

## Analytical Solutions of Time Space Fractional, Advection-Dispersion and Whitham-Broer-Kaup Equations

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**Abstract :** In this article, we study time-space Fractional Advection-Dispersion (FADE) equation and time-space Fractional Whitham-Broer-Kaup (FWBK) equation that have a significant role in hydrology. We introduce suitable transformations to convert fractional order derivatives to integer order derivatives and as a result these equations transform into Partial Differential Equations (PDEs). Then the Lie symmetries and corresponding optimal systems of the resulting PDEs are derived. The symmetry reductions and exact independent solutions based on optimal system are investigated which constitute the exact solutions of original fractional differential equations.

**Keywords :** modified Riemann-Liouville fractional derivative, lie-symmetries, optimal system, invariant solutions

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