajravelu et al. took the lead to extend it to address systems of nonlinear ordinary differential equations. Recently, MDDiM was further extended to solve nonlinear single and coupled partial differential equations. Here, for each model, we obtained third-order approximate series solutions for the water saturation in the presence of different inclinations. The obtained results, with minimum errors, are presented graphically and discussed. The results we obtained here agreed very well with the results available in the literature, which were obtained by the variational iteration method. Further, it is investigated that fast convergence in MDDiM compared to the variational iteration method. By looking at graphs, it is further investigated that water saturation increases with the distance for any inclination, and higher water saturation level with the existence of the mass flow rate.

**Keywords:** Fingering phenomenon, Homogeneous porous media, Inclined flow, Method of Directly Defining the inverse Mapping, Saturation of water